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## **Chapter 2: Dynamic Poverty Traps and Rural Livelihoods**

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## Chapter 2: Dynamic Poverty Traps and Rural Livelihoods<sup>1</sup>

Christopher Barrett and Brent M. Swallow

### Starting Points

The concept of poverty traps has achieved some prominence within macro development economics to explain the co-existence of groups of national economies that continually grow, invest and become prosperous with other groups of economies that stagnate, under-invest and remain poor. A parallel concept of livelihood strategies has been developed by a multi-disciplinary group of development researchers and practitioners to explain the inter-connections between asset portfolios, multiplex strategies of groups and individuals, and outcomes for the welfare of the rural poor. This paper brings together these two concepts and draws out implications for applied research, policy and planning.

### Background

At the end of the last decade the global community agreed on the need for concerted action to redress the global problems of poverty, malnutrition, poor health, low education, gender imbalance and environmental degradation. The first of the eight Millennium Development Goals formulated then was to cut by half the percentage of people living on less than \$1 per day between the year 1990 and 2015. This goal, which even if achieved would still strand hundreds of millions of people in persistent poverty, is proving very difficult to achieve in many developing countries. Indeed, many countries in Africa have actually experienced increased poverty rates and negative per capita income growth since 1990.

The various agencies involved in development assistance and development policy have shown an increasing, although still highly variable, concentration on the goal of reducing poverty in the world's poorest countries. Macroeconomists are told to focus on pro-poor growth; health agencies are told to give priority to the needs of poor districts; and veterinary scientists are told to develop vaccines that will contribute to pro-poor livestock development.

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The Future Harvest Centers of the Consultative Group on International Agricultural Research articulate their goal in terms of food security, poverty reduction and environmental conservation and have begun to explicitly consider poverty reduction in impact assessment studies (eg Adato and Meinzen-Dick, 2003).

Framing development assistance in terms of poverty reduction requires conceptual frameworks and analytical approaches that truly capture the nature and dimensions of poverty, that distinguish the proximal and distal causes and correlates of poverty, and that integrate across enterprises, sectors and social-spatial scales. Some progress has been made. The World Bank “Voices of the Poor” studies and its *World Development Report 2000/1* made a compelling case for the need to consider poverty in terms of low purchasing power, high vulnerability to social, economic and ecological shocks, and lack of voice and accountability (Narayan and Petesch, 2002). Improved data, analytical methods and communication techniques have led to greatly improved understanding of the spatial distribution of poor people and environmental resources, the vulnerability of different population groups, the quality of national governance, and the correlates of poverty at different scales (Elbers, Lanjouw and Lanjouw, 2001; McCay and Lawon, 2003).

Of special interest to those concerned with rural development policy is the analytical focus on livelihood strategies, rather than more specific production or marketing strategies. The sustainable livelihoods framework depicts the five types of capital that rural residents access – physical, social, natural, financial, and human – the policies and institutions that define people’s options for using that capital, the livelihood strategies that people use to transform assets into income, service and product streams, and the way that income and product streams are translated into welfare outcomes (Bebbington, 1999, Scoones 1998, Ellis 2000). The sustainable livelihoods framework informs much of the empirical analysis presented in other chapters of this volume.

We propose that the livelihoods framework can be further strengthened through more explicit conceptual and empirical attention to dynamic poverty traps. The essence of the relation between livelihood strategies and dynamic poverty traps can be distilled into four general points. First, there is often a clear and shared preference ordering among the multiple livelihood strategies that are observed among individuals or households within a particular rural population. Second, specific assets often constrain the level of welfare associated with a

livelihood strategy. Third, thresholds in the relationships that transform assets into outcomes mean that households that accumulate higher stocks of assets are sometimes able to generate much higher marginal returns than households that accumulate lower stocks of assets. Fourth, systematic imperfections in rural financial markets mean that individuals, households and communities commonly need to self-finance most capital accumulation. In this paper we develop these points and discuss the implications for analysis and policy.

