Factors Associated with Farm Households' Movement Into and Out of Poverty in Kenya: The Rising Importance of Livestock

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1. Introduction

For at least four decades, African governments and donors 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.[2] In 2000, more than 45 percent of sub-Saharan Africa's population was estimated to be below the poverty line, and this situation has not improved in at least the last 15 years (World Bank, 2000). Even after two successive years of 5 percent growth in real GDP in Sub-Saharan Africa in 2004 and 2005, rural poverty appears to be either steady or even increasing (World Economic Situation and Prospects, 2006). The co-existence of strong economic growth and deepening poverty underscores the fact that the causes of poverty are complex and that appropriate policy responses are inadequately understood.

Recent literature examining these complexities indicate that agricultural growth is more likely to benefit the literate and those with access to relatively large landholdings, credit, and markets, while the relatively impoverished, the landless, and the otherwise constrained get left behind (Ravallian and Datt 2002; Jayne et al. 2003; Geda et al. 2006). Other studies have found that poor households may fall back on low entry-barrier activities, such as wage labor and petty trading, but that these activities often fail in terms of long-term growth (Daniels 1995; Reardon 1997; Barrett 2000). Furthermore,

[1] With thanks to the workshop sponsors: Chronic Poverty Research Centre, Overseas Development Institute, Trocaire, Swiss Agency for Development and Cooperation (SDC).

[2] These broad strategies included "growth and trickle down" in the 1960s; integrated rural development and basic human needs in the 1970s; structural adjustment and economic liberalization in the 1980s and 1990s; and most recently, participatory poverty reduction strategies.

while income diversification strategies do help some households climb out of poverty, there is discouraging evidence that simultaneously, many households are falling into poverty, primarily due to health-related reasons (Krishna 2004; Kristjanson et al. 2004; Kristjanson et al. forthcoming).

Nonetheless, there are still many aspects of poverty that remain enigmatic. In particular, there is a dearth of knowledge about the dynamics of poverty: why some households are able to rise out of poverty over time, while others fall into poverty? Most quantitative studies characterizing rural poverty have been based on analysis of cross-sectional household survey data.[3] While this approach can identify factors that are contemporaneously correlated with indicators of household poverty, cross-sectional analysis cannot provide insights into how or why households move into or out of poverty over time. In particular, it is difficult to identify households' behavioral decisions at one point in time that alter the time path of their living standards over the future, which is arguably critical for designing effective poverty alleviation strategies.

This study explores the dynamics of poverty, specifically to examine how certain initial conditions, household decisions, and other factors that may change over time affect poverty. The study uses longitudinal data collected from 1324 households which participated in three nationwide surveys conducted over seven years, in 1997, 2000, and 2004. We identify dynamic relationships between behavioral variables, exogenous shocks at one point in time and indicators of household welfare in subsequent years.

These guiding research questions are:

- What is the relationship between households' *current* crop, livestock, and non-farm incomes, and household behavioral and investment choices in earlier years? How is this relationship affected by landholding size and labor quality (proxied by educational attainment)?
- How do prior farm investments affect the stability of household income in subsequent periods?
- What is the extent of households' movement into poverty, and what livestock and crop decisions and household characteristics appear to be associated with this?
- What is the extent of households' movement out of poverty, and what livestock and crop decisions and household characteristics are associated with this?

We start by developing a welfare indicator and characterizing the degree of poverty mobility, i.e., the extents to which households move into and out of poverty over time. We then identify salient household-level and community-level correlates of poverty in rural Kenya, then identify dynamic relationships between time-invariant initial conditions, lagged household resource allocation and technology adoption decisions, and current income and wealth outcomes. Lastly, the paper draws implications for designing policies and programs for alleviating rural poverty and promoting income growth for households of different landholding sizes.

This study finds the majority of our sample remaining static in terms of welfare throughout the 7 year period, although there is a degree of poverty mobility that provides

[3] Some notable exceptions are Deininger and Okidi, 2003 (see special issue of World Development on poverty), Barrett et. al 2006, and Gamba 2004 (using a subset of the data used in this study).

interesting insights. As one would expect, we find that reliance on low entry-barrier informal businesses as poverty alleviation strategies characterize the poor, while education and access to more land tend to characterize the relatively non-poor. Using more in-depth analysis, we also find that consistently non-poor households are more heavily invested in certain livestock activities, such as dairy production. Moreover, able households' decisions to enter into livestock markets are also found to be highly correlated with positive welfare changes over time.

