

Pathways into and out of Poverty: A Study of Rural Household Wealth Dynamics in Kenya¹

Milu Muyanga, T.S. Jayne, and William J. Burke²

Abstract

This study identifies the factors associated with smallholder farm households that have risen out of poverty or descended into poverty between 1997 and 2007 in Kenya. The study uses data from a nationwide balanced panel of 1,275 households and data from detailed retrospective ‘life history’ survey of 84 households that had experienced either an appreciable improvement or decline in their asset wealth over the 10-year panel period. The results indicate that household welfare dynamics is associated with a disparate set of idiosyncratic and unexpected shocks, such as death and chronic illness as well as intergenerational wealth transfers.

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² Muyanga is a research fellow at Tegemeo Institute, Egerton University, and is currently a Ph.D. candidate at Michigan State University. Jayne is professor, International Development, Michigan State University. Burke is graduate research specialist at Michigan State University, currently a visiting fellow at the Food Security Research Project in Lusaka, Zambia. Correspondences to muyangam@msu.edu

I. Introduction

For the past half-century, African governments and development agencies have experimented with a series of alternative approaches for addressing rural poverty, each giving way to a new paradigm as the persistence of poverty created disillusionment with prevailing approaches. These broad strategies included ‘growth and trickle down’ in the 1960s; basic human needs and state-led integrated rural development in the 1970s; structural adjustment and economic liberalisation in the 1980s and 1990s; and, since 2000, a heterodox mix of donor budget support to empower government ownership in the design of participatory poverty reduction strategies, and resurgent interest in agricultural development and food security, which has been pursued in highly disparate ways throughout Sub-Saharan Africa but which in general has been associated with a re-emergence of direct state operations in agricultural markets. In 2005, more than 40 per cent of sub-Saharan Africa’s population was estimated to be below the poverty line, and this situation appears to have improved only marginally over the past decade (World Bank, 2006). Despite successive years of five per cent growth in real gross domestic product (GDP) in sub-Saharan Africa in 2004, 2005, 2006, and 2007, rural poverty appears to be declining only marginally, and is even increasing in some countries.

Yet some smallholder farm households have successfully climbed out of poverty, and these cases provide an opportunity to learn how they did it. If researchers and policy makers knew more about the factors enabling some households to have risen out of poverty, it might be possible to replicate these factors more broadly through poverty reduction strategies. Conversely, some households that were once well above the poverty line have now descended into poverty, and these cases may also provide insights about the design of programs and policies to address rural poverty. Additional insights may be possible by identifying ‘successful’ farmers who have

consistently outperformed others in their communities and the reasons for it. This study is motivated by the need to better understand the factors enabling rural households in sub-Saharan Africa to escape from poverty and raise their living standards.

This study examines the factors associated with dramatic changes in farm household asset wealth over a 10-year period in Kenya. The study makes use of household panel survey data collected in 1997, 2000, 2004 and 2007 to identify three types of smallholder farm households: (i) those experiencing a major improvement in asset wealth; (ii) those experiencing a major decline in wealth leading to living standards below the poverty line; and (iii) ‘successful’ smallholder farmers consistently in the top quartile of asset wealth throughout the 10-year period. After identifying 28 households in each of these three groups, we revisited them in 2008 to conduct retrospective in-depth ‘life history’ surveys on these households. The sample was confined to smallholder farming households controlling less than 4 hectares of land, given that 95 per cent of Kenya’s smallholder population is also in this situation. The study thus omits cases of poverty reduction arising from obtaining access to significant new land, a situation that is infeasible for the vast majority of rural African households.

The study measures poverty and wealth in terms of households’ assets. While most studies to date have tended to measure household welfare in terms of income or consumption, arguments have been raised in support of households’ value of assets as a more appropriate measure of welfare. Asset holdings are considered to be a more stable indicator of current welfare and future vulnerability especially in regions where households rely greatly on their physical assets for their livelihoods (Krishna, 2004; Barrett and Swallow, 2006; Carter and Barrett, 2006; Cooper, 2008). Especially in environments where credit and insurance markets do not work for the rural poor, households rely on their assets to smooth consumption and to ensure

survival through repeated shocks. Thus, assets act as a ‘safety-net’ when households’ income streams are interrupted (Carter and Barrett, 2006). For these reasons, the study of household asset dynamics -- how households build up their asset base and why asset bases get depleted -- is likely to be important in developing effective poverty reduction strategies.

The present study is different from earlier works in two important respects. First, most earlier studies on poverty dynamics in Kenya (and in general) are based on only two or three waves of short panel data covering fairly short periods of analysis (Place et al., 2003; Kristjanson et al., 2004; Krishna et al., 2004; Barrett et al., 2006). Because many rural farm households tend to experience temporary movements into and out of poverty, a permanent movement across the poverty line is indistinguishable from temporary movements when only short panel data sets are available. Short panel periods may also fail to detect longer-term accumulation processes that occur over a decade or longer. This study covers a 10-year period, which makes it possible to detect long-term trends and distinguish them from transitory movements. The second contribution of this study over prior works is how we deal with long-term endogenous factors that tend to be regarded as exogenous in typical analyses that cover a relatively short time frame. The merging of retrospective ‘life history’ data into a decade-long panel survey data permit a fuller understanding of the range of near-term and temporally remote factors influencing wealth accumulation. The use of retrospective data also can be used to at least partially reduce omitted variable problems that lead to potential bias in the coefficient estimates of studies unable to control for temporally remote effects.

The paper is organized as follows: Section 2 examines poverty trends in Kenya over the past 20 years based on official government statistics. Section 3 describes the data and sampling methods used in this study. Section 4 reviews the literature on the determinants of poverty in

rural Africa based on prior studies and reports descriptive trends and factors correlated with asset wealth and poverty patterns in the nationwide panel sample. Section 5 presents the estimation strategy used to derive statistical inferences about the importance of these various factors associated with changes in poverty status over time. Section 6 reports the main findings, while Section 7 discusses the implications for the rural investments, programs, and policies designed to reduce rural poverty.

2. Poverty Trends in Kenya

Economic growth and poverty rates appear to have been generally inversely correlated over the past two decades in Kenya. In the 1990s, the Kenyan economy was in clear decline and poverty rates rose from 40 to 48 per cent in the early 1990s to 53 to 56 per cent by 1997. From the early 2000s up to 2007, however, the Kenyan economy showed signs of improvement. The economy grew from -0.3 per cent in 2000 to 7.1 per cent in 2007 (Figure 1). Even though poverty rates have declined during this period, they still remain pervasively high. According to the 2005/06 Kenya Integrated Household Budget Survey (KIHBS), implemented by the Kenya National Bureau of Statistics (KNBS), national absolute poverty declined from 52.3 per cent in 1997 to 45.9 per cent in 2005/06 (Table 1). Over the same period, absolute rural poverty declined from 52.9 to 49.1 per cent while urban absolute poverty declined from 49.2 to 33.7 per cent. The national food poverty rate declined from 48.3 to 45.8 per cent. KIHBS estimated the food poverty lines in monthly adult equivalent at KSh.988 and KSh.1474 for rural and urban areas respectively. Rural food poverty declined from 50.7 to 47.2 per cent while urban poverty increased from 38.8 per cent in 1997 to 40.5 per cent in 2006.

There are important regional differences in poverty (Table 2). North Eastern and Coast provinces registered the highest food poverty rates of 66 and 63.5 per cent respectively in 2005/06. Central Province registered the lowest poverty incidence (31.4%). Even though North Eastern province had the highest proportion of people living in poverty, it is sparsely populated and largely pastoral, and hence the causes of poverty there are different from the agriculture-based regions. The agricultural productive region of Central Province had the lowest poverty rates at 31.4 per cent.

Reducing rural poverty has been a central policy concern in Kenya. To enable the government to better understand the causes of poverty, the government of Kenya developed the poverty reduction strategy paper (PRSP) in 2001 (Republic of Kenya, 2001). The PRSP was a product of broad-based and in-depth consultations among key stakeholders and in particular the poor. It outlined the priorities and measures necessary for poverty reduction and economic growth. The PRSP was central to the development of a pro-poor and pro-growth Medium Term Expenditure Framework (MTEF) budget started in fiscal year 2000/01. The MTEF budget aimed at improving the quality of expenditure and shifting of resources towards pro-poor activities and programs.

Beginning 2003, a new government (NARC) came into power and continued economic recovery process and poverty reduction initiatives by preparing a broad nationwide development framework, the Economic Recovery Strategy for Wealth and Employment Creation (Republic of Kenya, 2003). Among other pro-poor programs, the government initiated free primary education and the Constituency Development Fund (CDF). Unlike previous government development funds, CDF resources are transferred directly to local constituencies which are tasked with managing the funds and determining how they will be spent through consultative processes with

communities. There is some evidence of improvement in rural households' proximity to some publicly provided services and infrastructure since the implementation of the CDF in 2003 (Chamberlin and Jayne, 2009).

3. A Description of the Data

The study draws from two sources of data. First, we utilize a balanced panel of 1,275 rural households interviewed in 1997, 2000, 2004 and 2007 by the Tegemeo Institute, a national policy institute of Egerton University. The four surveys were implemented under the Tegemeo Agricultural Monitoring and Policy Analysis Project between Tegemeo Institute and Michigan State University. A stratified sampling technique was used to take into account the ecological diversity inherent in the country. All the districts were classified into eight agro-regional zones. Agro-regional zones bring together areas with similar agro-climatic conditions, agricultural activities, and rural livelihoods. Using standard proportional sampling aided by national census data, farm households were sampled randomly from 24 districts. Two districts were excluded from this analysis because they are largely pastoral.

As mentioned earlier, households' poverty status is based on observing the value of a household's assets in each survey and comparing the changes over time. The list of productive assets consistently collected and valued in each of the four surveys includes ploughs, tractors and draft animal equipment, carts, trailers, cars, trucks, spray pumps, irrigation equipments, water tanks, stores, wheelbarrows, combine harvesters, donkeys, bulls, chickens, goats, sheep, calves, cows, pigs, turkeys and ducks. As mentioned in the introduction, recent studies in the poverty literature argue that asset wealth is easier to accurately measure than income or consumption, is less susceptible to random shocks than income, and is likely to be a more stable indicator of

household welfare, especially in regions where rain-fed agriculture is a major source of annual income and where weather-induced fluctuations in annual income are high. However, we did compare income-based measures with asset wealth and find the within-year Spearman R^2 correlation to range from 0.49 in 1997 to 0.56 in 2007 (all statistically significant at 0.05), indicating a fairly strong degree of consistency between the two indicators.

