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**OPPORTUNITIES FOR ASSET DIVERSIFICATION IN A LIVESTOCK SYSTEM:  
THE CASE OF THE PASTORAL BORAN OF SOUTHERN ETHIOPIA**

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**INTRODUCTION**

Internal population pressure can lead to a need for economic diversification. The Borana pastoral system of southern Ethiopia, traditionally based on cattle husbandry for wealth storage and milk production, has apparently functioned well for many years to mitigate risks inherent to semi-arid areas (Pratt 1987; Helland 1997). Recent increases in human and livestock populations, decreases in availability of grazing lands, and a decline in adherence to social mores, however, have eroded the effectiveness of traditional means to stem risks of livestock asset losses during drought (Coppock 1994; Helland 1997). It was speculated that because Boran households appear to be losing an increasing number of cattle in dry years, divesting some portion of their cattle wealth into non-traditional options (i.e. simple savings accounts in banks) could benefit wealth accumulation, risk mitigation, food security, and environmental protection. The basic concept is that a properly balanced investment portfolio should minimize risk for an expected level of net return (Markowitz 1952; Hardaker *et al.* 1997). Our primary objectives were to determine (i) production system trends, (ii) economic losses attributable to wasteful cattle mortality, (iii) the degree to which such losses are influenced by heavy stocking rates and drought, and (iv) whether provision of alternative (non-livestock) savings options could benefit the economic portfolio of households.

**METHODS**

The study surveyed Borana households residing within 35 km of four towns: Yabello, Negelle, Arero and Mega. A sample of 336 households was used to assess household economy and system trends. A sub-sample of 56 households was used to describe cattle herd dynamics during the period 1981-97. Herder recall was used to document cattle production and environmental variables for the period 1981-97. Main effects of rainfall, stocking rate and their interaction on the likelihood and magnitude of cattle mortality were assessed using a factorial analysis of variance in a repeated measures design (Littell *et al.* 1996). Two risk-modeling techniques – portfolio analysis and stochastic efficiency methods – were used for a risk-return analysis (Hazel & Norton 1986; Hardaker *et al.* 1997).

## RESULTS AND DISCUSSION

### *Household economies and system stability*

Most Boran perceive that their pastoral production system is facing serious problems. Ninety one percent of respondents perceive that their traditional system is in a downward spiral. A downward shift in wealth class was observed, as only 6% of sampled households moved up in wealth class while 50% moved down. All respondents believed that availability of milk is decreasing. The people are becoming more dependent on grain and the market place. The Boran are poorly diversified in terms of asset holdings and income. The general trend is that the system is becoming more unstable, poverty is increasing and household livelihood is becoming more insecure.

### *Cattle herd dynamics*

There was variation in local cattle production dynamics within the study area. Annual rainfall significantly affected the likelihood and magnitude of cattle mortality at each site ( $P < 0.05$ ), for mature and immature cattle. However, higher stocking rates also significantly affected the likelihood of mortality for immature cattle in all sites ( $P < 0.05$ ) and for mature cattle only in the vicinity of Yabello and Arero. The variation in stocking rate response across age groups and sites can be explained by variation in herd mobility and resource base. Since immature cattle are less mobile they are more likely to be affected by density-dependent factors. Variation in annual rainfall, in tandem with stocking rate, appears to influence cattle mortality. That stocking rate is a factor suggests that hedging behaviour involving asset diversification has relevance for portfolio diversification.

Lack of diversification has led to large cattle losses over 17 years (Fig. 1). The mean cattle holding per household declined from  $>90$  in 1980-81 to  $<65$  in 1996-97. This mortality loss is about 140 head/household, which is equivalent to US\$9000. The loss to the whole community is of the order of US\$380 000 000 over 17 years. This is a significant loss for a country whose gross national product income per capita is  $< US\$110$  per annum (World Development Report quoted in Institute of Development Studies 1996).

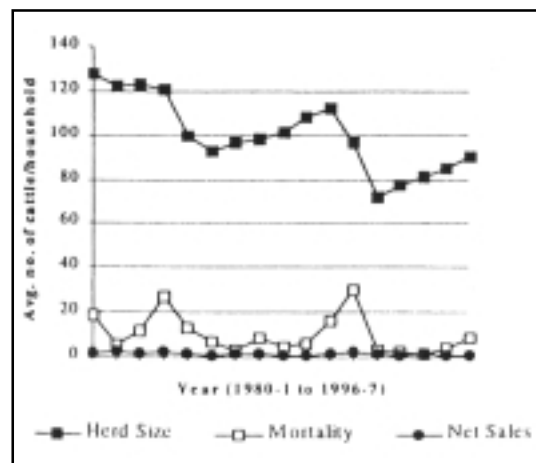


Figure 1: Borana cattle herd dynamics

### *Risk-return portfolio efficiency analysis*

Quadratic programming was used to generate the set of investment plans lying on the mean-variance efficiency frontier. Cattle herd structure observed for 1996-97 was used for all years. Bank interest rates were obtained from the Commercial Bank of Ethiopia.