2. Data and Methods

2.1 Sample

This study uses data from three surveys implemented by the Tegemeo Institute of Egerton University in Nairobi, Kenya. In 1997 the sampling frame was designed in consultation with the Central Bureau of Statistics, and contained 1540 households randomly chosen to represent 8 different agricultural-ecological zones (AEZ's), reflecting population distribution. Of the original sample, 1428 households (93%) were re-interviewed in 2000, and 1324 (86%) were re-interviewed in 2004. Holding consistently at just above 7% per survey, this rate of attrition is reasonably low compared to similar surveys in developing countries (Yamano and Jayne 2004). Nonetheless, when performing analysis on panel data, it is always advisable to examine the specific nature of attrition in order to determine whether it is random or systematic, as well as whether it is necessary to correct for potential attrition bias.

In Table 1, we examine key household characteristics by attrition status. The characteristics shown are those from the most recent survey in which the households that left the sample participated. Therefore, the information in columns 1 and 2 are from 1997, while columns 3 and 4 show characteristics in 2000. All cash values are shown in 2004 Kenyan schillings (Ksh) using the Kenyan consumer price index (CPI). Mean household value of assets was higher in 1997 among the households that left the sample in 2000 than that of those who remained in the sample. The opposite is true when comparing the 2000 value of assets between households falling out of the sample in 2004 and those remaining. Mean initial income levels between these groups were generally no different in 2000, while in 2004 the mean initial income of those that left the sample was significantly lower. In both periods smaller households are apparently more likely to leave the sample. Potential attrition bias is examined in more detail later in the paper.

Table 1. Mean Household Characteristics by Attrition Status

	Surveyed 1997, Attrition 2000	Surveyed 1997 and 2000	Surveyed 1997 and 2000, Attrition 2004	Surveyed All Years
	Values reported in 1997 survey		Values reported in 2000 survey	
	(1)	(2)	(3)	(4)
Number of Households	112	1428	104	1324
Income (,000 2004 Ksh)	177.6	173.4	150.3	207.8
Assets Value (,000 2004 Ksh)	222.1	135.5	60.4	102.0
Share of Net Income (mean %)				
Crop	39	46	40	65
Livestock	17	11	22	12
Non-Farm	44	43	38	24
Acres cultivated (main season)	3.48	3.48	2.90	4.62
Own land title deed (%)	46	44	31	48
Full Time Adult Equivalents[a]	5.1	5.6	4.9	5.6
Distance to Tarmac Road (km)	6.7	8.3	7.3	7.9
Has Formal Income (%)	34	38	45	59
Has Members over 40 years	72	77	74	85
Polygamous Household (%)	n.a.[b]	n.a.[b]	2.9	4.4

Source: TAMPA household surveys in 1997 and 2000
Note: (a) A household member's full time adult equivalent is the World Bank adult equivalent based on age and gender multiplied by the fraction of the year they spent in the household. (b) This information is not available in the 1997 survey.

2.2 Estimating Welfare and Comparing Households

The next task is to decide how poverty will be measured. Many prior studies have focused on consumption and income levels as measures of household welfare. More recently, however, there is a trend towards observing the value of a household's assets as perhaps a more appropriate measure, arguing that asset levels will be less susceptible to random shocks while still providing accurate description of a household's true level of poverty (some examples are Carter and Barrett 2006; Barrett and Swallow 2006, Krishna 2004). Income, on the other hand, is likely to be very much affected by transitory shocks such as weather fluctuations. In this context, we conduct our research using an asset-based welfare measure. To test the robustness of our findings, we also compute income-based measures of poverty and perform similar analyses of poverty mobility. We find that household asset and income levels are highly correlated and therefore reasonably consistent measures of poverty, although the income measures were more volatile, as expected. Full results and discussion of the income-based measure can be found in Appendix A.[4]

In principle, deriving an asset-based measure of welfare is a simple process of multiplying each of a household's assets by the local value of that asset, and summing

[4] Since the initiation of this study, further poverty dynamics research has been conducted using these data with an income-based poverty matrix and using a hazard model (Kirimi et. al. 2006).