### **Theory and evidence on poverty and livelihoods**

The last ten years has witnessed a paradoxical juxtaposition in Africa: worsening poverty trends accompanied by greatly improved understanding of poverty and the livelihoods of the poor. Some of the key findings about poverty can be summarized into the two key points below.

#### *Macro poverty traps are a reality*

As first discussed by the classic development economists such as Gunnar Myrdal, Allyn Young, and Paul Rosenstein-Rodan in the middle of the last century, there does indeed appear to have been a bifurcation of economic progress among the developing countries of the world. From relatively similar initial conditions, some developing economies have achieved sustained economic progress and accumulation, while others appear to be caught in *poverty traps* of under-investment, low productivity and high poverty. These differences in performance cannot be explained by differences in macro-economic policy and governance alone. Subsequent analysts have postulated different combinations of conditions that can generate such multiple equilibria: (i) increasing returns to scale technologies, often due to externalities at the societal level (Romer 1986, Lucas 1988, Azariadis and Drazen 1990, Durlauf 1996), (ii) spatial agglomeration economies and resulting market and technological effects at the regional level (Krugman 1991, Fujita et al. 1999), (iii) financial market failures combined with either indivisibilities in key investments, such as education or livestock (Loury 1981, Galor and Zeira 1993, Dercon 1998, Mookherjee and Ray 2002) or, (iv) irreversibilities due to subsistence or nutrition thresholds (Zimmerman and Carter 2003, Dasgupta 1997). Barrett and Carter (2002) and Easterly (2002) discuss the implications of these macro poverty traps for public policy and development assistance programmes.

*There are strong links between household assets, livelihoods and poverty*

The availability of new sets of household panel data has stimulated several studies of the determinants of rural poverty and income in African countries. The results from ten of these analyses are summarized in Table 1. The results on assets and income are quite consistent and intuitive across the studies. Both livestock assets and agricultural land holdings are strongly and positively correlated with income in almost all studies. Primary education is positively correlated with income in all countries except those in which average primary education is very low (e.g., Mozambique and Ethiopia).

The results on livelihood patterns and income levels are not as consistent. Formal sector employment is positively correlated with income in some countries, but is not a viable livelihood option in several other countries. While dependence on agriculture is negatively correlated with income in some countries, this effect is limited by the small size of land holdings in other countries. Jayne et al. (2001) argue that small land holdings in many countries limit the viability of agriculture as a livelihood strategy, forcing many small farmers to diversify into less profitable livelihood options.

A more detailed analysis of the links between livelihood strategies and income has been conducted for Rwanda by Barrett et al. (2001a). Figure 1, which is adapted from that study, depicts the cumulative frequency distributions of total income among 1079 households in Rwanda, organized into four distinct livelihood strategies. The farm and farm worker (FFW) strategy includes households that only work as unskilled agricultural laborers or farm their own land. The full-time farmer (FTF) strategy represents households that farmed their own land and livestock and had no off-farm employment. The mixed strategy (MIX) includes non-farm employment with farming and unskilled agricultural labor. Finally, the mixed-skilled only (MSO) strategy involves only farming or skilled non-farm labor for a salary or as an entrepreneur. As displayed in Figure 1, full time farming (FTF) and especially farm and farm worker (FFW) livelihood strategies are stochastically dominated by mixed strategies, especially those involving only skilled labor and farming (MSO). No one would choose the FFW strategy if they had access to the MIX or MSO strategies. Barriers to entry into higher return strategies become evident by revealed preference.

### **Micro-scale poverty traps and livelihoods**

Welfare orderings among distinct livelihood strategies, such as those presented in Figure 1, appear to be strongly related to barriers to entry that impede access to more remunerative livelihoods by those lacking the necessary financial, human or natural capital to undertake these activities (Dercon and Krishnan 1996, Ellis 2000, Barrett, Reardon and Webb 2001). In the Rwandan example, full-time farming is only an option for those endowed with enough land or livestock to absorb all the adult labor in the household. Skilled non-farm employment is only available to those with education, particular skills (e.g., blacksmiths, lorry drivers), or the necessary financial capital to start a business.