The computed household asset values were deflated using the Kenya consumer price index with 2007 as the base year. Next, wealth was divided by the number of adult equivalents (AE) according to the World Bank's gender and age-based scale. Figure 2 shows density curves of changes in households' asset values between survey years, while Table 3 presents information on the distribution of assets and income across the various survey years for the entire sample. As shown in Table 3, the mean value of household assets, after accounting for inflation, rose by 32 per cent over the period of 1997-2007 from Kenyan Shilling (KSh) 72,000 to KSh 95,000. However, looking at the distribution of changes in household assets across the sample, we can see that between each period, 25 per cent or more of the households experienced a decline. In all the other periods, however, at least 50 per cent of the sample was accumulating asset wealth, and for the top 10 per cent of farmers in each year (the 90th percentile as reported in Table 3), asset accumulation was quite substantial, averaging KSh56,000 (roughly US\$600) between periods.

Finally, the ratio of wealth per AE was stratified into terciles (or thirds) for each year, yielding three relative poverty rankings: very poor, moderately poor and non-poor. This procedure was conducted in each year (1997, 2000, 2004 and 2007), revealing the path of each household's relative welfare. The households were next categorized into four welfare mobility groups as follows: i) the chronically poor (those in the bottom tercile in each of the four years); ii) descending households (those in the 'top' in 1997 and 'bottom' in 2007); iii) ascending

households (those in the ‘bottom’ in 1997 and ‘top’ in 2007); and iv) consistently non-poor (those in the ‘top’ in each of the four years). Of the 1275 households in the sample, 165 are identified as chronically poor, 46 have fallen into poverty (the ‘descenders’), 49 have climbed from poverty (the ‘ascenders’) and 207 are consistently among the wealthiest households (this left out 808 households, or 63.4 per cent, in poverty mobility categories of either little movement in poverty over time or variations across years with no clear trend).

Retrospective and life history surveys were conducted in 2008. Based on the four household groupings from the nationwide sample as defined above, we conducted in depth retrospective surveys and life history interviews from a selected sub-set of households in three of the four categories (the ‘ascenders’, the ‘descenders’ and the consistently relatively well-off households). No life-history interviews were conducted of the chronically poor. The selection of households was confined to those owning 4 acres or less, a situation characterizing over 90 per cent of Kenya’s smallholder sector. We imposed this land limit on households to be included in the retrospective surveys because of the desire to identify processes associated with poverty reduction that could be applicable to the vast majority of rural households in Kenya for whom the escape from poverty cannot occur through major *extensification* of farm production. We also checked income changes for these households to ensure a high degree of correlation between changes in income and asset wealth, and excluded several households from participation in the retrospective surveys based on inconsistencies. After imposing these conditions on the sample, we selected more than half of the remaining ‘ascenders’ (those rising out of poverty) and ‘descenders’ (those falling into poverty) contained in the full sample for participation in the retrospective surveys. Overall, 84 households (27 ascenders, 27 descenders, and 30 consistently successful farmers) were selected to conduct in-depth retrospective ‘life history’ surveys. The

ascenders and descenders came from the extreme left and right respectively of the distribution represented in Figure 2. The non-poor group came from around the centre of the distribution (household that maintained relatively high asset values throughout the panel period but did not experience enormous changes in asset holding).

As another cross-check on the nationwide survey data, enumerators printed out graphs plotting the changes in each household's asset wealth from 1997 to 2007 on a piece of paper and asked household respondents during the retrospective surveys whether their households' welfare status followed the general pattern shown on the graphs. During this process it was found that a couple cases classified as 'descenders' were families that considered themselves to be at the 'winding up' stage of their life cycles. At the beginning of the panel they had relatively high asset values but had transferred assets or sold them to raise school fees for their grandchildren during subsequent interview years. In their view, they were not poor by any standards and were excluded from subsequent analysis. Results are reported for the remaining 78 households (30 ascenders, 25 descenders, and 23 consistently successful farmers). Table 4 presents the real asset values and incomes for households in each category over the four survey years.

The retrospective 'life history' survey obtained information about parents' family conditions and history, kinship ties, inter-generational transfers, shocks, gender-related factors, other aspects of household composition, and key investment decisions made that had long-term influences on households' current wealth and productivity conditions. Life history interviews were carried out at the household level while focus group discussions were implemented at the community level, in the sites where the sample households reside. The life histories brought in useful qualitative insights into asset holding and poverty dynamics.

4. Conceptual Framework

This study examines the role of various ‘pathways’ in influencing households’ escape from or descent into poverty. Conventional cross-sectional household surveys are of limited help in this task because of their inability to measure the dynamics of household accumulation over time and the factors affecting this trajectory. Cross-sectional studies typically find that farm household income or consumption is highly correlated with landholding size, other productive assets, the use of improved farm technologies, and employment in gainful non-farm jobs yet such studies cannot trace the direction of causality, for example, did households choosing to use improved farm technologies become wealthy, or are wealthy farmers more able to use improved technologies?

There is increasing evidence that the current wealth status of households and differences in wealth between households within a community can be partially attributed to temporally remote factors (for example, inheritance at the time the household was formed). Even a decade-long study is unable to fully trace out the sequence of how household decisions affect subsequent household welfare because information is missing on household decisions, shocks and basic characteristics at the time the household was formed, which may exert strong effects on the path of household asset accumulation over time. Retrospective surveys probing into conditions of the parents’ households and inter-generational transfers may partially enable researchers to account more comprehensively for such temporally remote factors, which would have the added benefit of reducing the omitted variable problem that would potentially lead to biased inferences about the importance of other variables contained in dynamic income, consumption, or wealth models. Therefore, the combining of retrospective life history information with conventional panel data survey information may permit both a fuller understanding of the range of near-term and

temporally remote factors influencing wealth accumulation as well as reducing the severity of the omitted variable sources of bias in the coefficient estimates of conventional survey-based studies of poverty mobility and wealth generation.

We start conceptually with the possibility that household's asset holding dynamics in any given year is a function of household demographic factors, prior idiosyncratic factors, the household's socio-economic environment, including spatial factors such as agro-ecological conditions and access to markets, and intergenerational factors, including differences across households in the extent to which they receive asset transfers from their parents and other parental decisions.

Household demographic factors: Changes in household composition (size, dependency ratios, and headship gender) through births, marriage, divorce, abandonment, death, and migration may affect households' physical asset holding. Previous studies reveal that household headship gender influences economic well-being; female-headed households are most likely to be disadvantaged (Posel, 2001; Fafchamps and Quisumbing, 2005). Hence a descent into poverty could result from a change in the gender of the household head resulting from the death of the male head, which in some parts of Africa is linked to the risk of losing land assets at some point in the future (Chapoto et al., 2008).

Also included under demographic factors are households' dependency ratios and social capital connections. Families with higher child-to-adult ratios usually face greater difficulty in accumulating assets than other households. Raising children entails costs that affect savings and asset holdings. Social capital is also an important factor determining access to land and other assets. Jayne et al. (2008) show that households in which the male head is related by blood to the

local headman have an average of 0.4 hectares more land, other factors constant, than other households in Zambia's smallholder farming sector.

Expenditure on children's education represents an investment that may cause a reduction in current wealth but promises to raise household income and wealth at some point in the future.

Shocks: Shocks deplete household assets, or predispose households to future asset depletion. Some shocks are random, such as drought, floods, and civil conflict, and have the capability of pushing households into poverty traps from which it is difficult to escape. Agricultural production involves a variety of price and yield risks which appear to be prevalent especially for small-scale farmers in semi-arid regions. Accidents, chronic illness, death, dislocation, abandonment in old age, alcohol abuse and household disputes and breakdown can destabilize a household asset holding (Bird and Shinyekwa, 2004). Earlier studies have shown that poorer households are more prone to adverse shocks than are wealthier households (Glewwe and Hall, 1998; McPeak and Barrett, 2001). Little et al. (2002) argues that while poor households' tend to sell their assets in response to shocks, their relatively wealthier counterparts maintain a higher asset base by keeping their assets off a devalued market and by purchasing the devalued assets from poorer households. These studies suggest that households' initial conditions largely determine the effects of a random shock on future assets and livelihoods.

Access to markets and infrastructure: Proximity to markets and infrastructure influence households' asset holding. Distances to markets and paved roads are often considered to affect households' ability to participate in markets. Access to infrastructure enhances households' access to input and product markets and may also influence the type of agricultural activity in which households engage (Zezza et al., 2007). Greater access to infrastructure implies reduced time and distance to urban centres. Households with greater access to electricity, water,

communication, roads and other forms of infrastructure will have a broader range of economic opportunities. Burke et al. (2007) found that nearly two-thirds of the non-poor households are less than a quarter of a kilometre from motorable roads in Kenya. Conversely, 68 per cent of the chronically poorest households are further than 0.25km.

Household history and inheritance: Family history may be a good predictor of household's current asset holding. The transfer of physical assets from parents to their children has been shown to influence the younger generations' future livelihoods and economic productivity (Moore, 2004; Quisumbing 2007). The transfer of assets from one generation to the next may depend on the number of potential recipients of the parents' assets. For this reason, factors such as the number of male (female) children of the parent's family in patrilineal (matrilineal) inheritance systems may influence the current asset position of the households in our sample.

Quisumbing explains various channels through which intergenerational transfers take place. These channels include family decision to invest in their children's human capital (schooling, child health and nutrition); decisions regarding transfers of assets that enable young families to form a new productive unit as children get married; and finally decision regarding the transfer of remaining assets to children as parents' age and eventually die. Particular categories of people are excluded from opportunities to accumulate wealth through inheritance, most notably women and children, because in many African setting women and children do not have secure property rights (Cooper, 2008). Male siblings are often favoured in some communities while females have a lesser claim on parental resources, including education in certain settings (Garg and Morduch, 1998; Morduch, 2000).