up across the value of all assets. Then, using a Kenyan CPI, these values are inflated to 2004 Ksh so they can be accurately compared. To more precisely observe each household's level of welfare, this figure is then divided by the number of full time adult equivalents (*FTAE*) in the household. The *FTAE* weights each household member by two things: 1) their adult equivalent according to the World Bank scale based on age and gender, and 2) the number of months spent in the household. This is shown in the following equation:

$$FTAE_{it} \equiv \sum_{k} \left(ae_{kt} * m_{kt} \div 12 \right)$$

Where *i* indexes households
t indexes time
k indexes individuals
ae = adult equivalent (using the World Bank measure)
m = the number of months spent in the household

Next, we compute the ratio of household asset levels per *FTAE* to the 1997 median value. This measure now allows us to assess a household's welfare in any particular year compared to the initial (1997) median value among all surveyed households. The function for our asset-based measure thus far is:

$$RA_{it} \equiv \left[\left(\sum_{j} \left(A_{ijt} * V_{ijt} \right) \Big/ \ CPI_{t} \right) \Big/ FTAE_{it} \right] \Big/ med97$$

Where *j* indexes productive assets[5]
RA = the ratio of household productive asset value to the 1997 median
A = Asset j for household i in year t
V = Local Value of asset j (Ksh) in year t for household i
CPI = Consumer Price Index figure used to inflate value to 2004 Ksh
FTAE = Full Time Adult Equivalents
med97 = 1997 median value of the numerator

Finally, this ratio is stratified into terciles (or thirds) for each year giving us the three relative poverty rankings: very poor, moderately poor and non-poor. This procedure is conducted in each year (1997, 2000, and 2004), allowing us to see how the relative welfare of each household changes (or doesn't change) over time. We then identify four specific categories of households: (a) those consistently in the wealthiest tercile, (b) those consistently in the poorest tercile; (c) those who moved from the bottom wealth tercile to the top tercile over the 7-year period; and (d) those that descended from the top to the bottom tercile over this period. This allows us to further investigate what factors may influence poverty mobility. For example, if we observe a group of households to have been very poor in 1997, moderately poor in 2000, and not poor in 2004, we have the chance to examine what characteristics of this group were associated

[5] "Productive assets counted in all survey years are: ploughs (tractor and animal traction), cart, trailer, tractor, cars, trucks, spray pump, irrigation equipment, water tanks, stores, wheelbarrow, combine harvester, donkey, bulls, chickens, goats, sheep, calves, cows, pigs, turkeys, and ducks.

with this steady upward trajectory. This is done with descriptive as well as econometric analysis.

2.3 Limitations

Ideally we would include the value of land when calculating the total value of household assets. Because land markets do exist in most areas of rural Kenya, survey respondents were able to provide sales and annual rental values for land in their villages. When including land valuation in total household assets, we find that land tends to be a large share of most households' total asset value. This is comprehensively demonstrated in Table 2. Here the households are ranked into terciles by landholding size in each year. Within each of these three land size terciles, we further separate them according to the share of land in the total value of their productive assets. Each cell reports the number of farms in each land tercile according to the share of land in total asset value. In other words, "Row percent" indicates the portion of households within each farm size tercile that have the specified share of total assets in landholdings. For example, we see that in 1997, among the smallest farms, 61.6% had more than 75% of their total assets tied up in land. In each year, the majority of all households have 75% to 100% of the value of their total assets in land. Furthermore, and somewhat surprisingly, there seems to be little or no correlation between farm size and the share of land in the total value of productive assets.

Table 2. Contribution of Land in Total Assets of Rural Small Farm Households

	Share of Land in Total Assets (%) 1997							
	0-25		25-50		50-75		75-100	
Farm Sizes	n	Row %[a]	n	Row %[a]	n	Row %[a]	n	Row %[a]
1997								
Smallest Third	17	(3.9%)	50	(11.4%)	102	(23.2%)	271	(61.6%)
Middle Third	12	(2.7%)	37	(8.4%)	104	(23.6%)	287	(65.2%)
Largest Third	4	(0.9%)	31	(7.0%)	79	(17.8%)	330	(74.3%)
2000								
Smallest Third	11	(2.5%)	29	(6.6%)	75	(17.0%)	326	(73.9%)
Middle Third	2	(0.5%)	20	(4.6%)	87	(19.9%)	329	(75.1%)
Largest Third	5	(1.1%)	18	(4.0%)	69	(15.5%)	353	(79.3%)
2004								
Smallest Third	6	(1.4%)	34	(7.7%)	83	(18.8%)	318	(72.1%)
Middle Third	3	(0.7%)	21	(4.8%)	67	(15.2%)	351	(79.4%)
Largest Third	7	(1.6%)	28	(6.3%)	69	(15.6%)	337	(76.4%)

Source: TAMPA survey data, 1997, 2000, 2004.
Note: a - Row percent indicates the portion of households within each farm size tercile that exhibit the specified share of land in total assets.