The general nature of this situation is confirmed by a growing number of studies of livelihood, income and asset dynamics. For example, Barrett *et al.* (2001b) found that among rice farming households in Côte d'Ivoire, households with poor initial asset endowments were unable to access superior livelihood strategies that bestowed considerable income gains following the massive CFA franc exchange rate devaluation of January 1994. Those with poor endowments were less able to respond to attractive emerging on-farm and non-farm opportunities, while ex ante richer households reaped considerable gains from devaluation that was promoted as benefiting small farmers. In Ethiopia, Lybbert *et al.* (2002) found that pastoralists whose livestock herds fall below a threshold of 12-15 head of cattle tend to become involuntarily sedentarized because of a minimum necessary scale for successful transhumant migration. Dercon (1998) likewise found that initial assets condition the ability of Tanzanian agro-pastoralists to accumulate wealth and move out of poverty. And Dercon and Krishnan (1996) find that in both Ethiopia and Tanzania, households' initial asset holdings – especially education, marketable skills and capital – are strongly and positively related to the likelihood of following the most remunerative livelihood strategies observed in their samples.

Together this evidence supports a number of parallels between the macro-level poverty traps described above and the micro-level situation of households and individuals in rural Africa. First, initial differences in asset holdings can have lasting effects on farm families' livelihoods. At the macro level of national economies the relevant assets include communication and transportation infrastructure, water storage and electricity generation capacity, the quality of health and education services, the quality of governance and the quality of the labour force. At the micro level of households and individual, key assets

include livestock, land, farm implements, treadle pumps and education of the family members.

Second, asset holdings constrain options available for production and accumulation of more assets. At the macro level, whole industries such as telecommunications, finance or tourism may be essentially ruled out as avenues for growth and tax generation because of low levels of infrastructure or education or due to prohibitively restrictive policies (Romer 1994). At the micro level, we know that those with little or no assets or skills are unlikely to be able to enter into remunerative nonfarm activities that lead to higher income, higher consumption and improved production (Dercon and Krishnan 1996, Barrett, Reardon and Webb 2001). Households caught on the wrong end of such traps often end up in a pattern of persistent poverty and steady degradation of the natural resource base on which they depend (Shepherd and Soule 1998, Coomes and Burt 1997, Coomes et al. 2000, Barrett et al., 2002b). Sufficient conditions for the existence of dynamic poverty traps at the household scale are that they have incomplete access to financial services (credit or insurance) along with (i) high return production or marketing strategies that exhibit a minimum efficient scale of production that is beyond the means of the credit-constrained poor (Barrett and Swallow 2003); or (ii) risk and subsistence constraints discourage long-term investment in high-return assets among poorer, more credit-constrained households (Zimmerman and Carter 2003).

The most extreme cases of micro scale poverty traps involve essentially irreversible human capital accumulation failures due to childhood undernutrition, illness and lack of education. Perhaps the most compelling models of poverty traps emerge at this micro scale, where undernutrition and morbidity early in life can lead to permanent reductions in physical stature and health status associated with sharply increased risk of involuntary employment and lower incomes in adulthood (Dasgupta 1993, 1997, Strauss and Thomas 1998), and where household-scale financial constraints can cause underinvestment in the education of children – even those with manifestly high natural ability – thereby propagating poverty across generations (Loury 1981).

## **Implications for livelihood studies**

The remainder of this chapter draws out the implications of the presence of dynamic poverty traps for livelihood studies and rural development policies. In this section we explore the need to adjust livelihood studies to better consider asset accumulation, livelihood ladders linked to those assets, transitions between livelihood strategies, and the strategies that farmers take to safeguard their assets against risks.

### *Asset accumulation and livelihood ladders*

The alternative livelihood strategies pursued by rural residents in a particular area will have distinct pathways of accumulation and welfare (i.e., income, expenditures or other measures of well-being) and distinct dynamic equilibria at which the strategy reaches a steady state of asset stocks and welfare. The steady states of distinct livelihood strategies may co-exist if there are asset thresholds that are difficult to surmount through self-finance. For example, the steady state for small-scale poultry production may make it difficult to accumulate enough assets to move into cattle production. Small differences in initial assets or idiosyncratic (i.e., household-specific) asset shocks can mean that some households are able to surmount thresholds and move to livelihoods offering higher welfare, while other households are unable to do so over extended periods. With several possible livelihoods, this could take the appearance of a livelihood ladder that some households are able to climb while others are unable to do so.