The availability of resources and inter-household competition has been theorized to significantly influence asset inheritance. Large family sizes represent severe competition for family resources especially with regard to investment in human capital (education and health) and transfer of physical assets. However, even though access to education is a function of household resources, Quisumbing (2007), assert that it is to a great degree a function of individual child's ability to do well academically. An earlier study of poverty dynamics in Kenya Burke et al. (2007) found out that access to education is an important determinant of wealth. The chronically poorest households are likely to be found in divisions where fewer than half of all heads received any formal education.

A child's birth order also comes into play. First-borns may have an advantage compared to other children in terms of schooling. Later-born children tend to face greater competition for parental resources. However, when the parents age or die, the first-borns tend to take up the responsibility of providing for their younger siblings, including paying for their education, which may affect negatively their ability to accumulate assets for their own families later.

5. Estimation Strategy and Empirical Model

To evaluate the determinants of household asset holding dynamics we use panel data estimation techniques. There are two major panel data models, fixed and random effects models. The fixed effects model is specified as follows:

$$y_{it} = \alpha_i + X_{it}\beta + \mu_{it} \quad (1)$$

where the variable α_i captures all the unobserved, time-constant factors that affect y_{it} . The variable α_i is unobserved heterogeneity. The underlying assumption in the fixed effects specification is the existence of correlation between independent variables and unobserved

heterogeneity that may result in inconsistent estimates in applied research. One of the key advantages of panel data is that it allows the fixed effect factor to be removed from equation (1) through fixed effect estimation. The main drawback of the fixed effects model is that it is not possible to estimate the impact of time-constant variables like the historical variables.

If there are sufficient grounds to assume that the unobserved heterogeneity is uncorrelated with any of the explanatory variables in all time periods, then estimator of equation (1) using fixed effect estimation is not efficient. Instead, an alternative method, a random effects model, is used. Equation (1) is rewritten as follows:

$$y_{it} = \beta_0 + X_{it}\beta + \varepsilon_{it} \quad (2)$$

where $\varepsilon_{it} = \alpha_i + \mu_{it}$. Generalized least squares (GLS) is used to rectify the problem of serially correlated errors, ε_{it} , introduced by the α_i component. Even though the random effects specification allows the inclusion of time-constant variables, the assumption that the fixed effect factor is uncorrelated with the explanatory variables is often not plausible.

To overcome these shortcomings of both fixed and random effects estimators, Mundlak (1978) and Chamberlain (1984) propose a framework known as the correlated random effects (CRE) or the Mundlak-Chamberlain device. This approach allows the modeling of α_i in the following way:

$$\alpha_i = \delta + \bar{X}_i + \zeta_i, \quad \zeta_i | X_i \sim N(0, \sigma_\zeta^2) \quad (3)$$

where \bar{X}_i represents the time-averaged X_{it} over the various panel periods. The CRE estimator however requires the model to have a standard normal distribution, and strict exogeneity conditional on α_i . The main benefits of the CRE estimator are that (1) it controls for unobserved

time-constant heterogeneity as with fixed effects and (2) by including time-average terms we can measure the effects of time-invariant independent variables.

In this study we therefore use the CRE estimator to model the correlates of household asset holding. The dependent variable y_{it} is the log physical asset value (in KSh) in each panel survey wave. We run three alternate models for the three welfare dynamics groups (ascenders, descenders and non-poor). The dependent variable in each specification is the log of the real household asset values. The construction of the physical asset variable was based on 16 assets collected consistently in each panel wave. These include productive assets such as ploughs, harrows, carts, trailers, tractors, cars, trucks, spray pumps, irrigation equipment, water tanks, stores, wheelbarrows, combine harvesters, donkeys, and animals (bulls, oxen, chickens, goats, sheep, calves, cows, pigs, turkeys and ducks). Land was not included in the dependent variable for two reasons: first, information on land values was not available for the 2000 panel wave. Second, as pointed out earlier on, landholding was controlled for while selecting the retrospective survey subsample.

The time varying explanatory variables are lagged by one panel period for two reasons: first, while some explanatory variables may affect asset stocks contemporaneously, most of the variables are expected to influence asset stocks after a lag. For example, distances to infrastructure facilities and shock variables such as adult mortality are assumed to impact on the households' asset stocks after a lag. The second reason was to circumvent any potential endogeneity problem arising from simultaneity problem. The explanatory variables include the following: demographic variables, shocks, distance to infrastructural facilities, spatial and time variables as well variables capturing households' historical and inheritance. The full list of explanatory variables and their summary statistics is presented in Appendix I.

6. Findings

Descriptive Results

This initial section discusses bivariate relationships as a prelude to the econometric findings. Table 5 indicates a clear relationship between asset wealth and gender of the household head. The majority (over 90 per cent) of non-poor households were consistently headed by males over the panel period. Among the ascending group, the proportion with male heads rose from 83 per cent in 1997 to 93 per cent in 2007. There seems to be an advantage for households with male heads. Among the descending group, the proportion of households headed by males plummeted from 88 per cent in 1997 to 56 per cent in 2007. This indicates that a switch in household headship from male to female, often associated with mortality of the household head or divorce, is associated with a descent into poverty. Surprisingly, the descender group also had fewer initial members in 1997 compared to the ascenders and non-poor households. The age of the household head did not seem to matter.

Non-poor households maintained a high proportion of members with post-secondary education (15%) and a low proportion of members with no formal education (9%) over the panel period (Table 5). In this group, the proportion of members without formal education dropped from 10 per cent in 1997 to about one per cent in 2007 while the proportion of individuals with post-secondary education increased from seven per cent in 1997 to 22 per cent in 2007. The proportion of members with post-secondary education remained low throughout the panel period for both ascenders and descenders. Other studies indicate that the success of education in reducing poverty hinges on participants excelling beyond secondary schools and acquiring skills that are in demand on the job market (Muyanga et al., 2007).

Characteristics pertaining to the initial household head and his family's characteristics are presented in Table 6. The ascenders appear to have settled in their current settlement more recently on average than the descenders and their non-poor counterparts. This finding could be attributable to the fact that obtaining more land for households in densely populated smallholder areas of Kenya often requires relocation to a new area. The male household head in the descending group had two wives on average in 1997 compared to the male heads in the ascending and non-poor categories who had one wife (Table 6). By contrast, the fathers of the household heads in the current sample had two wives on average in all groups. This finding could be interpreted as follows: having many dependents to support and more complex inter-household issues to manage may adversely affect the accumulation of wealth, whereas such conditions in the prior generation do not affect wealth dynamics in the current generation. Contrary to our expectation, the number of male siblings and birth order of the initial household head is not correlated with changes in household asset wealth (Table 6).

While most of the initial household heads had only completed primary education, some heads in the non-poor (17%) and ascenders (7%) groups had attained post-secondary education (Table 6). The descender group had the highest proportion of heads (16%) without formal education and none of the heads in this group had attained post-secondary education. In most cases, the educational attainment of the household head is not only determined by the motivation of the individual but is also largely based on the commitment of the head's parents to finance school fees over a sustained period. The impacts of education on current household assets hence largely reflect long-standing investments by the previous generation.

Findings in Table 6 also indicate that the landholding sizes of the household heads' fathers were substantially smaller among the descending group than among the ascenders. This

result holds no matter whether the fathers' landholding size is defined per wife, per brother of the father, or per extended family member. The relevance of examining land per brother of the father is that in patrilineal inheritance systems, the amount of land a father receives himself and can potentially pass on to his sons (which include the current heads of households in this sample) is a function of the number of brothers who also could receive family land in addition to the father. On average the fathers of the household heads had about 40 acres in the ascenders' group, 23 acres among the descenders; and 24 acres in the non-poor group. When we consider land inherited from the previous generation, the descenders inherited the least (Table 6). The non-poor group inherited on average 4.92 acres from the previous generation, the ascenders 3.83 acres, which is 27 per cent more land than the 3.01 acres inherited on average by the descenders.

During the retrospective 'life history' survey, an effort was made to list and value households' inheritance of assets from the previous generation (Table 6). In absolute terms the non-poor households inherited much more than either the ascenders or descenders, but the descenders inherited the least. Moreover, despite starting out with virtually twice as much through inheritance as the other two groups, the non-poor households' value of asset inheritance was lowest as a proportion of 2007 asset wealth and income, indicating that households that started their early stages with relatively high asset levels were much more able to develop a solid future wealth accumulation trajectory. These findings point strongly to the importance of inter-generational transfers in influencing poverty and livelihood outcomes in the current generation of smallholder farmers.

Table 7 presents findings on shocks experienced by the households ten years before the start of the panel survey in 1997. Information on these prior shocks was collected in the retrospective life history interviews in order to measure the potential effects of temporally

remote occurrences on the subsequent trajectory of household wealth accumulation. The descenders appear to have suffered more from prior shocks related to death, chronic illness and other shocks. These households lost 16 per cent of their members as a result of death compared to 10 per cent among the ascenders over 10-year period prior to the panel period. The non-poor sample didn't experience any mortality during this period. Similarly, 24 per cent of the members in the descender families experienced chronic illnesses between 1987-1997 compared to only 7 and 9 per cent in the ascender and non-poor groups. Chronic illnesses include sicknesses such as cancer, diabetes, tuberculosis and HIV/AIDS. The descenders also had a particularly high proportion of household heads suffering from chronic illnesses. Household heads are in most cases the breadwinners and are in a better position to protect household assets from encroachment by others. Chronic illness not only entails increased medical bills but also reduced incomes that could affect household asset holding. About 16 per cent of household heads in the descender group experienced chronic illness in the 1987-1997 period, compared to 9 per cent of the heads in the non-poor group, while none of the heads of ascender households suffered from chronic illness from 1987 to 1997. When we consider the estimated expenditure of chronic illnesses, the descender families on average spent KSh 20,930 while the non-poor and the ascender families spent KSh 2,830 and KSh 7,440 respectively in the ten-year period before 1997. These findings suggest a major correlation between household members' ability to stay healthy and their subsequent ability to accumulate assets over time and rise out of poverty. This relationship is examined in more detail in the multivariate analysis that follows.