Given its major influence in valuing assets, there is reason to consider the appropriateness of including land in our measurement. Obviously its inclusion is theoretically sound, but there are several countervailing arguments. First, because of data limitations, our measurement of landholding is according to land *farmed* not necessarily land *owned*, which causes estimation errors. Furthermore, our valuations of

land prices were obtained at the village level, so our measure does not account for variations in land quality within villages.[6] Lastly, because the value of land accounts for such a large share of household wealth, and tends not to vary much over time, including it in a study of poverty dynamics would tend to bias the results to show very little variation over time. Again, to test the robustness of our results, we report poverty mobility results both including land (in Appendix A) and excluding land (in the main body of the paper). As will be described later, the results and implications are highly consistent.

In summary, we compute asset (wealth)-based measures of poverty, rank all households into poverty terciles, and assess the degree of poverty mobility over time. We then identify four specific categories of households: (a) those consistently in the wealthiest tercile, (b) those consistently in the poorest tercile; (c) those who moved from the bottom wealth tercile to the top tercile over the 7 year period; and (d) those who descended from the top to the bottom tercile over this period. We then perform both descriptive and econometric analyses of the initial conditions, exogenous shocks, and household behavioral decisions associated with these four groups.

[6] The problem of varying degrees of quality is not as concerning when dealing with the values of the other assets in our analysis. For example, one would assume that a household reporting a new tractor would report a value much higher than one reporting a 20 year old tractor. This is evident in the data; 17 different values for 33 tractors were reported ranging from 1000 Ksh to 160000 Ksh. While this is no means without error, it is certainly a smaller margin of error than if we are forced to assign one value to all 'like' assets.

3. Estimating Welfare Mobility

Excluding owned land, we obtained the poverty mobility findings summarized in Table 3. Each row describes a particular poverty path between 1997 and 2004, which are listed according to mobility groups. More specifically, a "poverty path" describes a particular household's asset holdings over time in relation to initial (1997) median household asset holdings, i.e., whether it is accumulating or de-cumulating assets over time. Moreover, because poverty is defined according to the 1997 median level of assets, this measure allows us to examine whether asset poverty in this nationwide sample of small farm households is rising or falling over time. In the two far right columns we see the number of households and percent of the sample that have followed each of the 27 possible paths.

We can now identify our first treatment group, (a) those consistently in the wealthiest tercile, as the 249 households (18.8%) of the sample started out in the top third in 1997, stayed in the top third in 2000, and again in 2004. Similarly, we identify the next treatment group, (b) those consistently in the poorest tercile, as the 217 household (16.4% of the sample) started out relatively very poor (bottom) in 1997, remained it the bottom tercile in the year 2000, and again in 2004. Our third treatment group, (c) those who moved from the bottom wealth tercile to the top tercile over the 7-year period, consists of the 34 households meeting that criteria, regardless of their relative welfare in 2000. Similarly, we identify the fourth group, (d) those who descended from the top to the bottom tercile over the 7-year period, as the 37 households meeting that criteria, regardless of their relative welfare in 2000.

Table 3. Household Poverty Movements over time: Where households are ranked in terms of welfare terciles (Bottom 3rd Middle 3rd Top 3rd) by year

	Household Rank in terms of welfare terciles (Bottom 3rd Middle 3rd Top 3rd)			Number of Households	Percent of Total Sample (%)
Poverty Mobility Group	1997	2000	2004		
Rising from Poverty	Bottom	Bottom	Top	9	0.7
	Bottom	Middle	Top	17	1.3
	Bottom	Top	Top	8	0.6
				34	2.6
Declining into Poverty	Top	Top	Bottom	10	0.8
	Top	Middle	Bottom	16	1.2
	Top	Bottom	Bottom	11	0.8
				37	2.8
Consistently Non-Poor	Top	Top	Top	249	18.8
Consistently Poor	Bottom	Bottom	Bottom	217	16.4
Consistently in the Middle	Middle	Middle	Middle	107	8.1
				573	43.3
Otherwise in the same wealth tercile in 1997 and 2004	Bottom	Middle	Bottom	49	3.7
	Bottom	Top	Bottom	5	0.4
	Middle	Bottom	Middle	50	3.8
	Middle	Top	Middle	38	2.9

