# Heterogeneous Wealth Dynamics: On the roles of risk and ability


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# Introduction

Poverty traps are commonplace in policy debates today. But are there really poverty traps?

- Mixed evidence, based largely on tests of just one type (multiple equilibria traps)

If poverty traps exist, why and for whom?

- Multiple dynamic equilibria
- Conditional/club convergence based on immutable characteristics, w/unique L-L eqln
- These are not mutually exclusive, but do have significantly different policy implications

And what role do risk and ability play?

Generalizing the two distinct poverty trap mechanisms:

$$y_{ist} = \begin{cases} \alpha^c_{s\ell} + g^c_{s\ell}(y_{i0}) + \varepsilon_{ist} \;\; if \;\; i \in c \;\; and \;\; y_{i0} < \gamma^c_s \\ \alpha^c_{sh} + g^c_{sh}(y_{i0}) + \varepsilon_{ist} \;\; if \;\; i \in c \;\; and \;\; y_{i0} \geq \gamma^c_s \end{cases}$$

where y is a measure of well-being (assets for us)

*i* indexes individuals

*s* indexes states of nature

*t* indexes time periods

*c* indexes cohorts/clubs

*h* is the high equilibrium, $\ell$ is the low equilibrium

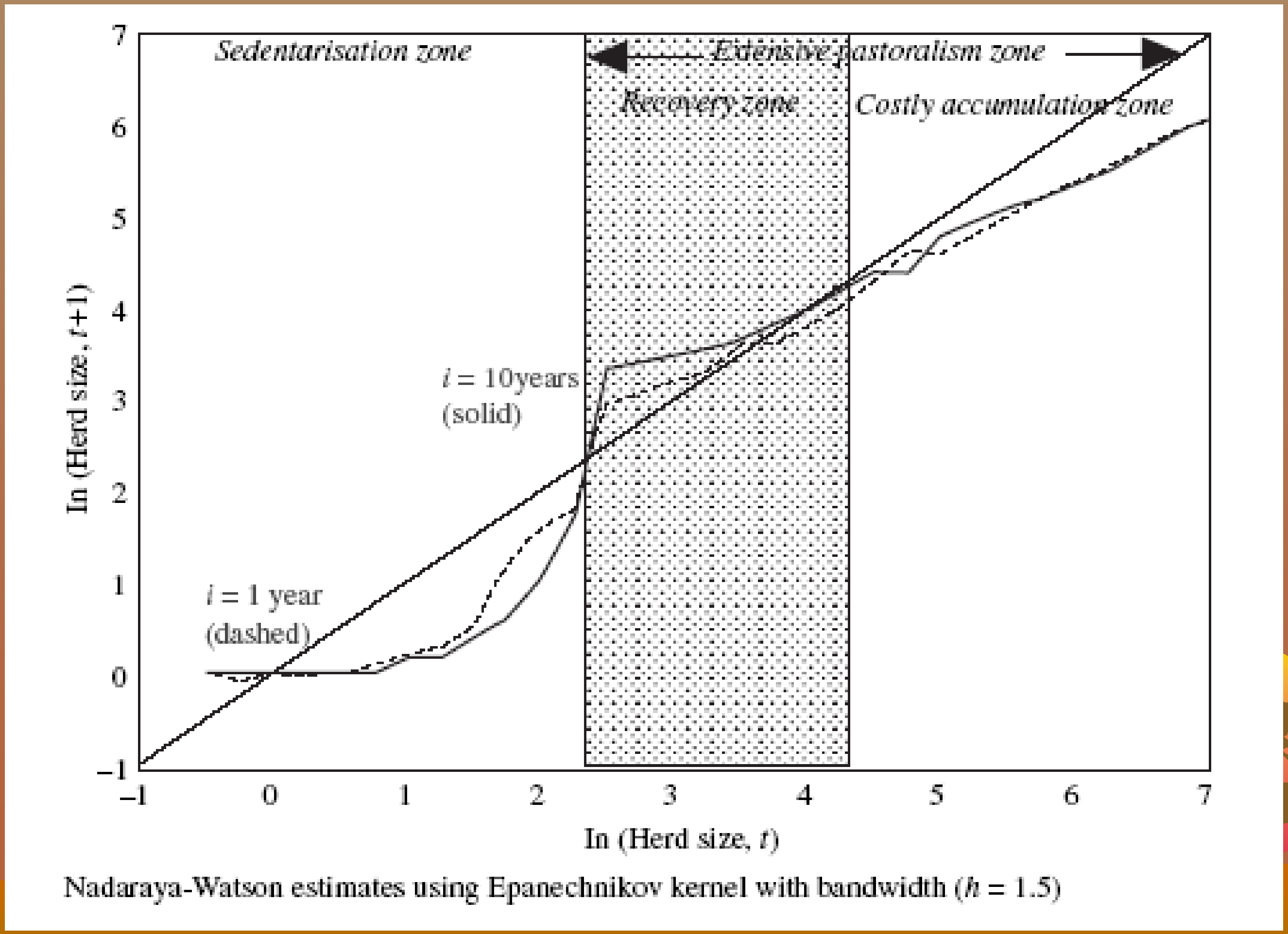
$\gamma^c$ is a cohort-specific threshold