For example, Moser and Barrett (2003) show that adoption of SRI (a high-yielding, low-input rice production method) in Madagascar is positively related to regular off-farm salaried employment and to prior adoption of off-season crops (mainly potato, to a lesser degree barley under contract farming arrangements with the national brewery) that produce a harvest just as the labor-intensive field preparation, planting and transplanting season begins for rice, thereby obviating seasonal liquidity constraints that otherwise impede adoption. Floyd *et al.* (2003) found that households in the western hills of Nepal that were more self-sufficient in food were more likely to experiment with and ultimately adopt two or more new agricultural technologies, with adoption rates among all groups highest for the technologies that are based on the existing production system and lowest for technologies based on exotic production systems. The small proportion of households who were able to adopt multiple technologies reported large improvements in welfare.

Analysis of such livelihood ladders requires panel household data on assets, technology adoption, incomes and livelihoods, combined with data from communities and local markets for interpreting patterns among the households. Research needs to combine quantitative and qualitative techniques and to be sensitive to the various ways that households may earn their livelihoods and the key types of capital that are necessary for those livelihoods.

#### *Thresholds and asset transitions*

A wide range of thresholds have been identified that affect the livelihoods of rural households in Africa. Here we suggest that these may be grouped as follows:

- a) *Thresholds in agricultural production* are consistent with dynamic equilibria in which some farmers engage in high investment-high return enterprises while other farmers do not. Examples are lumpiness of dairy cattle and oxen, lumpiness of farm implements, increasing economies of scale in agro-pastoral livestock production up to minimum levels of production (Barrett et al., 2002).
- b) *Thresholds in nonfarm rural employment* are consistent with segmented rural labour markets and bifurcated welfare levels in which some families are able to afford to educate their children for the skilled labour market while other families are unable to do so. In their study in high density areas of Western Kenya, Marenza et al. (2003) found that households with high levels of education had higher fertilizer application rates, higher probability of owning dairy cattle and tea bushes, had higher maize yields, and earned higher off-farm income per day.
- c) *Thresholds in economies of scope among household livelihood strategies* are consistent with the successful coupling of agricultural enterprises, such as coffee and dairy cattle in Kenya, and with high correlations between level of income and particular combinations of income sources. This is different from diversification *per se*. Other chapters in this volume show that more diverse livelihood strategies are not necessarily associated with higher welfare. For example, rural households with salaried employment are almost always usually able to achieve higher levels of income than rural households that do casual work for their neighbours. Rural households that earn important shares of their livelihood through extraction of natural resources are usually among the poorest in their villages.

d) *Thresholds in processing and marketing* condition entry into higher-return value-adding activities post-harvest for rural households. Financing, scale of operation and infrastructure constraints may limit access to remunerative activities, such as bulk storage, cooling and pasteurization of milk in dairy cooperatives or horticultural products (e.g., fruits, vegetables, cut flowers) subjects to costly, strict international grades and standards enforcement. In southwestern Morocco, Lybbert, Barrett and Narjis (2002) found that access to electricity and finance segmented households between distinct markets that emerged for argan oil, with the high-end export market controlled by non-natives of the argan forest whose superior capital and electricity access enabled them to test, certify and package the oil for European markets in ways beyond the reach of poorer forest dwellers, who were stuck selling only to lower-value local markets.

#### *Asset risk and poverty traps*

Standard economic analysis of risk considers the effects of stochastic processes on the payoffs to particular strategies and attitudes toward variation in payoffs. The perspective of dynamic poverty traps adds another dimension to this analysis: reductions in asset stocks below key threshold levels may cause households to shift from higher return to lower return livelihood strategies.