	Top	Bottom	Top	10	0.8
	Top	Middle	Top	34	2.6
				186	14.0
Smaller increases in relative welfare over time	Bottom	Bottom	Middle	59	4.5
	Bottom	Middle	Middle	67	5.1
	Bottom	Top	Middle	10	0.8
	Middle	Bottom	Top	10	0.8
	Middle	Middle	Top	50	3.8
	Middle	Top	Top	54	4.1
				250	18.9
Smaller decreases in relative welfare over time	Top	Top	Middle	55	4.2
	Top	Middle	Middle	43	3.2
	Top	Bottom	Middle	13	1.0
	Middle	Top	Bottom	12	0.9
	Middle	Middle	Bottom	59	4.5
	Middle	Bottom	Bottom	62	4.7
				244	18.4
Total Sample				1324	100

The first thing to note from this table is that the majority of households (57%) were in the same relative welfare level in 2004 as they were in 1997, reflecting the persistence of poverty as previously discussed. However, there is an observable degree of poverty mobility. Although less than 6% of our sample is classified as "rising from poverty" or "falling into poverty," it should be noted that this is in part due to our definition of mobility, which focuses on those households that have demonstrated "large" changes over time, i.e. going from the bottom to the top, or vice versa, from 1997 to 2004. We feel this approach identifies households that have most conclusively experienced clear improvements or declines in their livelihoods over the 7-year period. If we were to expand our definition to include households which have experienced "small" welfare changes over time, we can see that 22% are in a higher tercile in 2004 than in 1997, and 21% fall to a lower tercile during the same period. By this definition we could conclude there is a significant amount of poverty mobility.

In Table 4 we examine how the welfare measure of these groups and of the sample has changed over time, vis à vis the 1997 median level of wealth. We find that there is a sizable difference in 1997 between the average wealth of the consistently poor (15% of the 1997 median) and that of the consistently non-poor, who had assets valuing over ten times the 1997 median. Secondly, the mean value of productive assets for the entire sample in 1997 is nearly 3 times higher than the 1997 median value. Together, these findings suggest a high degree of welfare inequality within the sample, specifically a distribution of assets that is highly skewed to the right. These findings are consistent with other studies focusing on inequality in Kenya.[7] In 2000 the mean value of assets for the entire sample dipped to just over 200% of the initial median, rebounding slightly to around 240% in 2004. The same trend of a dip and partial recovery is evident among the consistently poor and consistently non-poor, showing that households' welfare levels are stagnant, if not declining, in more recent years compared to 1997.

[7] For more on inequalities in Africa see McCollough, Baulch, and Cherel-Robson, 2000; Sahn and Stifel, 2003; and Jayne, et. al., 2003.

Table 4. Changes in Asset level over time by Poverty Group

	Mean household value of assets per resident adult equivalents as a ratio of the 1997 median		
Asset-Poverty Category	1997	2000	2004
Consistently low tercile (n=217)	.1541	.1036	.1343
Consistently high tercile (n=249)	10.1227	6.8005	8.0837
Upward (n=34)	.3260	1.3946	3.4817
Downward (n=37)	3.6486	1.2303	.2896
Other (n=787)	1.5688	1.1658	1.2693
Total (n=1324)	2.9718	2.0591	2.3943

Source: TAMPA survey data, 1997, 2000, 2004.

One admitted limitation of the way we compute terciles is that by forcing equal numbers of households in the 2000 and 2004 terciles, it is possible that there are shifts in the real levels of assets over time such that the entire distribution of household wealth goes up or down, but we would not be able to detect it because we are forcing equal numbers of household to be in each tercile in 2000 and 2004 as there were in 1997. The regression analysis in Section 5 overcomes this potential limitation. However, it is useful to know how household wealth at various levels of the distribution have changed over this 7-year period. Table 5 reports the real level of households' assets at the 10th, 25th, 50th, 75th and 90th percentiles of the distribution for each year: 1997, 2000 and 2004. Table 5 can tell us whether inequality was rising over time, falling over time, and whether the absolute levels of wealth at various parts of the distribution was rising or falling.