[$\gamma^c$=0 implies unique eqln, while $\alpha^c=\alpha$ and $g^c$( )=g( ) imply common/unique path dynamics]

We want to understand these dynamics wrt assets among a very poor population

# Boran pastoralists and Data

Lybbert et al. (2004 *EJ*) found nonlinear, bifurcated wealth dynamics among Boran pastoralists in southern Ethiopia



# Boran pastoralists and Data

We use three data sets to unpack these wealth dynamics further

(1) Desta/Lybbert data: 17-year herd histories, 1980-97, for 55 households in 4 *woredas* in southern Ethiopia. Rich longitudinal data but very few useful x-sectional covariates

(2) PARIMA data: quarterly/annual panel, 2000-3 on 120 households in same *woredas*. Kenyan subsample from these data likewise exhibit S-shaped herd dynamics (Barrett et al. 2006 *JDS*).

(3) Subjective herd growth expectations of PARIMA hhs, 2004

- randomly selected herd size within 4 Lybbert et al. intervals
- asked herders their rainfall expectations for next year (A/N/B) and elicited conditional herd size distributions, given the random start value
- established if respondent had ever managed a herd approximately that size

# Our questions:

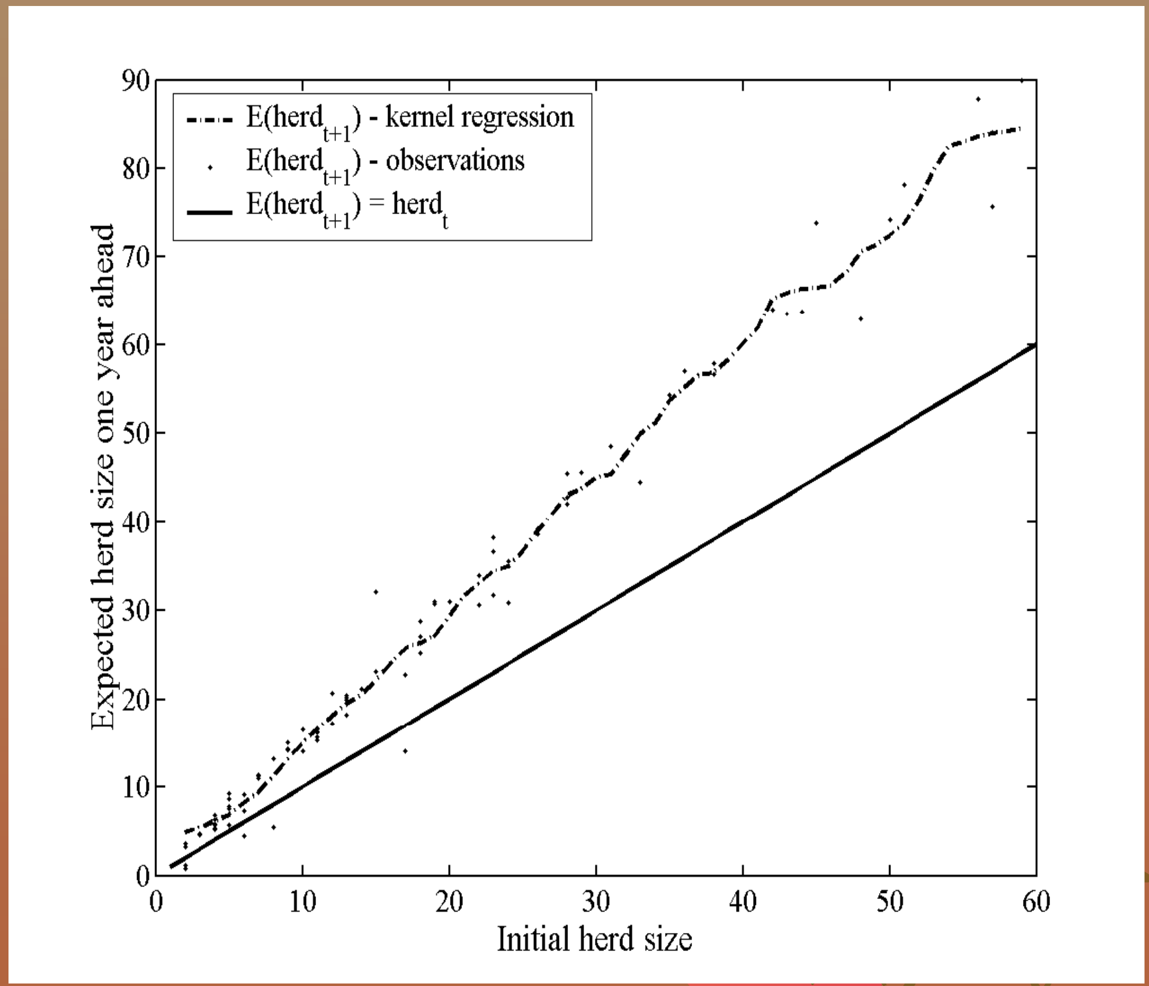
- Are these dynamics understood by Boran pastoralists?
  - *Yes.*

- What are the sources of poverty traps?
  - *Poor rainfall is the source of S-shaped herd dynamics but … ability plays a key role, too.*

- Why care?
  - *Implications for the design of policy (e.g., post-drought restocking).*

# Expected herd dynamics

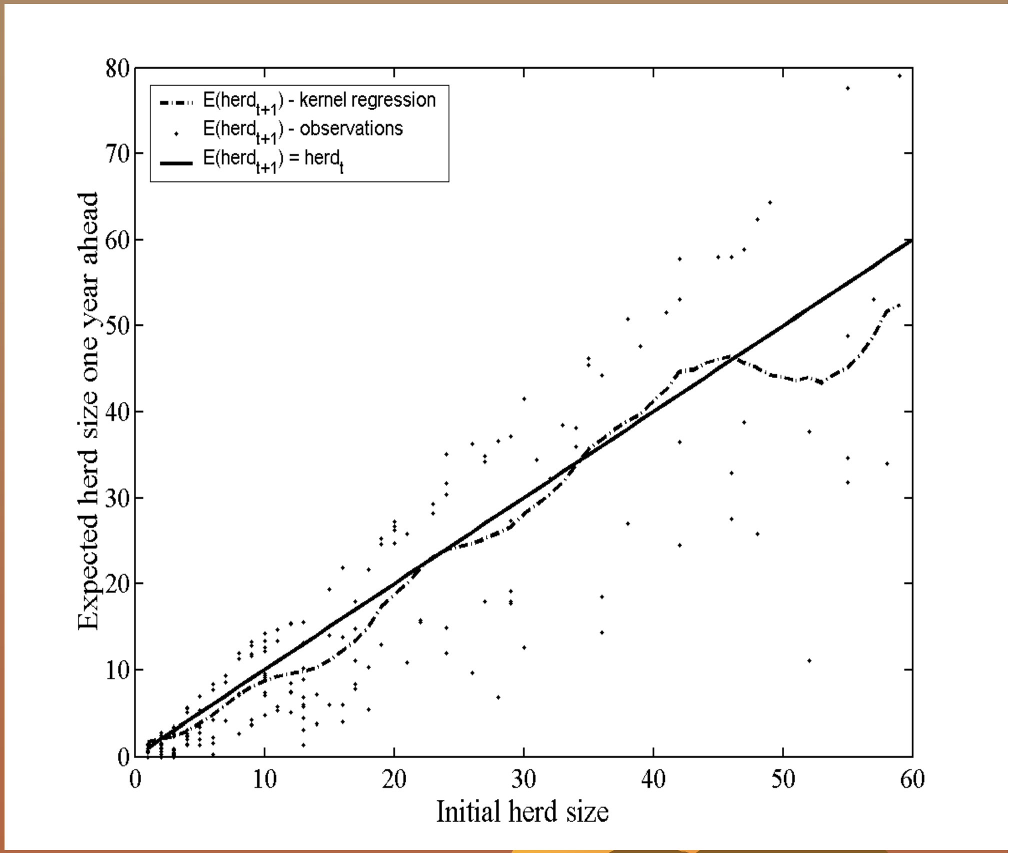
Under Above Normal/ Normal rainfall, virtually universal expectations of growth, with minimal dispersion among herders.