Mathematical representation of the model is as follows: minimize  $V(W) = X'CX$ ,  $SX_i = 1$  and  $SX_i r_i = W$ , where  $X$  is the portfolio allocation vector,  $SX_i = 1$  (summation of the proportion of choices),  $r_i$  is mean return,  $C$  is the covariance matrix of return to asset, and  $W$  is the critical wealth value.

The cattle investment constitutes four classes (i.e. mature cows, mature males or bulls, immatures and calves). Each class was considered as an independent investment. Three scenarios were used to construct the optimal portfolio: cattle alone, cattle

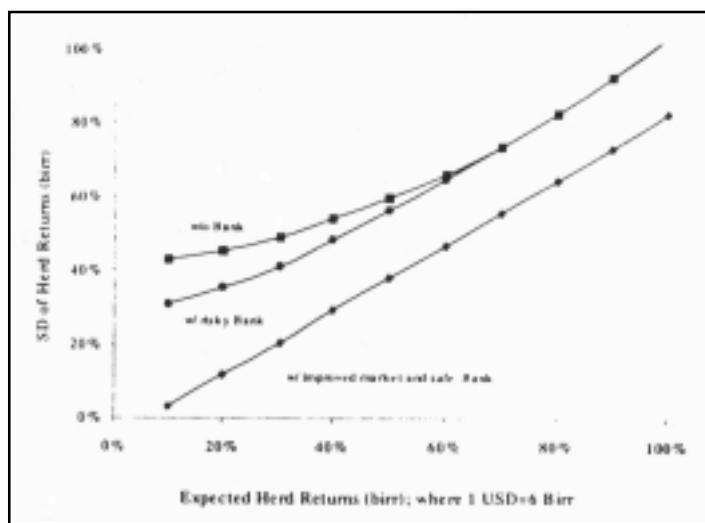


Figure 2: Borana mean-variance frontiers

and a risk bank, and cattle and a safe bank with improved marketing. In all cases, investment in cattle alone was least efficient for a risk-averse investor. Combination of cattle with even an unsafe bank – which was assumed to suffer a 15% probability of crashing (if it crashed, the pastoralists would lose 100% of their deposits) – was found to be more efficient than holding all assets on the hoof. The ideal situation of a safe bank and improved marketing was superior to all other scenarios (Fig. 2). In a cattle-alone investment, bulls were a low-risk and low-return investment. Once banking was introduced, the portfolio share of bulls began to decrease and went down to zero at a 20% rate of net return. The bank behaved as a stabilizing investment component. With a safe bank and improved marketing, bulls did not appear at all in the portfolio share. Cows and calves were a high-return, high-risk investment. Banks were a low-return and low-risk investment. In situations where banks were accessible and safe, even with a moderate rate of bank failure, it was to the benefit of pastoralists to keep some portion of their wealth in banks rather than keeping it all on the hoof. In a stochastic dominance analysis, bulls never dominated any other type of cattle in terms of risks and returns. Banks were found to be efficient in avoiding down side risk.

## CONCLUSION

The Borana pastoral system is perceived to be increasingly unstable and cattle-keeping is more risky. Stocking rates and annual rainfall influence cattle mortality. Economic losses due to cattle mortality are very high, and assets should be diversified. Rural financial institutions could help stabilize pastoral asset accumulation. A cow-calf operation in tandem with a safe rural financial system and improved marketing is the most efficient portfolio combination for pastoralists here.

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## **REFERENCES**

- Coppock D. L. (1994) *The Borana Plateau of Southern Ethiopia Synthesis of Pastoral Research. Development and Change 1980-1991*. System Study No. 5 International Livestock Center for Africa.
- Hardaker J. B., Huirne R. B. M. & Anderson J. R. (1997) *Coping with Risk in Agriculture*. CAB International, Wallingford, Oxon.
- Hazel P. B. R. & Norton R. D. (1986) *Mathematical Programming for Economic Analysis in Agriculture*. MacMillan Publishing Co., New York.
- Helland J. (1997) Development issues and challenges for the future in Borana. A report prepared for Norwegian Church Aid, Ethiopia.
- Institute of Development Studies (1996) An evaluation of development cooperation between European Union and Ethiopia, 1976-1994. Final Report. University of Sussex, UK.
- Littell R. C., Milliken G. A., Stroup W. W. & Wolfinger R. D. (1996) *SAS System for Mixed Models*. SAS Institute Inc. Cary, NC.
- Markowitz H. (1952) Portfolio selection. *J. Finance* 7. 77-91.
- Pratt D. J. (1987) Status report on rangelands and range development in the Sidamo and Hararghe provinces of Ethiopia. Draft main report. Food and Agriculture Organization of the United Nations, Rome, Italy FAO Project TCP/ETH/4535.