Table 5. Percentiles of Asset Levels over time (2004 Ksh per hh)

	Household value of productive assets per resident adult equivalents			Percentage change,
Percentile	1997	2000	2004	1997 - 2004
	----------2004 Ksh per household----------			
		------		----- % -----
10	582	278	433	-34
25	3378	2163	2879	-17
50	9294	7043	8561	-9
75	22334	18788	20479	-9
90	51565	45245	50797	-2
Mean	27619	19136	22252	

Source: TAMPA survey data, 1997, 2000, 2004.

We see, as with the means of our various asset-poverty groups, that the distribution at these various levels experiences a dip in 2000 (a drought year in much of Kenya) and partial recovery in 2004. What is interesting, however, is how this recovery varies, or perhaps more importantly how the dip itself varies, at these different levels of the distribution of asset wealth. Notice that, although the tenth percentile in 2004 is higher than it was in 2000, it is 34% lower than it was in 1997. The ninetieth percentile, however, is only 2% lower than it was in 1997. This is an indication that while the level of wealth among the relatively wealthy has been fairly consistent, the level wealth among the relatively poor has declined sharply. That is not to say that these are necessarily the same households (that is the subject of the rest of this study). Instead, this simply says

that the bottom 10% of households in terms of wealth in 2004 is worse off than the bottom 10% were in 1997. Meanwhile, the top 10% in 2004 have not changed much at all in terms of asset wealth. This, again, is another sign of growing inequality among Kenya's rural households.

In Figure 1 we examine the distribution of wealth in yet more detail. Here our sample is segregated by wealth per full time adult equivalents (FTAE) at increments of 5,000 Ksh. Once again, these results suggest a high degree of inequality in our sample. We see that the lowest welfare group, those with 0 to 5,000 Ksh of assets per ftae (roughly zero to US$65), consistently contains the largest segment of the sample. Meanwhile, in each year there is a sizable portion of the sample enjoying more than 50,000 Ksh per ftae.

Figure 1: Distribution of Wealth

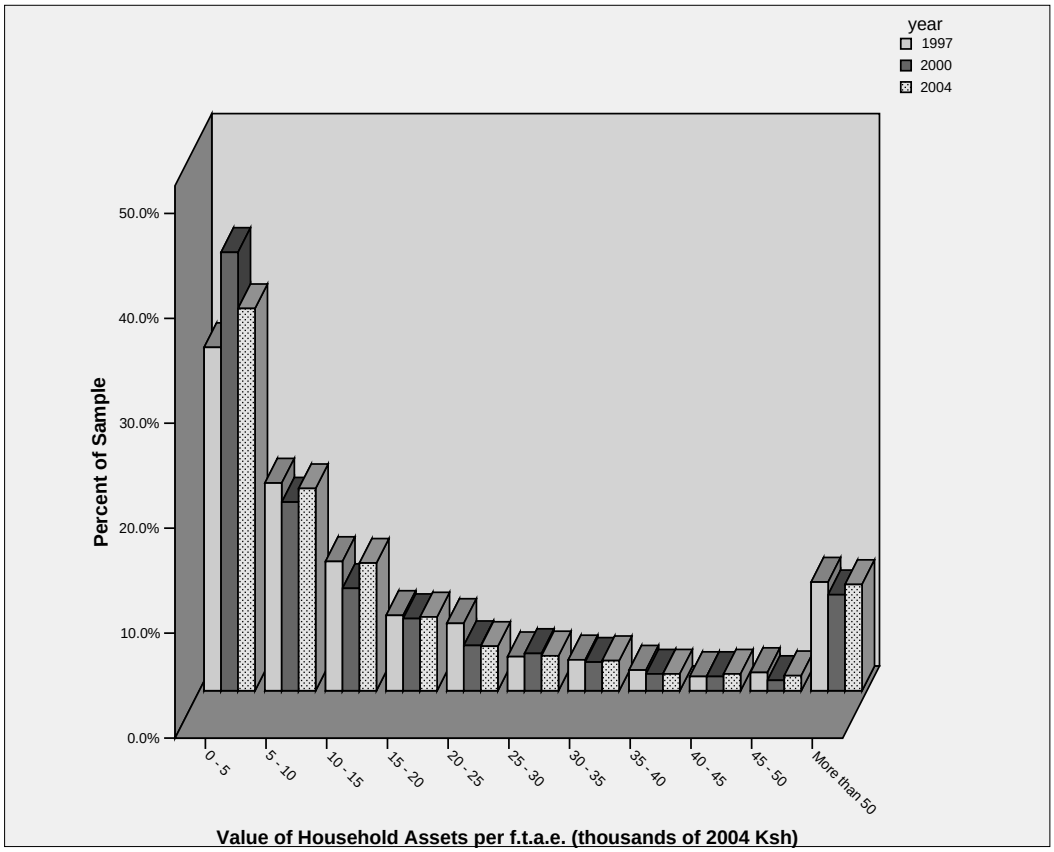
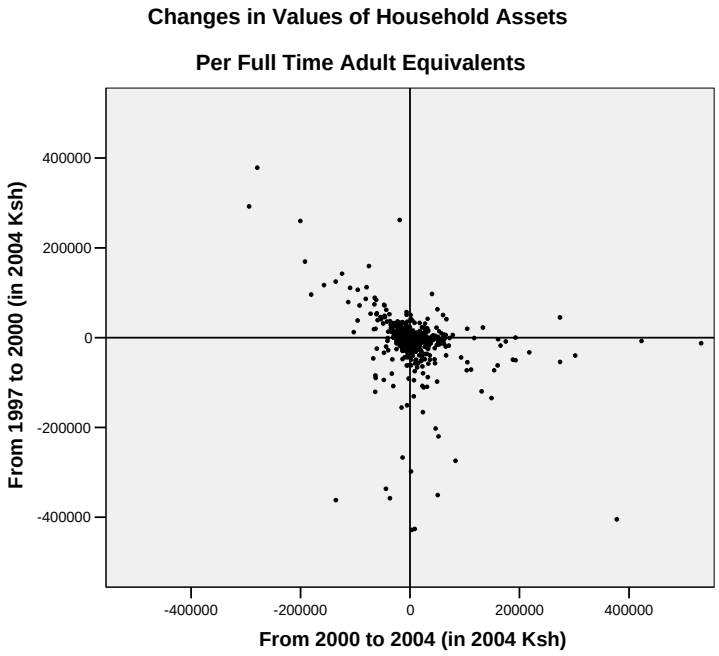