# Expected herd dynamics

But with Below Normal rainfall, considerable dispersion, and some suggestion that multiple equilibria possible ... Negative shocks appear to drive nonlinear herd dynamics (i.e., poverty trap arises due to risk).

Insurance and risk management ability become important.



# Expected herd dynamics

So do herders expectations match the herd historical record? We use state-dependent expectations to simulate herd evolutions given a mixture of states of nature over time.

- Use historical rainfall data from area
- Parametric estimates of state-dependent growth functions (look just like preceding figures)

Run simulation as follows (500 replicates):

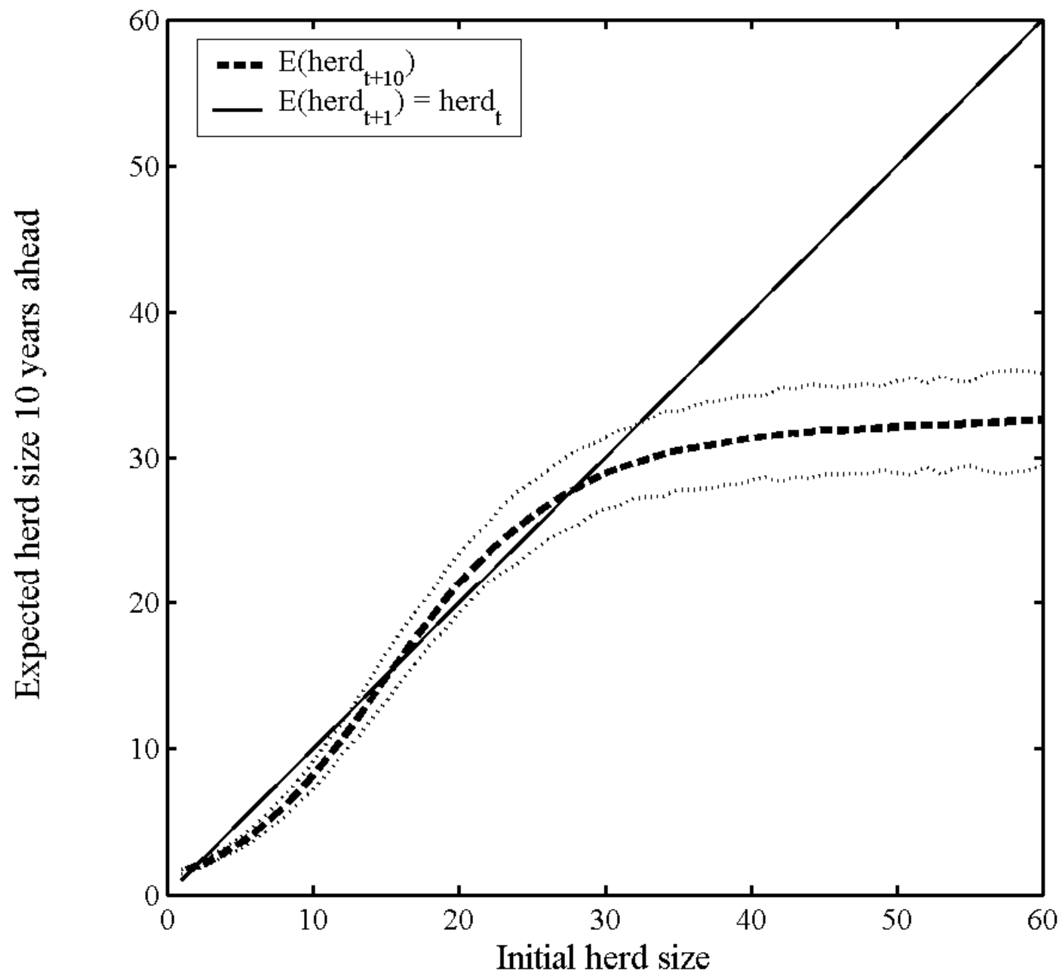
i) take initial herd size

ii) randomly draw rainfall state

