DIFFERENTIAL RISK EXPOSURE AND STOCHASTIC POVERTY TRAPS AMONG EAST AFRICAN PASTORALISTS

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In the pastoral and agropastoral systems of east Africa's arid and semi-arid lands (ASAL), climatic shocks, price volatility, disease outbreaks, and widespread violence beget frequent disruption of already-fragile livelihoods. Last year's drought dramatically demonstrates that intense suffering recurs regularly in the ASAL in spite of significant humanitarian aid flows. This article explores why that might be. We draw on preliminary results of an ongoing quarterly survey in six sites in northern Kenya, seventeen years' herd history data collected from Boran pastoralists in southern Ethiopia (Desta), five years' seasonal data on land use and herd management decisions among Gabra pastoralists in northern Kenya (McPeak 2000a, b), and three years' transactions-level data on livestock markets in northern Kenya (Barrett et al.). In the interest of brevity, we present only a synthesis of findings from these and related studies that suggest how differences in pastoralists' ubiquitous risk exposure create and sustain structural poverty traps from which many ASAL pastoralists are having a difficult time escaping.

Differential Risk Exposure in the East African ASAL

ASAL populations face multiple, serious risks. Perceptions of risk vary across the region by gender and wealth (Smith, Barrett, and Box). However, we focus here only on the most important risk faced by pastoral households: sudden, unexpected herd loss.[1] Given that pastoralists extensively graze their animals and that forage growth depends almost entirely on rainfall, drought can lead to sudden, unexpected herd losses. Average rainfall in our study area averages only 250–750 mm/year, and is highly variable, with coefficients of variation ranging from 44% to 65%.

The recent regional drought underscores both the severity and the unevenness of herd loss. Sample households in two of our Kenyan survey sites, Ngambo in Baringo District and Suguta Marmar in Samburu District, suffered mean herd loss of 45% and 35%, respectively, between March/April and June/July 2000 when the long rains failed. Yet, in neighboring Marsabit District to the (more arid) north, mean herd sizes of sampled households over the same period fell only 1% in North Horr and increased 5% in Kargi.

There is also great interhousehold variation in mortality experience within study sites. Figure 1 shows the distribution of herd mortality rates over seventeen years' herd histories for fifty-five Boran households in southern Ethiopia. Average annual mortality was 16.2% of beginning period stocks, peaking at 46.5% in 1991/92 (year 12). Losses are common and can be quite severe, but mortality rates exhibit great dispersion. In a majority of years, zero losses is within
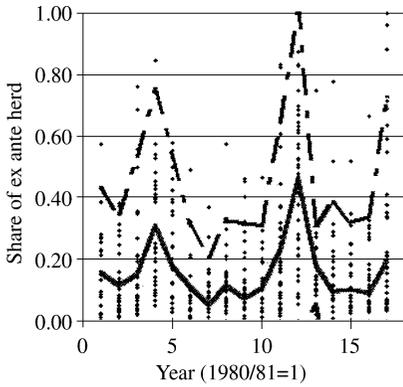
Note: Points reflect households, solid lines are year-specific household weighted mean, and dashed lines are mean ±2 standard deviations.

Figure 1. Annual mortality rates in southern Ethiopia

one standard deviation of the mean. Lybbert et al. find that even at the 15% significance level, one cannot reject the hypothesis that the number of animal deaths experienced by a Boran household is unrelated to a vector of community-level covariates. Household specific factors, sometimes interacted with community-level variables such as rainfall, account for all the predictable variation in mortality experience among southern Ethiopian Boran households.

This underscores that inter-household differences in capacity to mitigate risk *ex ante* or to cope with shocks *ex post* lead to great cross-sectional differences in income or wealth variability, even in the face of common biophysical disturbances. In spite of covariate drought shocks, household level impact appears idiosyncratic in the east African ASAL.

Strategies to Reduce Risk Exposure in the East African ASAL

Mobility

Pastoralists have historically confronted spatial and temporal variability in forage and water availability through migration mediated by complex common property regimes within and across ethnic groups. But mobility is increasingly impeded by governments' gazetting of protected areas for wildlife conservation, the growth of rural towns, increased cultivation of key resource areas, and the rapid escalation of violence brought about by the proliferation of automatic weapons in ASAL. Restricted mobility has led to the increased concentration of herds in certain areas, accelerating localized range degradation and contributing to more frequent population crashes in familiar livestock cycles (Coppock; McPeak 2000a).