The poor tend to be much more exposed than the rich are to asset risk and thus face a higher probability of being cast below critical thresholds due to adverse shocks caused, for example, by drought, floods, hurricanes, infectious disease or war. This is true at the macro scale. For example, IFRCRCS (2002) reports that more than 98 percent of the people affected by different types of environmental (e.g., droughts, earthquakes, floods, avalanches) and technological (e.g., industrial or transport accidents) disasters worldwide, between 1992 and 2001, lived in low and medium human development nations. It is also true at the micro scale. For example, Strauss and Thomas (1998) review a range of evidence showing that poorer people consistently suffer more episodes of illness than do the rich. Krishna et al. (2003) show that health shocks are by far the most common reason for households falling into poverty in Rajasthan, India, and western Kenya. In the absence of effective safety nets to limit the damage done by asset shocks, people routinely fall not only into poverty, but beyond critical asset thresholds and into poverty traps.

Asset shocks are problematic not only because they occur, destroying personal and family capital by droughts, floods, hurricanes, wars, etc., but also because people follow precautionary strategies in order to try to avoid them. The existence of critical thresholds at which people switch between livelihood strategies heavily affects household risk management. Because households know (i) that asset shocks occur with positive probability (ii) that this probability is affected by current allocation decisions and (iii) that some asset shocks induce involuntary livelihoods transitions, people adapt their behaviors accordingly. They become more likely to choose activity and asset portfolios that limit asset and income risk, foregoing high-return investments that would demand significant short-term sacrifice beyond what is prudent and safe (Binswanger and Rosenzweig 1993). They willingly destabilize consumption in order to protect assets so as to minimize the probability of suffering irreversible asset shocks in the next period (Zimmerman and Carter 2003, Barrett et al. 2003). The further they move beyond critical asset thresholds, the more they can begin to afford to undertake higher risk and higher return livelihood strategies, leading to locally increasing returns to assets.

### **Implications for rural development policies**

Integration of the concepts of dynamic poverty traps and rural livelihoods raises several important implications for rural development policy as well. We emphasize four in particular.

#### *Agricultural extension for poverty alleviation*

Extension services should distinguish client groups on the basis of livelihood strategies and asset portfolios, and consider how new technologies would fit into different strategies and how they might be limited or facilitated by different asset levels. For households that are relatively rich in land and labour, but poor in other assets and income generation potential, extension agents might focus on knowledge-intensive techniques that are not subject to threshold effects. For example, there is evidence from Zambia, Malawi and Kenya that access to information and germplasm are the most important constraints to the adoption of agroforestry approaches to soil fertility enhancement, even among relatively poor households and female headed households (Place et al., 2002; Gladwin et al., 2002).

### *Agricultural technology development*

Research on improved technologies typically focuses on expanding the yield frontier or on developing crop and animal varieties that can better resist abiotic or biotic stresses. This is obviously desirable for those farming households that presently appear willing and able to employ frontier technologies. But in many cases, households opt for seemingly inferior, earlier generation technologies, leaving “improved” seeds, machinery and methods on the shelf. A key insight offered by the dynamic poverty traps approach is that the highest return technologies, at least in terms of welfare improvements among the poor, may come not from expansion of the agricultural production frontier so much as from creating and introducing “transition technologies” that are feasible and desirable to adopt now, but which naturally lead to accumulation and graduation to still-better technologies. Technologies that increase returns to existing livelihood strategies can thus become avenues to new, more desirable, livelihood strategies that can be adopted in the future.

### *Rural Financial Markets*

If poorer households could freely draw down cash savings or take out loans at reasonable interest rates or receive insurance payments on extraordinary losses, most problems of persistent poverty would vanish. In poor communities, however, incomplete rural financial markets limit people’s ability to make trades across time and across states of nature so as to overcome the financing constraints that underpin poverty traps. Limited access to finance severely limits uptake of improved technologies and investment in productive assets or activities offering high expected rates of return. Furthermore, the poor commonly have trouble weathering shocks, suffering either persistent or catastrophic health problems (Hoddinott and Kinsey 2001) or necessitating distress sales of valuable productive assets. Hence the push to extend microfinance, encompassing both savings and credit products for the poor (Zeller et al. 1997), and to provide novel forms of insurance against rainfall and other shocks (Skees 2000).