Perhaps surprisingly, prior losses from other shocks such as floods, fire, accidents, and theft tended to affect the non-poor and the ascenders more than the descenders families. This may be because random shocks that affect all households equally would have the greatest

monetary impact on households that are relatively well-off to begin with. However, this finding could also occur if some of the shocks, such as theft, are non-random and more likely to afflict better-off households.

Next we turn to shocks experienced during the 1997-2007 panel period (Table 8). The descenders once again experienced more household heads' deaths (28%) while the ascenders experienced only a few deaths (3%) over the panel period. The fact that the descenders incurred the greatest proportion of deaths both prior to the 1997-2007 period as well as during it is consistent with the premise that communicable diseases are at play: infection of one adult leads to subsequent illness and/or death among other adults. The descenders suffered considerably from household heads' deaths throughout the panel period (12% between 1997 and 2000; 12% between 2001 and 2004; and 4% between 2005 and 2007). By contrast, only 3 per cent of household heads died over the entire 10-year period within the ascenders category. These findings illustrate the relationship between household asset accumulation and current and prior health status.

The descenders also suffered more from chronic illness than the ascenders. On average, the losers had about 15 per cent of their members chronically ill while the winners had 13 per cent. The non-poor had 16 per cent of their members chronically ill. However, when we look at the estimated expenditure on chronic illness over the panel period the non-poor category appears to have spent double the amount spent by the losers and winners. This may represent the tendency for wealthier households to afford to spend more on treatment. It may also represent moral hazard tendency by wealthier households to seek medical treatment even for non-serious illnesses that least bother the poor. Caregiving may also be taken on disproportionately by relatively well-off families that are better able to handle such adversities. So, although chronic

illness is more likely to afflict the descenders, it is the ascenders and non-poor who spend more on health care.

Results not presented here due to lack of space indicate that there was a slight decrease in distance to fertilizer retailers, electricity, motorable roads and telephone services for all groups over the panel period. Distance to tarmac road have on average remained the same for each category over the panel period. In general, the non-poor group had the best access to infrastructure and services while the descenders were somewhat further away from these basic services. However, the direction of causality between household wealth and access to infrastructure and services cannot be established except through the dynamic multivariate approach in the following section.

Results from the spatial analysis are presented in Figure 3. The results reveal that the three welfare groups (ascenders, descenders and non-poor) coexist. While poverty incidences vary across regions with some regions exhibiting high poverty incidences, the ascender and descender households are scattered across districts and agro-ecological zones. Earlier studies found evidence of high geographic concentration in the location of the households entering into and escaping from poverty (Kristjanson et al., 2004; Barrett et al., 2006).

Next, we examine trends in agricultural land, input use, and production over time among the three groups (Table 9). Several patterns stand out. First, the ascenders were more likely to accumulate and cultivate land over the 10-year panel period. By contrast, the descenders lost land; the mean land owned among descenders was 3.03 acres in 1997, but this declined to 2.50 acres by 2007. Their area cultivated also declined over this period from 2.44 to 1.92 acres. The consistently non-poor owned and cultivated considerably more land than either the ascenders or descenders. On the surface, these patterns point out the importance of land in contributing to

asset wealth, but both land owned and land cultivated appear to be related in numerous cases to the health status of family members and the avoidance of other unanticipated shocks that can force households to sell or loan out land and other assets.

Perhaps surprisingly, the descender households were more likely to use fertilizer, used fertilizer more intensively, and were more likely to receive agricultural credit in all four survey years than the ascenders (Table 9). These findings indicate that increased fertilizer use and access to credit are not necessarily preconditions for farm households to rise out of poverty, nor do relatively high fertilizer use rates ensure that households will not descend into poverty. This result could be attributable to a number of reasons: first, high fertilizer use rates are only profitable if accompanied by optimal use of the other inputs and adequate rainfall. Second, while smallholder farmers are hypothesized to use land more intensively with increasing population density, emerging evidence shows return per unit of input applied declines after a certain population density thresholds (500-600 persons per km²) is reached (Jayne and Muyanga, 2012). Consequently, continued land intensification beyond that threshold could lead farm households into poverty.

In the retrospective 'life history' survey, information on the importance of different sources of finance used to buy major physical assets (such as land and livestock) and the reasons as to why households sold major assets over the panel period was elicited. The results indicate that while proceeds from farm output are important (48% among the descenders; 50% among the ascenders; and 70% among the consistently non-poor), the ascenders rely a lot on off-farm earning (33%) and savings (20%) as important source of finance used to buy assets. Reasons for asset disposal also varied across the three welfare categories with school fees cutting across the categories. The descenders cited pressing social needs such as school fees (44%), medical bills

(24%) and food (16%) as the critical reasons that forced them to sell assets. The winners mentioned school fees (30%), culling (13%), food (10%) and buying other assets (10%) as the most important reasons. Even though the non-poor cited school fees (22%) as one of the reason as to why they sell assets, other non-pressing needs such as culling the stock (26%) and disposing off assets no longer needed (13%) were mentioned.

Findings from Correlated Random Effects Model

The results from the correlated random effects estimation of the factors determining household asset dynamics are presented in Table 10. To save on space, some of the statistically insignificant variables are not shown in Table 10. We highlight five key findings across the models and then discuss them in more detail below: (1) the role of head of household's demographic characteristics in differentially affecting wealth accumulation; (2) distance to infrastructural facilities; (3) the role of unexpected one-off setbacks, in particular the death and sickness of adult members; (4) family history and inter-generational transfers; and (5) social capital and connections. The three models were also re-estimated with lagged household income as explanatory variable (results not reported). Granger-causality tests of household income and assets had showed that current income is a statistically significant predictor of future asset wealth. Feedback effects from asset wealth to future income were also strong. Evaluated at mean real income levels, a 10 per cent increase in current income is estimated to result in a 1.24 per cent increase in the next period's asset wealth.

Household's demographic characteristics influence asset accumulation: Male-headed households are more successful at accumulating assets. A change from female to male headship is associated with more than a doubling of the household's asset wealth especially for ascenders

and descenders. This finding confirms the earlier bivariate finding that the majority of households descending into poverty over the panel period experienced a change in headship gender from male to female. This finding attests to the often-devastating long-term negative impact of widowhood, separation, or abandonment of females by their spouses on household assets dynamics.

Asset accumulation is an increasing function of the age of the household head. Asset accumulation is positively related to the age of the household head. Among the non-poor and the ascending households, an increase in the age of the household head by one year increases household asset holding by about 12 per cent. The square of the age, which was meant to control for life cycle effects, was not statistically significant and thus was dropped.

Relatively small households are successful in asset accumulation. Asset accumulation is inversely related to household size. An increase in household size by an additional person reduces asset holding by about eight percent for the ascending group. Similarly, the number of wives of the initial household head influenced asset accumulation. Households whose initial head had more than one wife experienced a decline in asset wealth during the panel period. This finding was particularly valid to the non-poor and the descending households. The decision by the initial household head to marry an additional wife reduced household assets by more than 100 per cent over the panel period, possibly due to dowry payments and increased competition on family resources. Results from the descriptive analysis indicated that in situations where the initial household head was polygamous, the household was more likely to have a high dependency ratio.

Reduced distances to infrastructural facilities increase households' assets: Increased distances to healthcare services is associated with a decline in asset wealth for the descending

group. An increase in distance to the nearest healthcare facility by a kilometer reduces household asset holding by 26 per cent. A joint test of significance for all distance to infrastructural facilities emerged statistically significant for the descending group.

Unexpected health setbacks matter: Deaths and chronic illness had significant negative impacts on changes in households' asset wealth. For example, the death of an adult member during the panel period reduced household asset holding seven fold for the descending households. Chronic sickness by a household member reduces household asset holding by more than 100 per cent among the descending households. While deaths adversely affect households' labor force, chronic illnesses drain household assets as well. As reported in the descriptive results, a sizeable number of the descenders cited asset selling to pay for medicines, medical bills, and caretaking. We are not in a position to evaluate whether these shocks are completely random or whether there are attributes of afflicted household members that are correlated with the occurrence of such shocks. However, prior research has shown that disease-related chronic illness and mortality are indeed correlated with particular household characteristics (Gillespie, 2006; Chapoto and Jayne, 2008) such as educational attainment, initial wealth, and mobility. These results emphasize the importance of staying healthy over the long run and avoiding debilitating diseases in reducing rural poverty rates. Similarly, loss from other shocks such as fire accidents, loss of property due to theft, court cases, extortion/conning, floods, drought, famine, and witchcraft in the decade prior to the start of the initial survey in 1997 affected negatively the descending and ascending households' accumulation during the panel period.

Demographic/economic characteristics of prior generation influence asset accumulation: The number of brothers of the initial household head affected the current household's asset accumulation. Having many brothers represent intense competition for the

prior generation's resources. Having an additional brother for the initial household head decreased asset accumulation for the current household by more than 100 per cent. This finding was valid especially for the non-poor and the descending households. The economic position of the father of the current household head also significantly influences the future trajectory of the current household's asset accumulation. If the father of the initial household head derived most of his income from non-farm activities such as business, the household experienced a more than 100 percent increase in assets over the 10-year panel period compared to other households. While non-farm income is an indication of income diversification and ability to cope with agricultural income risks, non-farm income also is a proxy for social status of the previous household and, thus, may explain other benefits that trickled down to the current households that were not captured by other variables in the survey instrument.

Land inheritance of the initial household head influenced asset accumulation positively. A quick look at the coefficients in the three regressions reveals that land inheritance influenced the descendents to larger extent. This result confirms the descriptive finding that the descending households inherited less land from their parents. Similarly, the rank at birth among the male siblings of the initial household head affected current households' asset accumulation among the non-poor households. Households headed by first borns experienced a decline in asset wealth over the 10 years panel period.

Social Capital and Connections: The length of time the household has stayed in the current location matters. The length of duration in the current settlement is an indicator of social capital acquisition and connections that impact on the ability of a household to accumulate assets. An additional year in the current settlement increases asset accumulation by about six and eight percent for the descending and non-poor households, respectively. Social capital has been

shown to be an important factor determining access to land (Jayne et al., 2008) and welfare more generally (Robison et al., 2002).