iii) apply appropriate growth function estimates to predict next period's herd, s.t. biological constraints (e.g., no negative herds, gestation lags)

iv) repeat steps ii) and iii) to generate ten-year ahead transitions, as in Lybbert et al. (2004).

Simulated dynamics strikingly similar to Lybbert et al. results!




Boran pastoralists appear to perceive herd dynamics accurately.

# Ability and expected herd dynamics

Why such dispersion in bad rainfall years? One conjecture: herding is difficult and husbandry ability matters a lot.

Problem: ability is unobservable.

Solution: estimate ability using stochastic parametric frontier estimation methods and actual data (PARIMA):

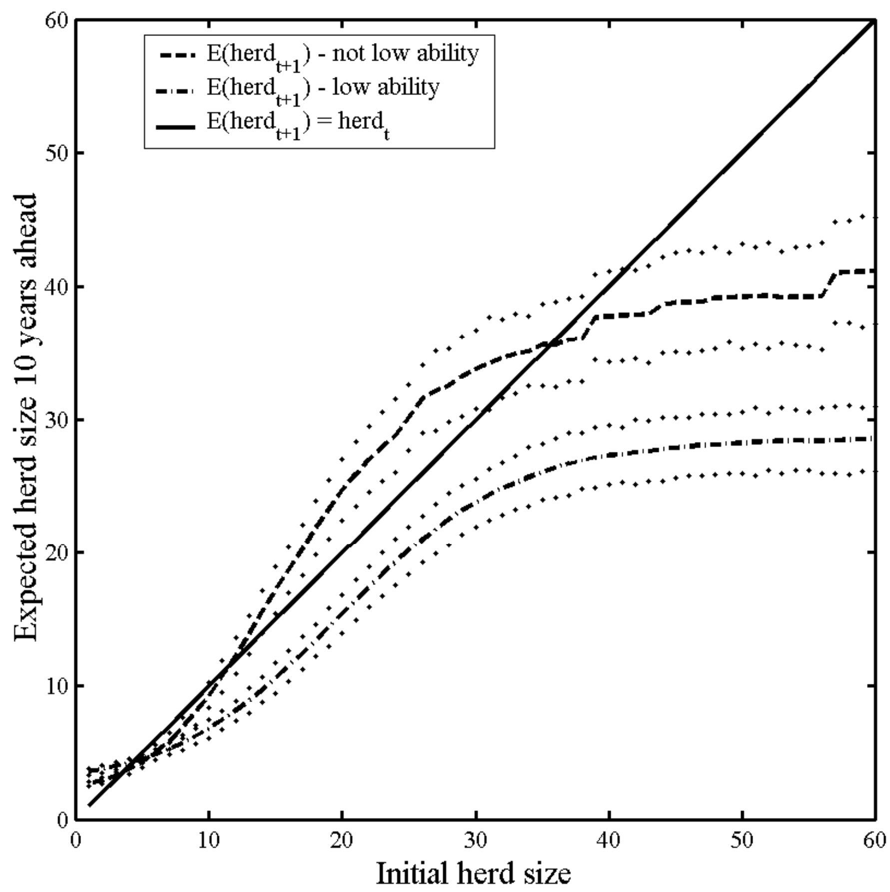
$$h_{it} = f(h_{i\,t-1}) + \beta X_{it} - \phi_i + \psi_{it}$$