### *Safety Nets*

The threat of uninsured asset loss and the possibility that unforeseen events can knock people into lower-level livelihood strategies underscore that safety nets can play an extremely valuable role in mitigating asset risk, in keeping short-term shocks from leading to chronic poverty through endogenous asset decumulation or low-return production and portfolio strategies. There are examples of safety net schemes that seem to work, perhaps especially

those based on public employment guarantees, such as food-for-work programs, when designed and implemented properly (von Braun 1995, Ravallion 1999, Barrett, Holden and Clay 2003). Food aid can likewise contribute to better consumption outcomes and anthropometric status and to the protection of crucial productive asset stocks (Quisumbing 2003, Barrett and Maxwell forthcoming), although it largely fails to help move recipients out of chronic poverty. Rather, food aid prevents decline into deeper destitution.

In sum, rural development policies need to emphasize both opening up pathways out of poverty for those seemingly trapped in chronic poverty – through improved access to transition technologies and to financial products – and to erect and maintain effective safety nets to keep the poor from being undercut by adverse shocks. Extension services play a potentially valuable role in identifying distinct client groups on the basis of livelihood strategies and asset portfolios and thus in helping to target different policy interventions to communities and households with different needs.

## References

Adato, M. and R. Meinzen-Dick (2002), *Assessing the Impact of Agricultural Research on Poverty Using the Sustainable Livelihoods Framework*. EPTD Discussion Paper No. 89/FCND Discussion Paper No. 128. International Food Policy Research Institute, Washington, D.C.

Azariadis, C. and A. Drazen (1990), "Threshold externalities and economic development," *Quarterly Journal of Economics* 105, 3: 501-526

Barrett, C.B. (2002a), "On Social Networks and Economic Development", Cornell University working paper.

Barrett, C.B. (2002b), "Food Security and Food Assistance Programs," in B.L. Gardner and G.C. Rausser, eds., *Handbook of Agricultural Economics* (Amsterdam: Elsevier).

Barrett, C.B., S. Holden, and D. C. Clay (2003), "Can Food-For-Work Programs Reduce Vulnerability?" in Stefan Dercon, editor, *Insurance Against Poverty* (Oxford: Oxford University Press).

Barrett, C.B., P.P. Marenja, J. McPeak, B. Minten, F. Murithi, W. Oluoch-Kosura, F. Place, J. C. Randrianarisoa, J. Rasambainarivo and J. Wangila (2003), "Welfare Dynamics in Rural Kenya and Madagacar," Cornell University working paper.

Barrett, C.B. and D. G. Maxwell (forthcoming), *Food Aid After Fifty Years: Recasting Its Role*.

Barrett, C.B., F. Place and A.A. Aboud, eds. (2002), *Natural Resources Management in African Agriculture: Understanding and Improving Current Practices* (Wallingford, UK: CABI).

Barrett, C.B., T. Reardon and P. Webb, eds. (2001), "Income Diversification and Livelihoods in Rural Africa: Cause and Consequence of Change" *Food Policy* 26, 4 special issue.

Barrett, C.B. and B.M. Swallow (2003), "Fractal Poverty Traps" Cornell University working paper.

Bebbington, A. (1999), “Capitals and Capabilities: A Framework for Analyzing Peasant Viability, Rural Livelihoods and Poverty,” *World Development* 27(12): 2021-2044.

Coomes, O.T. and G.J. Burt (1997), “Indigenous market-oriented agroforestry: Dissecting local diversity in western Amazonia, *Agroforestry Systems* 37, 1: 27-44.

Coomes, O.T., F. Grimard and G.J. Burt (2000), “Tropical forests and shifting cultivation: Secondary forest fallow dynamics among traditional farmers of the Peruvian Amazon,” *Ecological Economics* 32, 1: 109-124.

Dasgupta, P. (1997), “Nutritional status, the capacity for work, and poverty traps,” *Journal of Econometrics* 77 (1): 5-37.

Dercon, S. (1998), “Wealth, risk and activity choice: cattle in Western Tanzania,” *Journal of Development Economics*, 55, 1: 1-42.