Mortality differences across study sites can be partly explained by differences in mobility. In the year preceding the herd losses described above, households in Kargi and North Horr watered their animals at 6.1 and 5.7 different water points on average, respectively, while households in Sugata Marmar and Ngambo used only 3.9 and 3.4 points on average, respectively. Herders in areas with greater mobility cope better with drought.

Moreover, within a given area, household characteristics significantly influence household land use decisions. McPeak (2000a) finds that rangelands around towns tend to be degraded, and household herd size is negatively correlated with use of these degraded areas. There is greater risk of animal loss due to armed raiders away from towns, but food aid is distributed in towns. Wealthier pastoralists can better absorb raiding losses and can survive on herd products alone in areas far from food aid distribution points. Pastoralists with smaller herds cannot absorb such losses, thereby creating a critical relationship between risk, mobility, and household herd size.

Financial Savings

Formal banking institutions in this area are few and very far between, although there have been some recent attempts at introducing microfinancial institutions and mobile banks into rangeland communities. The overall impact of these efforts has been modest. According to Desta, 1–2% of pastoral households in southern Ethiopia keep bank accounts; our current survey indicates only 12% of sampled Kenyan households keep bank accounts. This is not because they are unaware of banks. More households in our Kargi sample had accounts in the past (17%) than have them currently (7%). Probit results (not shown) provide an alternative explanation. Banking appears more accessible or attractive to wealthier pastoralists; the probability of a household having a bank account significantly increases only in livestock and houses owned.

Marketing

One might explain low rates of financial savings if pastoralists use livestock as non-financial savings, selling animals in response to income shocks. Yet we find very little livestock sales response to shocks, as can be seen by comparing figures 1 and 2. It is not clear whether this is a rational response to weak markets characterized by considerable transactions costs and price risk, a signal of complex property rights in animals that impede market sales, a cultural orientation toward holding livestock at all costs, or some other factor we cannot yet identify. But we find little use of livestock sales to smooth asset or income shocks in the east African ASAL.

Partly, this is because livestock markets in the area are weak. Analysis of roughly 24,000 observations on livestock sales in the northern Kenyan markets of Marsabit and Moyale reveals extraordinary variability in livestock prices across space and time and weak spatial correlation in price movements. Rainfall and quarantine shocks have especially pronounced effects on both the conditional mean and the conditional variance of livestock price distributions faced by pastoralists in these up-country markets (Barrett et al.). The same shocks have almost no effect on prices for otherwise identical animals
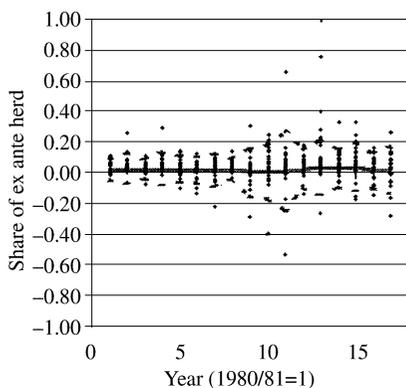
at the same times in the Nairobi terminal market.[2]

Poorer pastoralists sell a larger share of their herd than do wealthier pastoralists (Little; Lybbert et al.). This, partly, reflects market proximity, since the poor tend to live closer to towns than the rich and thus may enjoy lower transactions costs. But mainly this seems to reflect financial market failures that make lower wealth producers more likely to liquidate assets in the face of highly volatile income streams.

Finally, pastoralists rarely use markets to restock after a crisis has passed. Females comprise only 20–30% of animals sold in any species or market (Barrett et al.), and less than 9% of the herds in our Kenyan sample households were acquired by purchase, compared to the roughly three-quarters acquired by births and inheritance. It appears that current marketing institutions are not well suited for transforming animal wealth into cash during crisis periods or for self-restocking using financial savings after the crisis has passed.