7. Conclusions and implications for rural development strategies

This study identifies the factors associated with farm households rising out of poverty and descending into poverty in Kenya between 1997 and 2007. The study is motivated by the need for a better micro-level understanding of the factors enabling rural households in Sub-Saharan Africa to escape from poverty and raise their living standards. The study uses households' physical asset holdings as the main measure of welfare, which is considered a more stable and accurately measured indicator of current welfare than income or consumption.

Using a nationwide balanced panel of 1,275 farm households in 22 districts in Kenya interviewed in 1997, 2000, 2004, and 2007, we find that a relatively small fraction of the sample experienced either an appreciable improvement or decline in their asset wealth over the 10-year period. Over 70 per cent of the sampled farm households are in roughly the same wealth position as they were 10 years earlier, although more households experienced an increase in asset wealth than those experiencing a decline. Evidence also points to a decline in poverty rates, which is consistent with Government of Kenya findings of declining national poverty rates over the same general period.

Roughly 11 per cent of the sampled households experienced a substantial improvement in asset wealth between 1997 and 2007. The study results indicate various attributes associated with the three welfare categories. For the ascending households, the following factors mattered: gender and age of the household head; household size; number of wives of the initial household head; chronic illness during the panel period; loss as a result of other shocks; and prior

generation factors such as the main occupation of the father to the initial household head and the amount of land inherited by the household head from parents.

The descenders were associated with the following factors: gender of the household head; number of wives of the initial household head; distance to the nearest health care facility; deaths before 1997; loss as a result of other shocks; prior generation factors such as number of brothers of the initial household head, main occupation of the father to the initial household head, the amount of land inherited by the household head from parents; and the duration in the current settlement.

For the non-poor households the following attributes played a role: age of the household head; number of wives of the initial household head; prior generation factors such as number of brothers of the initial household head, rank at birth of the initial household head, main occupation of the father to the initial household head, land inheritance of the initial head from parents; and the duration in the current settlement.

Households headed by a male adult are considerably more likely to enjoy an upward asset wealth trajectory over time than a household headed by a woman is. Households in this sample in which the head of household switched from a man to a woman usually experienced a subsequent decline in their asset wealth. This appears to be due to a variety of factors, including men's ability to protect the household against encroachment on assets such as land, and men's greater likelihood of being eligible to participate in outgrower schemes and other potentially lucrative activities (Doss and Morris, 2001; Doss, 2006). Relatively small households and those that are headed by relatively aged heads seemed to enjoy an upward wealth trajectory over the panel period. Households whose initial household head had fewer wives also tended to accumulate assets. Similarly, households successfully accumulating assets and rising out of

poverty were more likely to have remained healthy and were not adversely affected by mortality. A significant minority of households incurred the death or chronic illness of an adult member, which is associated with a major decline in household animal and asset holdings. Even adult mortality experienced before the start of our panel period in 1997 adversely affects asset wealth in the 1997-2007 period, indicating the persistence of mortality effects.

Households that enjoyed a large land inheritance from the prior generation tended to accumulate assets. Similarly, household history seemed to matter: the duration of time the household has spent in the current settlement influences wealth accumulation. This represents social capital accumulation and connections. The economic status of the father of the initial household head had a positive impact on the current generation's asset accumulation, reflecting the importance of intergenerational wealth transfers.

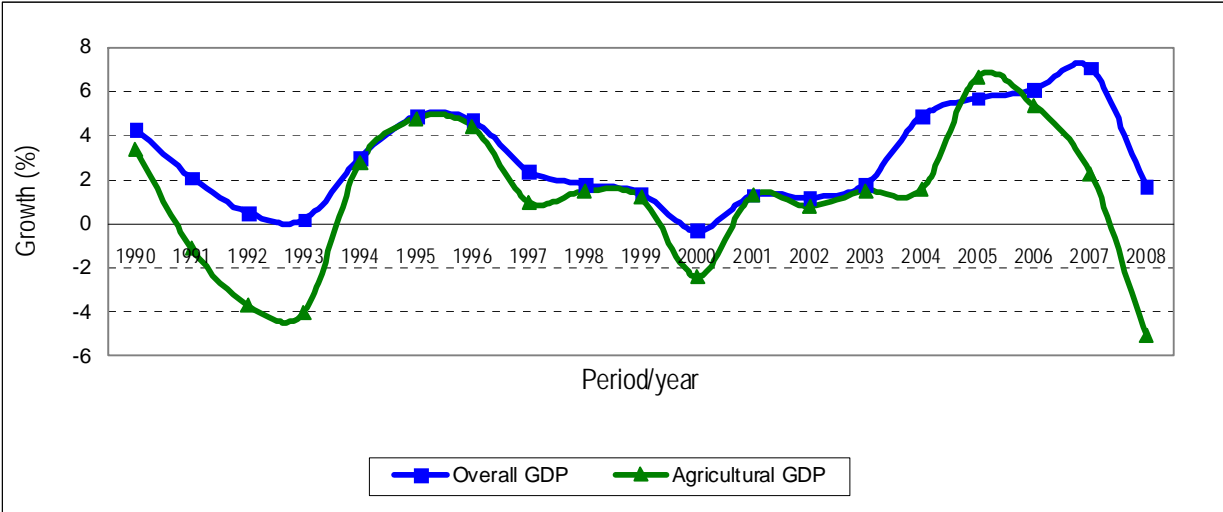
Unlike earlier studies on poverty dynamics in Kenya, this study somehow succeeds in isolating long-term asset holding accumulation or deterioration trends from transitory movements. While over half of the sample households experienced transitory movements into and/or out of poverty during the study period, only a small fraction of the sample experienced either an appreciable improvement or decline in their asset wealth. Another unique finding from this study is that households' welfare pathways are not only a function of the households' idiosyncratic factors (such as unanticipated chronic illness or death) but that intergenerational factors also play an important role. In one way or another, the previous generation's inability to accumulate assets and transfer them to the next generation to prepare it to effectively meet challenges faced during adulthood contributes to the persistence of poverty.

These findings are not surprising, but they do underscore the difficulty of achieving rapid poverty reduction in rural and largely agrarian societies without a sustained source of income and

productivity growth for at least several generations. Agriculture remains the most likely engine that could catalyse such long-term growth processes in rural Kenya given the fact that agriculture constitutes the main source of livelihoods for the majority of rural households. It is noteworthy that households falling into poverty experienced a decline in the amount of land they owned and cultivated over the 10-year panel period, while household rising out of poverty more than doubled their landholding size, and cultivated 70 per cent more land in 2007 than in 1997. In addition, the consistently non-poor owned and farmed more land in every survey year than either the ascenders or descenders.

The findings also indicate that increased fertilizer use and access to credit will not ensure that farm households are able to rise out of poverty. The productive use of these inputs will of course support income growth and poverty reduction, but if households cannot productively use these inputs, the reverse may be true. Other research evidence indicates that smallholders' ability to productively utilize modern agricultural inputs are related to public investments in improved crop science, viable extension systems to transfer agronomic and management knowledge to farmers, and investments in physical infrastructure to raise the returns to using purchased inputs (Mellor, 1976; Byerlee and Eicher, 1997; Alston et al., 2000; Evenson, 2001). Combined with the findings highlighted earlier regarding the importance of individuals' health status in future asset growth, the findings of the study broadly support the perspective that an effective rural productivity and poverty reduction strategy will feature a synergistic range of public investments in health, education, and agriculture that work together to stimulate transformative economic growth processes.

Figure 1: National GDP and agricultural GDP growth rates in Kenya



Source: Republic of Kenya, Economic Surveys (various issues). A new System of National Accounts (SNA) was introduced in 2003 that captures activities in some fast growing sub-sectors that were ignored by the old SNA.

Figure 2: Change in households' asset value between survey years (N=1275)