Frontier estimates indicate significant differences in dynamics above/below 15 cattle threshold

# Ability and expected herd dynamics

Separate out lowest quartile of the estimated ability distribution, re-estimate the parametric growth model, and re-run the 10-year-ahead herd size simulations shown earlier, we find:

- low ability face unique LLE (1-2 cattle)
- high ability face same LLE, but multiple equilibria w/threshold ~12-17 cattle (same as Lybbert et al.)



# Ability and expected herd dynamics

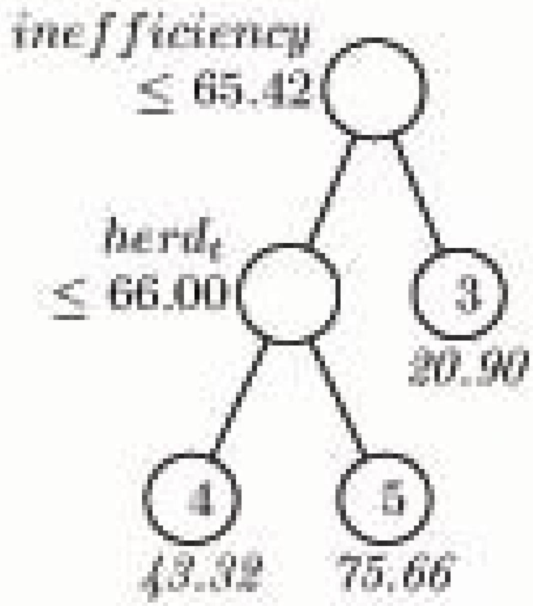
We confirm this result using the Desta/Lybbert data:

- Estimate a stochastic frontier and recover (more suspect) estimates of herder-specific ability
- Use regression trees method, using GUIDE algorithm, to allow for unknown, endogenous splitting variables and values

Results:

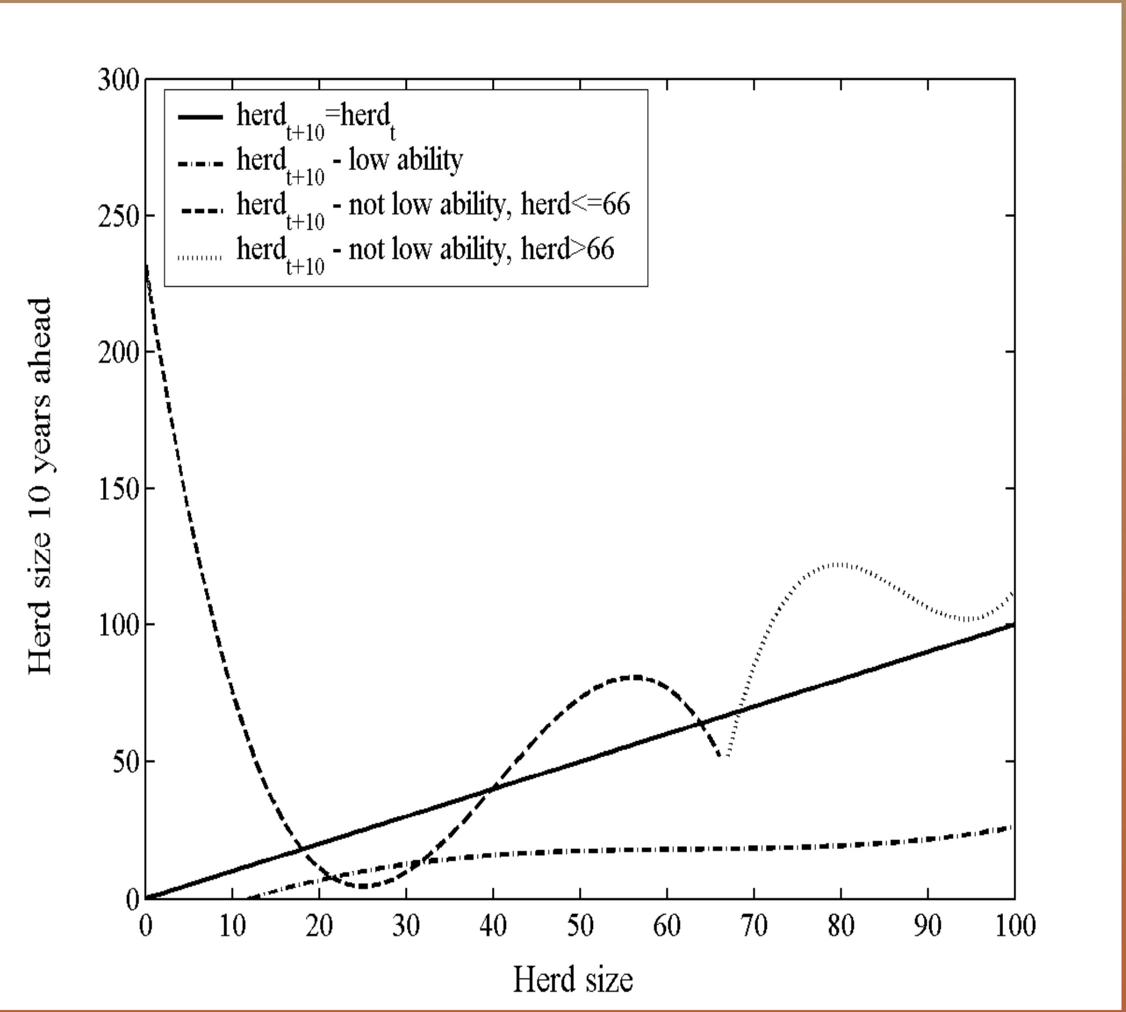
- Low-ability herders again face unique low-level eqln
- Higher-ability herders face multiple regimes

# Ability and expected herd dynamics




Piecewise-multiple linear least-squares GUIDE model.
At each intermediate node, a case goes to the left
child node if and only if the condition is satisfied.
Number in italics beneath a leaf is the sample mean of $herd_{t+10}$

# Ability and expected herd dynamics




Regression trees prediction of herd dynamics conditional on ability and initial herd size

# Why care?

- Policy consequences – Wealth dynamics matter to ultimate efficacy of interventions