Dercon, S. and P. Krishnan (1996), “Income Portfolios in Rural Ethiopia and Tanzania: Choices and Constraints,” *Journal of Development Studies* 32, 6: 850-875.

Dercon, S. and P. Krishnan (2000a), “Vulnerability, seasonality and poverty in Ethiopia,” in B. Baulch and J. Hoddinott, eds., *Economic Mobility and Poverty Dynamics in Developing Countries*. London: Frank Cass.

Elbers, C., J. Lanjouw and P. Lanjouw (2001). “Welfare in villages and towns: micro-level estimation of inequality and poverty.” Free University of Amsterdam working paper.

Ellis, F. (2000), *Rural Livelihoods and Diversity in Developing Countries* (Oxford: Oxford University Press).

Floyd, C., A.-H. Harding, K.C. Paudel, P.D. Rasali, K. Subedi, and P.P. Subedi (2003), “Household adoption and associated impact of multiple agricultural technologies in the western hills of Nepal,” *Agricultural Systems* 76: 715-738.

Fujita, M., P. Krugman and AJ Venables (1999), *The spatial economy; cities, regions and international trade* (Cambridge: MIT Press).

Galor, O. and J. Zeira (1993), "Income distribution and macroeconomics," *Review of Economic Studies* 60, 1: 35-52.

Gladwin, C.H., J.S. Peterson, D. Phiri and R. Uttaro, "Agroforestry adoption decisions, structural adjustment and gender in Africa," in C. Barrett, F. Place and A. Aboud (eds.), *Natural Resources Management in African Agriculture*, CABI Publishing, Wallingford, UK, pp. 115-128.

Hoddinott, J. and Kinsey, B.H. (2001), "Child Growth in the Time of Drought," *Oxford Bulletin of Economics and Statistics* 63, 4: 409-436.

International Federation of the Red Cross and Red Crescent Societies (2002), *World Disasters Report 2002*. Geneva: IFRCRCS.

Jayne, T.S., T. Yamano, M. Weber, D. Tscharley, R. Benfica, D. Neven, A. Chapoto, and B. Zulu (2003), "Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies", *Food Policy*, in press.

Krishna, A., P. Kristjanson, M. Radeny and W. Nindo (2003), "Comparing Pathways out of Poverty in Kenya and India," International Livestock Research Institute working paper.

Krugman, P. (1991), "Increasing Returns and Economic Geography, *Journal of Political Economy* 99, 3: 483-499.

Loury, G.C. (1981), "Intergenerational Transfers and the Distribution of Earnings," *Econometrica* 49, 4: 843-867.

Lucas, R. (1988), "On the mechanics of economic development," *Journal of Monetary Economics*, 22, 1: 2-42.

Lybbert, T.J., C. B. Barrett and H. Narjis (2002), "Market-Based Conservation and Local Benefits: The Case of Argan Oil in Morocco," *Ecological Economics*, 41, 1: 125-144.

Lybbert, T.J., C.B. Barrett, S.Desta, and D.L. Coppock (2002), "Stochastic Wealth Dynamics and Risk Management Among A Poor Population," Cornell University working paper.

Marenja, P.P., W. Oluoch-Kosura, F. Place and C. Barrett (2003), *Education, Non-farm Income, and Farm Investment in Land-Scarce Western Kenya*. BASIS Brief No. 14. University of Wisconsin, Madison, Wisconsin, USA.

McCay, A. and D. Lawon (2003), "Assessing the extent and nature of chronic poverty in low income countries: issues and evidence," *World Development* 31(3): 425-439.

Mookherjee, D. and D. Ray (2002), "Contractual Structure and Wealth Accumulation," *American Economic Review* 92,4: 818-849.

Moser, C.M. and C.B. Barrett (2003), "The disappointing adoption dynamics of a yield-increasing, low external input technology: the case of SRI in Madagascar," *Agricultural Systems* 76: 1085-1100.

Narayan, D. and P. Petesch. 2002. *Voices of the Poor: From Many Lands*. New York, N.Y: Published for the World Bank, Oxford University Press.