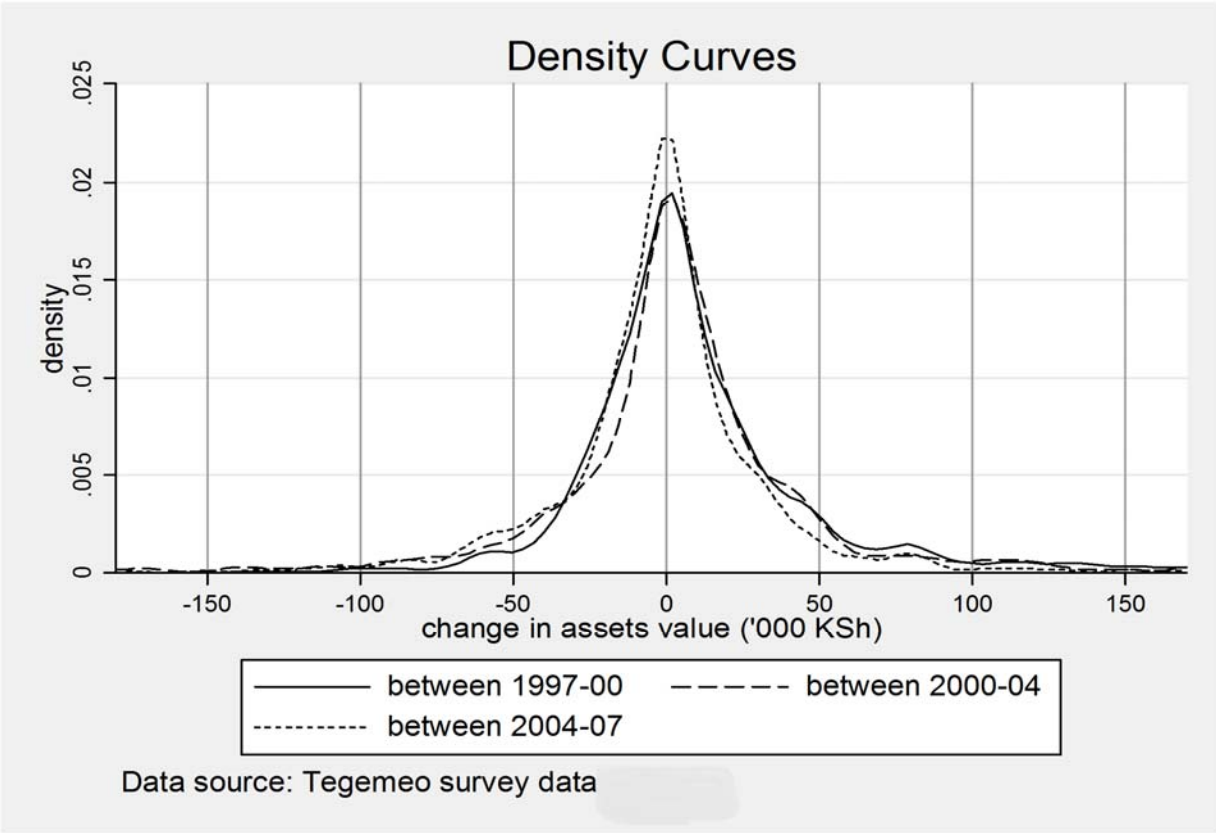
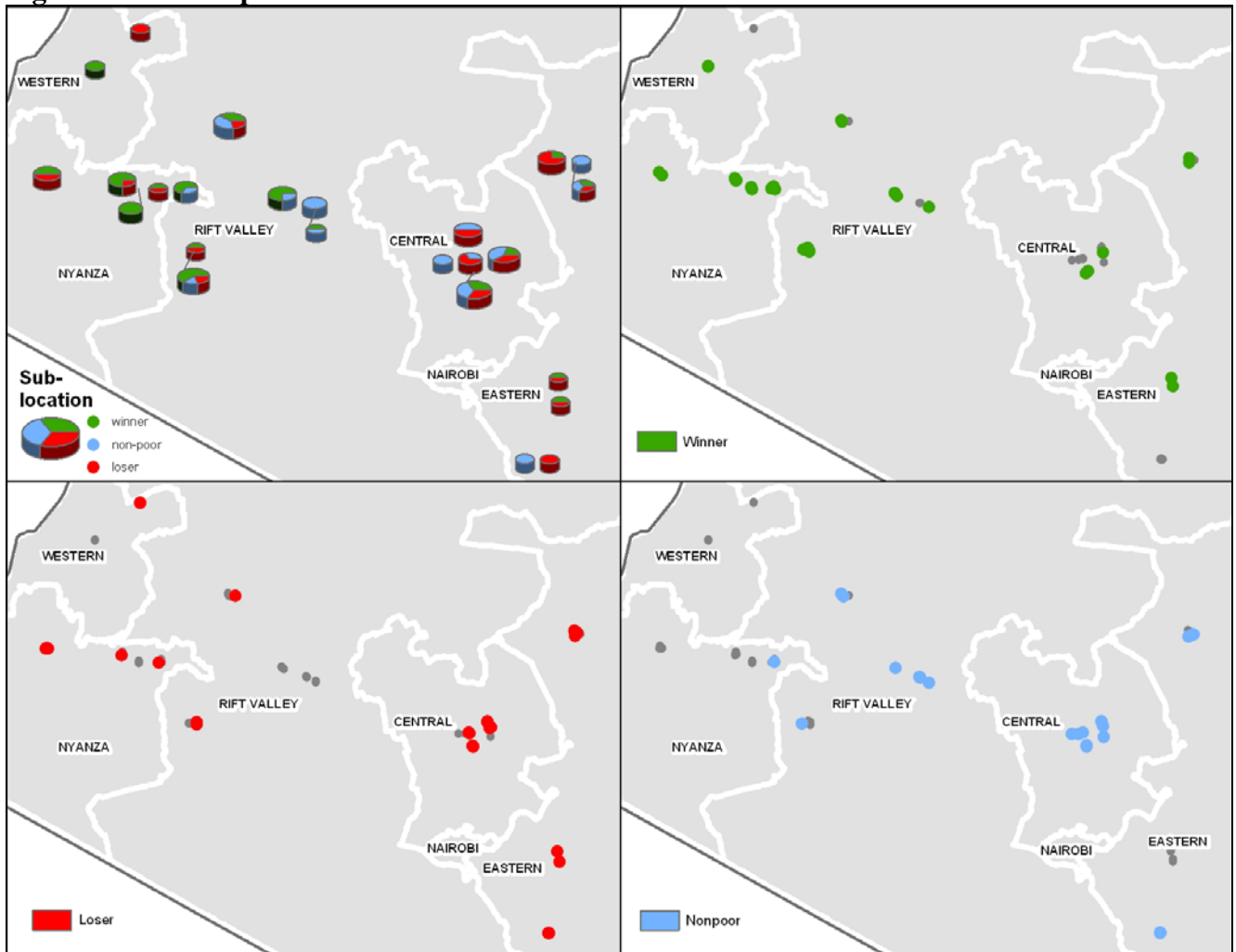


Figure 3: Sub-sample households



Data source: Tegemeo survey data 1997, 2000, 2004, 2007.

Table 1. National poverty rates in Kenya (1997 and 2005/06)

| | | WMS III (1997) | | | KIHBS (2005/06) | | |
|----------|-----------------|------------------|------------|-------------|-----------------|------------------|------------|
| | Poverty Measure | Adult Equivalent | Households | Individuals | Poverty Measure | Adult Equivalent | Households |
| Rural | Food | 50.7 | 43.4 | 50.6 | 47.2 | 38.5 | 47.2 |
| | Absolute | 52.9 | 46.4 | 53.1 | 49.1 | 42.0 | 49.7 |
| | Hardcore | 34.8 | 30.1 | 34.9 | 21.9 | 18.0 | 22.3 |
| Urban | Food | 38.3 | 32.4 | 38.4 | 40.5 | 31.2 | 40.4 |
| | Absolute | 49.2 | 43.5 | 50.1 | 33.7 | 27.4 | 34.4 |
| | Hardcore | 7.6 | 5.9 | 7.7 | 8.3 | 5.9 | 8.3 |
| National | Food | 48.3 | 41.6 | 48.9 | 45.8 | 36.7 | 45.8 |
| | Absolute | 52.3 | 45.8 | 52.6 | 45.9 | 38.3 | 46.6 |
| | Hardcore | 29.6 | 26.2 | 30.5 | 19.1 | 14.9 | 19.5 |

Source: Republic of Kenya, 2007

Table 2. Rural food poverty in Kenya by region 2006

| Province | Headcount ($p_{\alpha=0}$) (adult Equivalent) | Poverty Gap ($p_{\alpha=1}$) | Poverty Severity($p_{\alpha=2}$) | Contribution (%) |
|---------------|--|--------------------------------|---------------------------------------|------------------|
| Central | 31.4 | 9.3 | 4.1 | 9.6 |
| Coast | 63.5 | 21.9 | 10.5 | 9.6 |
| Eastern | 45.2 | 15.8 | 7.6 | 18.8 |
| North Eastern | 66.0 | 24.9 | 12.3 | 4.3 |
| Nyanza | 46.0 | 15.7 | 7.4 | 14.8 |
| Rift Valley | 49.5 | 17.5 | 9.1 | 28.0 |
| Western | 51.1 | 17.4 | 8.0 | 15.0 |
| Total-Rural | 47.2 | 16.2 | 7.9 | 100 |

Source: Republic of Kenya, 2007

Note: The poverty indices are the FGT (Foster et al., 1984) indices: $P(\alpha) = \frac{1}{N} \sum_{i=1}^N \left[\frac{(z - Y_i)}{z} \right]^\alpha I(Y_i < z)$ where

Y_i is the household per adult equivalent income, z is the poverty line and α is a measure of poverty aversion.

Table 3. Households' assets and incomes in real values -- '000KSh [N=1275]

| | mean | value at i th percentile in distribution of households | | | | |
|-----------------------------|--------|---|--------|-------|--------|--------|
| | | p10 | p25 | p50 | p75 | p90 |
| Households' assets by year | | | | | | |
| _1997 | 71.01 | 2.82 | 13.00 | 31.67 | 63.52 | 120.38 |
| _2000 | 82.93 | 2.85 | 13.07 | 33.88 | 79.02 | 171.85 |
| _2004 | 90.23 | 3.92 | 16.47 | 38.58 | 82.17 | 190.48 |
| _2007 | 93.81 | 4.28 | 17.51 | 37.53 | 82.53 | 177.27 |
| Changes in household assets | | | | | | |
| _between 1997 and 2007 | 22.80 | -32.41 | -10.33 | 5.05 | 28.84 | 74.77 |
| _between 1997 and 2000 | 11.93 | -27.15 | -10.67 | 2.20 | 22.44 | 61.45 |
| _between 2000 and 2004 | 7.30 | -42.25 | -11.15 | 2.37 | 21.06 | 51.67 |
| _between 2004 and 2007 | 3.58 | -43.39 | -15.12 | -0.15 | 12.60 | 39.02 |
| Households' real incomes | | | | | | |
| _1997 | 114.76 | 13.98 | 33.64 | 74.65 | 146.40 | 247.14 |
| _2000 | 129.24 | 20.07 | 44.01 | 86.88 | 158.75 | 269.02 |
| _2004 | 126.60 | 20.28 | 42.33 | 71.22 | 159.61 | 274.80 |
| _2007 | 113.75 | 24.99 | 43.46 | 76.27 | 136.50 | 245.82 |

Data Source: Tegemeo Survey Data 1997, 2000, 2004, 2007.

Table 4. Households' assets in real values '000KSh in the retrospective survey sub-sample

| status | survey year | mean | value at i th percentile in distribution of households | | | | |
|-------------------|-------------|--------|---|--------|--------|--------|--------|
| | | | p10 | p25 | p50 | p75 | p90 |
| Descenders [N=25] | _1997 | 54.62 | 27.58 | 43.26 | 50.60 | 66.54 | 86.63 |
| | _2000 | 55.77 | 17.69 | 28.02 | 45.79 | 60.34 | 109.15 |
| | _2004 | 41.96 | 8.70 | 21.42 | 40.09 | 50.71 | 60.57 |
| | _2007 | 19.39 | 3.50 | 12.25 | 20.49 | 24.99 | 37.54 |
| Ascenders [N=30] | _1997 | 17.47 | 0.56 | 5.17 | 14.07 | 22.87 | 31.29 |
| | _2000 | 58.67 | 5.18 | 24.94 | 44.80 | 64.68 | 107.85 |
| | _2004 | 74.58 | 9.24 | 26.76 | 44.61 | 88.25 | 173.75 |
| | _2007 | 101.17 | 44.29 | 59.53 | 75.77 | 113.98 | 202.79 |
| Non-poor [N=23] | _1997 | 209.49 | 69.51 | 93.62 | 123.49 | 233.60 | 552.69 |
| | _2000 | 274.63 | 106.12 | 120.93 | 176.75 | 278.31 | 715.29 |
| | _2004 | 229.31 | 87.21 | 106.23 | 174.45 | 245.63 | 431.78 |
| | _2007 | 274.07 | 103.29 | 135.52 | 169.30 | 364.03 | 637.79 |

Source: Tegemeo survey data 1997, 2000, 2004, 2007.