Figure 2 shows changes in the value of assets over time for each household on a scatter-plot. Each point represents a household, with changes in the period between 1997 and 2000 on the vertical axis and changes between 2000 and 2004 on the horizontal axis. This representation of our sample seems to highlight three groups of households. In the upper left quadrant of this Figure, we see a number of households showing large increases in welfare for the initial period, followed by a loss of nearly the same amount during the second period. A second group, shown in the lower-right quadrant, includes households that endured a sizable loss of wealth in the first period, many of which rebounded with an increase during the second. The third and largest group is concentrated around the origin, and includes households experiencing relatively small changes in welfare throughout the 7 year period of our survey.

Figure 2. Households' Changes in Asset Values from 1997 to 2000, and from 2000 to 2004.

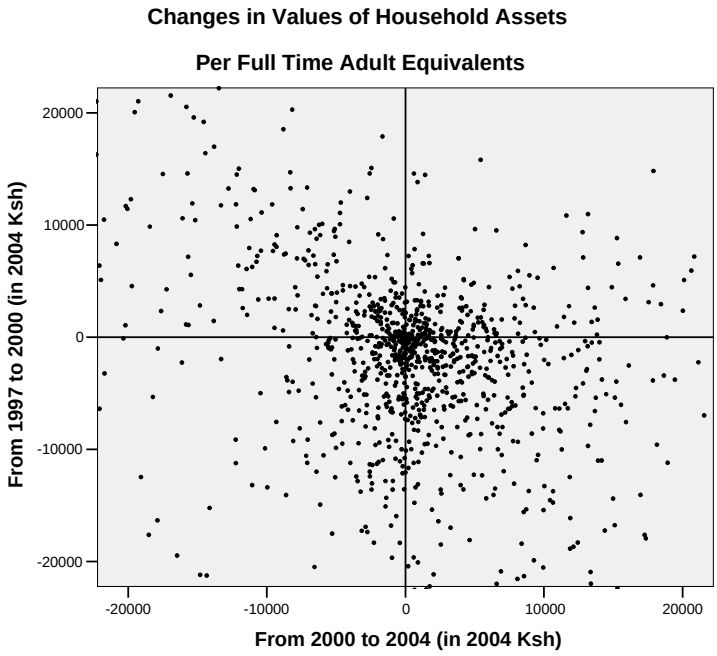


Source: Tegemeo survey data

Figure 3 represents the data in a similar fashion, but here we focus more on the third group described above, only showing households experiencing changes of less than 20,000 Ksh in both periods. Again, we find a cluster of observations around the origin, having experienced very little change in wealth throughout, and the rest of this group seems fairly randomly dispersed in terms of changes in welfare.