Insurance

Although none of our sample households own formal insurance, informal social insurance exists in the form of livestock transfers between herders. However, empirical evidence shows this type of insurance is of limited effectiveness as an *ex post* coping mechanism. In southern Ethiopia, transfers cover less than 5% of a household's mortality losses above the community mean, on average (Lybbert et al.). Meanwhile, McPeak (2000b) finds that while livestock transfers tend to be redistributive, poorer households are less well insured *ex post* by livestock transfers than are wealthier households. Interestingly, both studies find there is a history-dependence to social insurance through livestock transfers, as current transfer receipts are declining in individuals' past net receipts. Because poorer herders tend to have been net receivers of animals in the past, they often find their access to current period transfers is limited.

Note: Points reflect households, solid lines are year-specific household weighted mean, and dashed lines are mean ±2 standard deviations.

Figure 2. Annual net sales rates in southern Ethiopia

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[2] Quarantines are a distributionally regressive means of animal disease control in Kenya, protecting wealthier, peri-urban livestock owners' herds at the cost of sharp wealth losses among poorer ASAL pastoralists.

Herd Accumulation

Herd accumulation is the primary means of increasing productivity and providing self-insurance for ASAL pastoralists. Although pastoral wealth is relatively equitably distributed, with Gini coefficients ranging from 0.36 among the desert Gabra (McPeak 2000b) to 0.54 among the semi-arid Boran of southern Ethiopia (Desta), striking differences emerge in the wealth and welfare trajectories of households distinguished only by their *ex ante* endowments. Mortality shocks can trap poorer pastoralists in poverty. Southern Ethiopian herd histories indicate that households with herds of fewer than six head of cattle are expected to lose their herd within ten years (Lybbert et al.). McPeak (2000b) finds that 29% of sampled Gabra households in northern Kenya had household herd sizes below 4.5 TLU[3] per person both in early 1993 and early 1997. Although 11 of 26 households managed to achieve a herd size above this level for at least some time between these two dates, these gains were insufficient to prevent them from falling back below this mobility threshold following the 1996 drought.

There are two main reasons why poorer pastoralists tend to either lose or sell their animals. First, the costs of inputs such as veterinary medicines or access to water points are often beyond their means. Second, it takes roughly 4.5 TLU per capita to sustain herders on milk and blood in the open range. So poorer herders typically cannot migrate with animals, instead they are staying close to towns where they can buy or be given food. But since areas around town often suffer localized range degradation, semi-sedentarization reduces livestock productivity. Those with large enough herds take advantage of open range areas where stocking rates are almost always well below time-varying carrying capacity, thereby enhancing per animal lactation and weight gain (Coppock; McPeak 2000a).

Herd accumulation is nonetheless a costly risk reduction strategy. At the household level, competition for forage and water, disease transmission, and reduced supervision per animal lead to a positive and statistically significant relationship between *ex ante* herd size and livestock mortality (Lybbert et al.).

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[3] TLU stands for tropical livestock unit, a standardized measure equal to roughly 250 kg live weight. 1 TLU = 1 head of cattle = 0.7 camels = 10 sheep = 11 goats.

Nonetheless, mortality losses increase at less than a one-for-one rate with beginning period herd size. So although mortality rate in crisis periods increases in current period herd size, so are the predicted remaining herd size after the crisis has passed. Larger herds *ex ante* provide an effective, albeit costly, means of insuring sufficient herd size *ex post*.

Activity Diversification

Activity diversification is often viewed as an *ex ante* strategy adopted to reduce risk exposure. But limited rainfall, infrastructure and incomes constrain the non-pastoral options available. Adoption of non-pastoral activities currently appears to be mainly used as an *ex post* coping strategy. Diversification into non-farm activities is most commonly observed among poorer pastoralists driven by herd losses into unskilled wage labor and petty trade, as well as by young adults who have not yet accumulated herds, although a few wealthier herders do have small businesses to complement livestock husbandry (Coppock; Little et al.). Cropping also appears to be a more important activity for poorer households than wealthier households. In our Kenya sample, individuals within sampled households were asked to rank their different activities in order of importance over the past ten years. Tobit regression of these rankings (unreported) indicate that the importance of cultivation is decreasing in household herd size.