Table 5: Evolution of household demographic variables over the panel period

| | Descenders [25] | | Ascenders [30] | | Non-poor [23] | |
|---|-----------------|------|----------------|------|---------------|------|
| | Mean | SE | Mean | SE | Mean | SE |
| Male headed households (proportion) | 0.74 | 0.09 | 0.92 | 0.05 | 0.92 | 0.06 |
| _gender in 1997 | 0.88 | 0.07 | 0.83 | 0.07 | 0.91 | 0.06 |
| _gender in 2000 | 0.88 | 0.07 | 0.97 | 0.03 | 0.96 | 0.04 |
| _gender in 2004 | 0.64 | 0.10 | 0.93 | 0.05 | 0.91 | 0.06 |
| _gender in 2007 | 0.56 | 0.10 | 0.93 | 0.05 | 0.91 | 0.06 |
| Age of the household head (years) | 56.90 | 2.74 | 52.85 | 2.27 | 55.40 | 2.55 |
| _age in 1997 | 52.48 | 2.86 | 46.77 | 2.42 | 50.78 | 2.55 |
| _age in 2000 | 56.44 | 2.82 | 51.10 | 2.35 | 52.78 | 2.47 |
| _age in 2004 | 58.48 | 2.56 | 54.93 | 2.12 | 57.39 | 2.60 |
| _age in 2007 | 60.20 | 2.72 | 58.60 | 2.20 | 60.65 | 2.58 |
| Household size | 6.56 | 0.53 | 7.86 | 0.64 | 7.09 | 0.54 |
| _household size in 1997 | 6.96 | 0.58 | 7.33 | 0.46 | 7.39 | 0.53 |
| _household size in 2000 | 7.76 | 0.56 | 8.67 | 0.57 | 8.65 | 0.61 |
| _household size in 2004 | 6.24 | 0.57 | 7.97 | 0.78 | 6.65 | 0.50 |
| _household size in 2007 | 5.28 | 0.40 | 7.47 | 0.75 | 5.65 | 0.52 |
| Members with no education (proportion) | 0.17 | 0.03 | 0.15 | 0.03 | 0.09 | 0.03 |
| _proportion in 1997 | 0.22 | 0.04 | 0.19 | 0.03 | 0.10 | 0.03 |
| _proportion in 2000 | 0.17 | 0.03 | 0.20 | 0.03 | 0.13 | 0.04 |
| _proportion in 2004 | 0.26 | 0.04 | 0.19 | 0.03 | 0.13 | 0.04 |
| _proportion in 2007 | 0.04 | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 |
| Members with primary or some primary education (proportion) | 0.59 | 0.05 | 0.62 | 0.04 | 0.43 | 0.05 |
| _proportion in 1997 | 0.63 | 0.05 | 0.59 | 0.04 | 0.54 | 0.05 |
| _proportion in 2000 | 0.61 | 0.05 | 0.59 | 0.03 | 0.43 | 0.04 |
| _proportion in 2004 | 0.56 | 0.05 | 0.61 | 0.04 | 0.37 | 0.04 |
| _proportion in 2007 | 0.54 | 0.05 | 0.67 | 0.04 | 0.39 | 0.05 |
| Members with secondary or some secondary education (proportion) | 0.19 | 0.04 | 0.16 | 0.03 | 0.29 | 0.04 |
| _proportion in 1997 | 0.13 | 0.03 | 0.19 | 0.03 | 0.29 | 0.03 |
| _proportion in 2000 | 0.21 | 0.04 | 0.20 | 0.03 | 0.32 | 0.04 |
| _proportion in 2004 | 0.16 | 0.04 | 0.12 | 0.03 | 0.29 | 0.05 |
| _proportion in 2007 | 0.24 | 0.04 | 0.14 | 0.03 | 0.27 | 0.04 |
| Members with post secondary education (proportion) | 0.03 | 0.02 | 0.04 | 0.02 | 0.15 | 0.03 |
| _proportion in 1997 | 0.02 | 0.01 | 0.02 | 0.01 | 0.07 | 0.02 |
| _proportion in 2000 | 0.01 | 0.01 | 0.01 | 0.01 | 0.12 | 0.02 |
| _proportion in 2004 | 0.02 | 0.02 | 0.08 | 0.03 | 0.20 | 0.04 |
| _proportion in 2007 | 0.05 | 0.02 | 0.05 | 0.02 | 0.22 | 0.05 |

Source: Tegemeo survey data 1997, 2000, 2004, 2007.

Table 6: Characteristics pertaining to the initial household head

| | Descenders [25] | | Ascenders [30] | | Non-poor [23] | |
|--|-----------------|-------|----------------|-------|---------------|--------|
| | Mean | SE | Mean | SE | Mean | SE |
| Years residing in the present settlement | 60.28 | 3.84 | 49.03 | 3.40 | 63.35 | 4.24 |
| Number of wives of initial household head | 1.64 | 0.15 | 1.37 | 0.08 | 1.13 | 0.05 |
| Number of wives of the father of the initial hh head | 1.52 | 0.13 | 2.17 | 0.38 | 1.57 | 0.18 |
| Father of initial head had some formal education (%) | 16 | 4 | 30 | 5 | 26 | 5 |
| Number of brothers | 3.96 | 0.23 | 4.27 | 0.22 | 3.74 | 0.18 |
| Number of brothers from same mother | 7.68 | 0.53 | 8.70 | 0.60 | 7.30 | 0.50 |
| Number of brothers in extended family | 3.72 | 0.39 | 4.43 | 0.62 | 3.57 | 0.43 |
| <i>Order at birth among brothers (%)</i> | | | | | | |
| _first born | 52 | 6 | 43 | 5 | 30 | 6 |
| _second born | 20 | 5 | 27 | 5 | 30 | 6 |
| _third born | 16 | 4 | 10 | 3 | 22 | 5 |
| _other | 12 | 4 | 20 | 4 | 17 | 5 |
| <i>Order at birth among other siblings (%)</i> | | | | | | |
| _first born | 28 | 9 | 17 | 7 | 22 | 9 |
| _second born | 16 | 7 | 30 | 9 | 13 | 7 |
| _third born | 32 | 10 | 20 | 7 | 22 | 9 |
| _other | 24 | 9 | 33 | 9 | 43 | 11 |
| Education attainment of 1997 initial hh head (%) | | | | | | |
| _no formal education | 16 | 4 | 3 | 2 | 4 | 2 |
| _primary or some primary education | 48 | 6 | 67 | 5 | 43 | 6 |
| _secondary or some secondary education | 36 | 6 | 23 | 4 | 35 | 6 |
| _post secondary education | 0 | 0 | 7 | 3 | 17 | 5 |
| Father's land holding size (acres) | 23.01 | 2.91 | 39.78 | 5.46 | 23.66 | 2.75 |
| _father's land (acres /wife) | 15.47 | 1.67 | 20.51 | 3.08 | 18.66 | 2.76 |
| _father's land (acres/bother) | 6.23 | 0.77 | 15.72 | 3.32 | 6.70 | 0.67 |
| _father's land (acres/bother) (extended family) | 3.19 | 0.31 | 4.44 | 0.56 | 3.79 | 0.36 |
| Land inherited from parents (acres) | 3.01 | 0.26 | 3.83 | 0.40 | 4.92 | 0.82 |
| Estimated value of inheritance ('000 KSh) | 581.18 | 65.20 | 626.39 | 61.51 | 1,188.86 | 159.52 |
| _as proportion of assets value | 14.30 | 1.59 | 12.82 | 1.19 | 7.15 | 1.03 |
| _as proportion of income | 7.04 | 1.30 | 5.74 | 0.59 | 4.81 | 0.68 |

Source: Retrospective survey, 2008.

Table 7: Shocks experienced in the last 10 years before the panel period

| | Descenders [25] | | Ascenders [30] | | Non-poor [23] | |
|--|-----------------|-----------|----------------|-----------|---------------|-----------|
| | <i>Mean</i> | <i>SE</i> | <i>Mean</i> | <i>SE</i> | <i>Mean</i> | <i>SE</i> |
| Members died (% within the household) | 16 | 05 | 10 | 04 | 00 | 00 |
| Members chronically illness (% within the household) | 24 | 05 | 07 | 03 | 09 | 03 |
| Head chronically ill (% within the group) | 16 | 04 | 00 | 00 | 09 | 03 |
| Expenditure on chronic illness (‘000 KSh) | 20.93 | 7.35 | 2.83 | 1.22 | 14.78 | 7.44 |
| _as a proportion of assets value | 0.47 | 0.15 | 0.06 | 0.02 | 0.11 | 0.06 |
| _as proportion of income | 0.22 | 0.07 | 0.02 | 0.01 | 0.05 | 0.02 |
| Estimated loss from other shocks (‘000 KSh) | 4.40 | 1.20 | 17.00 | 3.79 | 18.50 | 7.42 |
| _as a proportion of assets value | 0.10 | 0.03 | 0.43 | 0.12 | 0.14 | 0.06 |
| _as a proportion of income | 0.03 | 0.01 | 0.20 | 0.06 | 0.08 | 0.02 |

Source: Retrospective survey, 2008.