  Example: post-drought restocking

- 3 scenarios

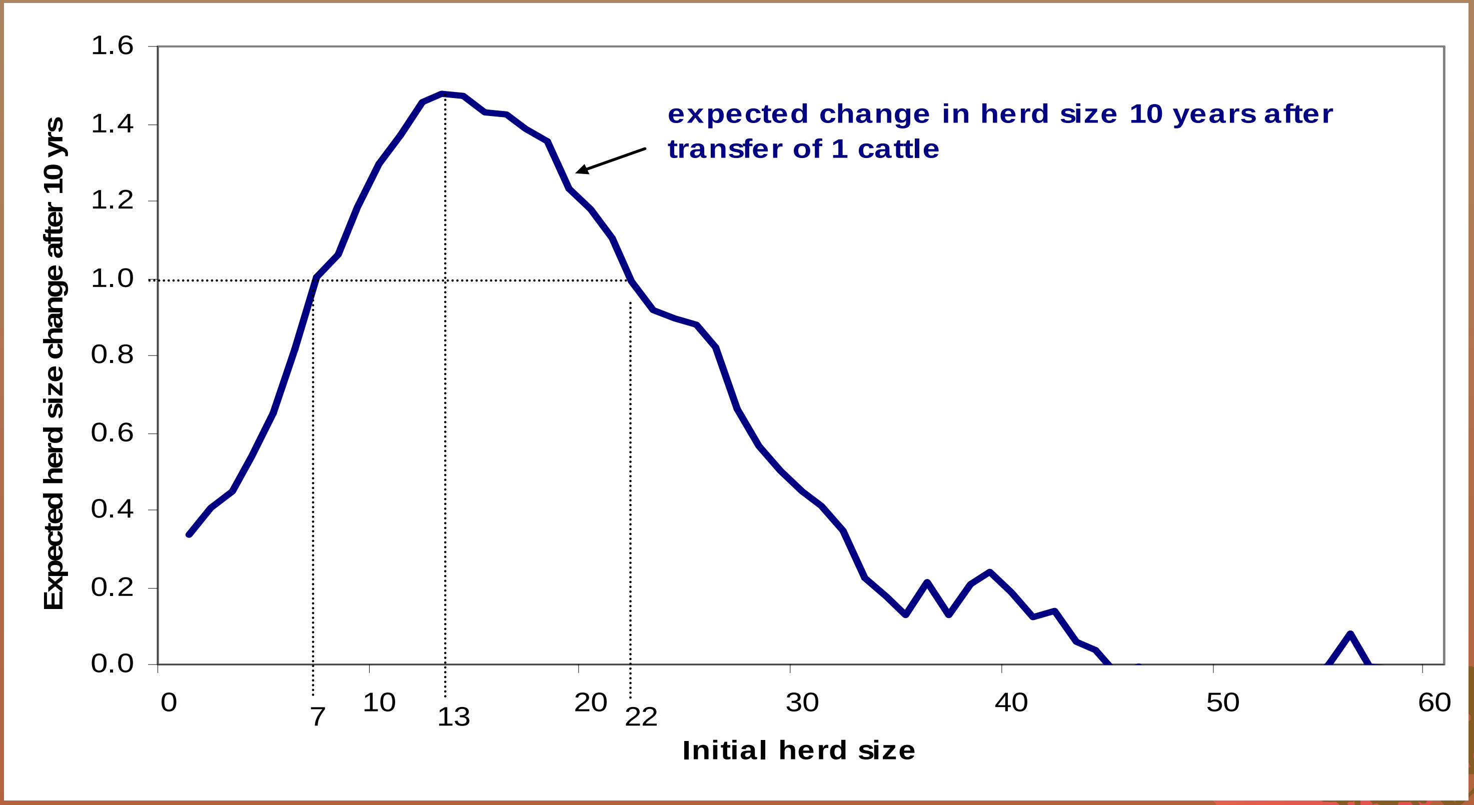
  (1) Standard pro-poor: Give to the poor (below 5 cattle but not stockless)

  (2) Give to those near the threshold

  (3) Give to those near the threshold and of high ability

# Why care?

Exploring the consequences of nonlinear dynamics:



# Why care?

| Scenario | Number of beneficiaries | Average transfer | Average herd size | Net Gains (10 years ahead) |
|---|---|---|---|---|
| (1) | 17 | 2.12 | 2.88 | -0.77 |
| (2) | 13 | 2.69 | 12.54 | 0.46 |
| (3) | 16 | 2.31 | 11.69 | 2.83 |

The consequences are dramatically different:
from negative net gains to gains nearly triple the transfer.

Policy challenge:
progressivity vs. return on investment

# Conclusions

Using unique hh-level panel and expectations data from Ethiopian pastoralists, we find:

- Subjects seem to understand nonstationary herd dynamics found in herd history data
- Multiple equilibria appear to arise due to adverse rainfall shocks … so insurance matters, as might changing features that affect performance in poor rainfall years (e.g., water points, supplementalfeeding)
- Considerable heterogeneity of ability to deal with adverse shocks.
- Lower ability herders face unique, low-level equilibrium (a club convergence result)
- Higher ability herders face multiple equilibria
- Policy implications for targeting, restocking, safety nets: no one-size-fits-all approach

Thank you for your attention
and your comments!