External Assistance

Absent credit, liquid savings in cash or kind, or significant private transfers between herders, external transfers from government and charities occupy an important place in the ASAL. Food aid distribution is ubiquitous and doled out equitably to all who reside in a given area. McPeak (2000a) finds current fixed-point distribution policies can induce spatial concentration of animals in a small area around the distribution site(s), thereby contributing to localized range degradation and lower livestock productivity and increased mortality rates. Although food aid assistance is a humanitarian response to a food security crisis, there are problems with its implementation that lessen its effectiveness. The most worrisome side effect of food aid is that it is increasingly used to support a permanently dependent population who have

settled around the market towns in pastoral areas. It is the plight of this population to which we turn now.

Stochastic Poverty Traps in East African Rangelands

Life on the open range is risky, with limited market access or (animal or human) health care, vulnerability to human and wildlife predators, and increasingly constrained access to key dry season grazing and watering points. But those who suffer severe shocks on the range and are driven to town have it worse. Absent substantial restocking, they cannot return to their previous way of life. As we have stressed above, restocking through the use of savings, markets, and social insurance is extremely limited, and more accessible to the *ex ante* wealthy. Thus migration from the range to town far exceeds that going the opposite way, as pastoralists fall below an asset threshold that enables them to escape an apparent stochastic poverty trap. Indeed, as more near-stockless pastoralists get driven toward towns, stocking densities there increase, reducing range and thus animal productivity. Moreover, herders in town face difficulties obtaining good information on current conditions in open range areas, and reduced protein and energy intake limit boys' strength to undertake arduous treks necessary to reach good pasture and water (Nathan, Fratkin and Roth; Smith, Barrett and Box).[4]

The endogenous expected returns to assets appear to be increasing and the variability of returns decreasing in wealth among east African pastoralists. The oft-observed positive relationship between *ex ante* wealth and both return on assets and self-insurance capacity begets stochastic dynamic poverty traps in the east African ASAL. Wealthier herders are better able to self-insure through asset accumulation and diversification and thereby achieve not only lower risk exposure, but also higher returns. Households who lose their herds adopt non-pastoral income generating strategies as an *ex post* coping strategy rather than as an *ex ante* risk reducing strategy.

⁴ The ASAL are unusual in that town-based people are less healthy than are people in open rangelands, underscoring the importance of larger herds and mobility (Nathan et al.).

External humanitarian aid all too often consists of massive transfers of food during crisis periods. Relatively little external aid is provided to help prevent such crises from occurring. We close by offering some preliminary conclusions as to what policies might help prevent such crises from occurring, explicitly focusing on combating stochastic poverty traps.

Policy Implications

Given grinding poverty and distressingly frequent shocks in the east African ASAL, what can be done to help vulnerable populations avoid or escape stochastic poverty traps? In the short run, the most essential principle is to support, not undermine, pastoralists' preferred means of managing risk: herd accumulation and mobility. Prompt restocking of pastoralists to at least self-sufficiency thresholds ($\sim$4.5 TLU per capita) makes sense in more arid rangelands not suffering widespread degradation (McPeak 2000a). Given budget constraints, this surely means redirecting newly stockless or near-stockless pastoralists out of pastoralism through managed purchases and skills training. Otherwise, the poor are likely either to lose the animals to disease or drought or to be forced to sell the animals for considerably less than the cost of the transfer. Mobility can also be encouraged by increasing security in pastoral rangelands. Many good rangelands go unused due to the fear of armed raiders. Increased government effort to ensure safety would increase mobility and decrease risk exposure.

Methods to avoid in the short term include destocking programs and cadastral projects to put rangeland under individual private tenure. The empirical evidence suggests overstocking is more a local than a general problem, and such policies limit pastoralists' mobility and thus their capacity to optimally exploit rangelands. So too must donors search for more effective means of emergency relief than widespread point provision of food aid through towns, given apparent unintended consequences of that approach.

In the longer term, pastoral development must be based on simultaneous improvements on three fronts. First, marketing infrastructure and institutions must improve so as to reduce price volatility, inter-market price differentials and transactions costs, and to encourage managed offtake and restocking

of animals in response to biological variation in range carrying capacity. Second, there must emerge microfinancial institutions and products appropriate to the ASAL and accessible to poorer residents. Finally, development of non-pastoral economic activities in the ASAL is necessary to widen the range of employment and investment options available, especially to those who lose their herds.

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