Table 8: Shocks experienced by the households during the panel period

| | Descenders [25] | Ascenders [30] | Non-poor [23] |
|---|-----------------|----------------|---------------|
| Deaths of household head over the panel period (% within the group) | 28 | 3 | 22 |
| _between 1997-2000 | 12 | 0 | 9 |
| _between 2001-2004 | 12 | 0 | 0 |
| _between 2005-2007 | 4 | 3 | 13 |
| Household members died (% within the household) | 16 | 10 | 20 |
| _between 1997-2000 | 16 | 03 | 22 |
| _between 2001-2004 | 16 | 07 | 09 |
| _between 2005-2007 | 16 | 10 | 20 |
| Members chronically ill (% within the household) | 15 | 13 | 16 |
| _between 1997-2000 | 04 | 07 | 26 |
| _between 2001-2004 | 12 | 03 | 04 |
| _between 2005-2007 | 28 | 30 | 17 |
| Estimated expenditure on chronic illness (‘000KSh.) | 11.16 | 11.03 | 23.56 |
| _between 1997-2000 | 1.2 | 1.13 | 17.43 |
| _between 2001-2004 | 2.12 | 0.33 | 1.52 |
| _between 2005-2007 | 7.84 | 9.57 | 4.61 |
| Estimated loss resulting from other shocks (‘000KSh.) | 15.24 | 61.73 | 51.32 |
| _between 1997-2000 | 7.08 | 17.43 | 21.30 |
| _between 2001-2004 | 0 | 3.80 | 18.72 |
| _between 2005-2007 | 8.16 | 40.5 | 11.30 |

Source: Retrospective survey, 2008.

Table 9. Trends in land owned and cultivated, input use and access to farm credit

| | Survey | Acres owned | Acres cultivated | Fertilizer use (%) | Fertilizer application rate (kg/acre) | Manure use (%) | Received credit (%) | Planted one or more cash crops (%) |
|------------|---------|-------------|------------------|--------------------|---------------------------------------|----------------|---------------------|------------------------------------|
| Descenders | average | 2.97 | 2.31 | 0.80 | 69.73 | 0.66 | 0.57 | 0.49 |
| | 1997 | 3.03 | 2.44 | 0.69 | 65.73 | 0.31 | 0.54 | 0.31 |
| | 2000 | 3.17 | 2.67 | 0.81 | 76.83 | 0.81 | 0.69 | 0.62 |
| | 2004 | 3.17 | 2.20 | 0.81 | 69.47 | 0.81 | 0.50 | 0.50 |
| | 2007 | 2.50 | 1.92 | 0.88 | 66.91 | 0.73 | 0.54 | 0.54 |
| Ascenders | average | 3.98 | 2.99 | 0.63 | 42.54 | 0.52 | 0.35 | 0.41 |
| | 1997 | 2.16 | 1.84 | 0.47 | 37.06 | 0.20 | 0.30 | 0.27 |
| | 2000 | 4.17 | 3.25 | 0.60 | 39.32 | 0.53 | 0.37 | 0.43 |
| | 2004 | 4.17 | 3.78 | 0.70 | 48.97 | 0.67 | 0.30 | 0.47 |
| | 2007 | 5.34 | 3.11 | 0.77 | 44.81 | 0.67 | 0.43 | 0.47 |
| Non-Poor | average | 6.81 | 4.62 | 0.95 | 91.67 | 0.78 | 0.57 | 0.48 |
| | 1997 | 3.14 | 3.41 | 0.92 | 113.26 | 0.46 | 0.63 | 0.33 |
| | 2000 | 6.96 | 6.07 | 0.96 | 97.29 | 0.79 | 0.58 | 0.54 |
| | 2004 | 6.96 | 4.57 | 0.96 | 86.95 | 0.92 | 0.42 | 0.54 |
| | 2007 | 10.20 | 4.42 | 0.96 | 69.19 | 0.96 | 0.67 | 0.50 |

Data Source: Tegemeo Survey Data 1997, 2000, 2004, 2007.

Table 10. Estimation Results from Correlated Random Effects Model of Determinants of Household Physical Asset between 1997 and 2007

| VARIABLES | Descenders | | Ascenders | | Non-poor | |
|--|---------------|-------------|---------------|-------------|---------------|-------------|
| | Coef. | ρ-score | Coef. | ρ-score | Coef. | ρ-score |
| Time-varying variables | | | | | | |
| <i>Demographic and economic variables</i> | | | | | | |
| Gender of hh head (1=male; 0=female) | 1.100 | 0.03 | 1.249 | 0.05 | -0.377 | 0.35 |
| Age of the household head in year | 0.011 | 0.24 | 0.116 | 0.06 | 0.129 | 0.00 |
| Household size | -0.116 | 0.53 | -0.081 | 0.02 | 0.019 | 0.78 |
| Distance to markets, infrastructure and services | | | | | | |
| Distance to fertilizer seller (Km) | 0.017 | 0.78 | 0.002 | 0.94 | -0.021 | 0.46 |
| Distance to motorable road (Km) | -0.053 | 0.42 | -0.171 | 0.66 | 0.006 | 0.92 |
| Distance to water source (Km) | -0.078 | 0.16 | -0.103 | 0.51 | -0.043 | 0.16 |
| Distance to healthcare services (Km) | -0.262 | 0.01 | -0.024 | 0.29 | -0.029 | 0.51 |
| Distance to nearest extension service (Km) | -0.065 | 0.55 | -0.012 | 0.93 | -0.005 | 0.92 |
| Shocks | | | | | | |
| Number of deaths | -0.305 | 0.68 | 0.259 | 0.68 | 0.034 | 0.91 |
| Number of individual chronically sick | 0.571 | 0.14 | -1.263 | 0.10 | -0.142 | 0.41 |
| Household time-constant variables | | | | | | |
| Number of deaths before 1997 | -7.070 | 0.00 | 0.415 | 0.62 | - | - |
| Number of members chronically ill before the 1997 | 0.955 | 0.17 | -0.672 | 0.74 | 3.501 | 0.14 |
| Estimated loss as result of other shocks before 1997 | -0.595 | 0.00 | -0.022 | 0.00 | -0.006 | 0.53 |
| Number of wives of the initial household head | -2.926 | 0.00 | -0.078 | 0.72 | -6.556 | 0.00 |
| Demographic/economic characteristics of prior generation | | | | | | |
| Number of brothers of the initial household head | -1.852 | 0.00 | 0.075 | 0.68 | -2.204 | 0.01 |
| Occupation of father of the initial household head (1=farming; 0=off-farm) | -9.712 | 0.00 | -1.522 | 0.03 | -2.830 | 0.00 |
| Land inheritance of the initial household head (acres) | 3.288 | 0.00 | 0.211 | 0.00 | 0.171 | 0.00 |
| Order of the head among other male siblings (1=first born; 0=other) | 2.136 | 0.11 | -0.274 | 0.59 | -4.874 | 0.00 |
| Number of years in the current settlement | 0.078 | 0.00 | 0.001 | 0.85 | 0.062 | 0.00 |
| Constant | 43.979 | 0.00 | 17.930 | 0.07 | 46.897 | 0.00 |
| Observations | 75 | | 90 | | 69 | |
| Number of households | 25 | | 30 | | 23 | |
| R^2 | 0.70 | | 0.52 | | 0.86 | |

Note: ρ-score is the measure of statistical significance; coefficients at ρ<0.10 or better are highlighted in bold.

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Appendix Table 1. Variables used in the econometric analysis

| Variable | mean | Value at percentile in distribution | | | | |
|--|--------|-------------------------------------|------------------|------------------|------------------|------------------|
| | | 10 th | 25 th | 50 th | 75 th | 90 th |
| Time varying- over the panel (97, 00, 04) | | | | | | |
| Household size (number) | 7.54 | 4 | 6 | 7 | 9 | 11 |
| Gender of head (1=male; 0=female) | 0.88 | 0 | 1 | 1 | 1 | 1 |
| Household head education | | | | | | |
| No formal education (1=yes; 0=no) | 0.12 | 0 | 0 | 0 | 0 | 1 |
| Some primary/primary (1=yes; 0=no) | 0.52 | 0 | 0 | 1 | 1 | 1 |
| Some secondary/secondary (1=yes; 0=no) | 0.26 | 0 | 0 | 0 | 1 | 1 |
| Post secondary (1=yes; 0=no) | 0.10 | 0 | 0 | 0 | 0 | 1 |
| Household members' education- prop. with: | | | | | | |
| No formal education | 0.18 | 0.00 | 0.00 | 0.16 | 0.29 | 0.40 |
| Some primary/primary | 0.55 | 0.25 | 0.40 | 0.57 | 0.71 | 0.83 |
| Some secondary/secondary | 0.21 | 0.00 | 0.00 | 0.20 | 0.33 | 0.50 |
| Post secondary | 0.06 | 0.00 | 0.00 | 0.00 | 0.08 | 0.20 |
| Distance to infrastructure (Km) | | | | | | |
| Motorable road | 1.04 | 0.00 | 0.07 | 0.40 | 1.00 | 2.50 |
| Water | 3.08 | 0.00 | 0.00 | 0.55 | 3.50 | 9.00 |
| Electricity | 2.74 | 0.10 | 0.50 | 2.00 | 3.00 | 5.00 |
| Land size (acre) | 3.67 | 0.62 | 1.50 | 3.00 | 4.70 | 8.00 |
| Time constant | | | | | | |
| Number of years in the current settlement | 84.97 | 35.00 | 53.00 | 109.00 | 109.00 | 109.00 |
| Number of wives of initial household head | 1.38 | 1.00 | 1.00 | 1.00 | 1.00 | 2.00 |
| Initial head was a first born (1=yes; 0=no) | 0.42 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| Estimated value of inheritance before the panel | 777.76 | 0.00 | 160.00 | 400.00 | 1,200.00 | 2,027.50 |
| Estimated value of inheritance over the panel | 120.38 | 0.00 | 0.00 | 0.00 | 0.00 | 250.00 |
| Shocks | | | | | | |
| Number of deaths before the panel (per | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Number of chronically sick before the panel | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Estimated loss from other shocks before the | 19.86 | 0.00 | 0.00 | 0.00 | 15.00 | 68.00 |
| Number of deaths over the panel (per | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Number of chronically sick over the panel (per | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Estimated loss from other shocks over the | 12.66 | 0.00 | 0.00 | 0.00 | 0.00 | 25.00 |
| Previous generation | | | | | | |
| Number of wives of initial household head's father | 1.78 | 1.00 | 1.00 | 1.00 | 2.00 | 3.00 |
| Main source of income of initial household head's | | | | | | |
| Farming | 0.74 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 |
| Business | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Formal/salaried employment | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Initial household head's father land size | 10.02 | 1.25 | 2.40 | 5.10 | 8.33 | 17.00 |