Place, F., S. Franzel, J. DeWolf, R. Rommelse, F. Kwasiga, A. Niang and B. Jama (2002). "Agroforestry for soil fertility replenishment: evidence on adoption processes in Kenya and Zambia," in C. Barrett, F. Place and A. Aboud (eds.), *Natural Resources Management in African Agriculture*, CABI Publishing, Wallingford, UK, pp. 155-168.

Ravallion, M. (1999), 'Appraising Workfare' *World Bank Research Observer* 14, 1: 31-48.

Romer, P. (1986), "Increasing returns and long run growth," *Journal of Political Economy* 94, 4: 1002-37.

Romer, P. (1994), "New goods, old theory, and the welfare costs of trade restrictions," *Journal of Development Economics* 43, 1: 5-38.

Scoones, I. (1998), "Sustainable Rural Livelihoods: A Framework for Analysis: University of Sussex IDS Working Paper number 72.

Shepherd, K.D., and M.J. Soule (1998). "Soil fertility management in west Kenya: dynamic simulation of productivity, profitability and sustainability at different resource endowment levels" *Agriculture, Ecosystems and Environment* 71, 1:131-145.

Skees, J.R. (2000), "A role for capital markets in natural disasters: A piece of the food security puzzle," *Food Policy* 25, 3: 365-378.

Strauss, J. and D. Thomas (1998), "Health, Nutrition, and Economic Development" *Journal of Economic Literature* 36, 2:766-817.

von Braun, J. (ed.) (1995), *Employment for Poverty Reduction and Food Security*, International Food Policy Research Institute, Washington DC.

Zeller, M., G. Schrieder, J. von Braun, and F. Heidhues (1997), *Rural Finance for Food Security for the Poor: Implications for Research and Policy*. Washington: International Food Policy Research Institute.

Zimmerman, F.J. and M.R. Carter (2003), "Asset smoothing, consumption smoothing and the reproduction of inequality under risk and subsistence constraints," *Journal of Development Economics* 71, 2: 233-260.

Table 1: Relations between assets, livelihoods and household incomes:  
Summary of results from previous studies from Africa

Study sample	Asset and correlation	Livelihood and correlation	References
Kenya 1994 (~ 10,000 households)	primary education (+), land holdings (ns)	agriculture dependence (-)	Geda et al. (2001)
Uganda 2000 (315 households in 3 districts)	land holdings (+), livestock (+), productive tools (+)	self employment (+)	Ellis and Bahiigwa (2001)
Zimbabwe 1995 (594 households in 3 semi-arid districts)	oxen (+) scotch carts (+), wheelbarrows (+), education (+)	regular wages (+)	Bird and Shepherd (2003)
South Africa 1998 (1200 households in KwaZulu Natal)	arable land (+) family members (-)	(not reported)	Carter and May (2001)
South Africa 1999 (number of households not reported)	(not reported)	formal sector employment (+)	Aliber (2003)
Malawi 1998 (12,960 households)	education (+) agricultural land (+) livestock (+) distance to public services (-)	formal sector employment (+), tobacco production (+ in one region, ns in one region)	Mukherjee and Benson (2003)
Ethiopia 1995 and 1996 (2695 households)	agricultural land (+) livestock (+) primary education (ns) secondary education (na)	(not reported)	Jayne et al. (2001)
Kenya 1997 (1416 households)	agricultural land (+) livestock (+) primary education (+) secondary education (+)	(not reported)	Jayne et al. (2001)
Zambia 1999 / 2000 (6330 households)	agricultural land (+) livestock (+) primary education (+) secondary education (+)	(not reported)	Jayne et al. (2001)
Rwanda 1991 (1108 households)	agricultural land (+) livestock (+) primary education (+) secondary education (na)	(not reported)	Jayne et al. (2001)
Mozambique 1996 (3851 households)	agricultural land (+) livestock (+) primary education (ns) secondary education (ns)	(not reported)	Jayne et al. (2001)

(+) indicates positive impact on household income, (-) indicates a negative impact on household income, (ns) indicates no statistically significant impact on household income, (na) indicates not applicable

**Figure 1: Income Orderings by Livelihood Strategy in Rwanda**