From the generally random distributions of households shown in Figures 2 and 3 we can hypothesize that changes in welfare are dependant upon more than simply the passage of time, thus presenting interesting research questions as was discussed above.

Figure 3. Households' Changes in Asset Values from 1997 to 2000, and from 2000 to 2004 among households with changes below 20000 Ksh in both periods.



Source: Tegemeo survey data

In summary, after ranking the households into terciles and mapping their poverty movement over time, we find that the majority of observations are relatively no better (or worse) off after 7 years than they were in the initial period. Secondly, we find that welfare among the entire sample is fairly stagnant, if not decreasing, over time. Also, there is evidence of a high degree of inequality among the sample. Finally, despite the majority of our sample remaining in the same wealth tercile throughout, we observe that there are many cases showing significant changes in welfare over the 7 years, and that these changes are likely dependent on more than simply the passage of time. This presents the opportunity to investigate the research questions originally motivating this paper. The next section will examine these questions with primarily descriptive analysis, followed by a section using multivariate analysis.

4. Descriptive Analysis of Factors Associated with Current Welfare and Welfare Mobility

It is essentially undisputed that welfare inequality is present and persistent in rural Kenya. Furthermore, studies have shown that a portion of the variation in welfare can be explained by households' location both geographically (Kristjanson et al. 2005) and in time. Table 6 shows the results from various pooled OLS models that examine these effects on welfare, as measured here and throughout the paper by the ratio of household's productive assets per full time adult equivalents to the 1997 median. In each case one of the dummy variables was omitted from the regression, subsuming its effect into a constant term.

Table 6. Spatial, Time, and Household Characteristic Effects on Welfare Variance

RA_{it} =	R^2
F1(constant, Household Characteristics[a]) + v_{it}	.182
F2(constant, Zone dummies) + v_{it}	.046
F3(constant, District dummies) + v_{it}	.082
F4(constant, Village dummies) + v_{it}	.178
F5(constant, Time dummies) + v_{it}	.003
F6(constant, Household Characteristics, Time dummies, Village dummies) + v_{it}	.292

Source: TAMPA survey data 1997, 2000, 2004

Note: *RA* is the ratio of the value of each household's productive assets to the 1997 median, and *v* is the residual term. *i* indexes households, and *t* indexes time.

a – Household characteristics are dummies for whether any member has a formal job, is over 40 years old, has achieved at least a secondary education, and whether the households primary land tenure is ownership with a deed. Continuous variables are the number of full time adult equivalents, kilometers to a tarmac road, that distance squared (distance to tarmac not included in F6 due to collinearity with village dummies), the number of main season acres farmed, and that acreage squared.

These results tell us that a model including only dummy variables for the 8 agro-ecological zones (AEZ) represented in the sample explains 4.6% of the variation in welfare. A similar model with only dummies for the 23 districts included in all three surveys explains 8.2% of this variation, while a separate model with dummies for each of the 106 villages surveyed each year explains 17.8% of welfare variation. The model with only time dummies for the different years of the survey explains 0.3% of the variation. The model containing only household characteristics explains 18.2% of the overall variation, which is more than any of the models from which these variables are excluded. A full model, containing household characteristics, village dummies and time dummies explains 29.2% of the variation of estimated welfare in our sample. The implication of these models is that while geography is an important determinant of poverty, the greatest variations in household asset levels are at the household level, since household characteristics evidently explain more of the variation in wealth than any set of geographic dummy variables.

The relationship between welfare and geography is also examined in Table 7, where the population of each AEZ is shown by asset-poverty mobility group. Thus, each row will sum to 100%, while statistics in each column can be compared to the statistics from the entire sample. For example, we see that 58% of the observations in the Coastal Lowlands are consistently in the lowest welfare tercile, compared to just 16% of the

entire sample. Likewise, the Western Lowlands, Transitional, and Highlands are disproportionately consistently poor, compared to the sample. Conversely, we find that observations in the Central Highlands, High Potential Maize Zone, and Marginal Rain Shadow zone are more likely to be consistently in the top welfare tercile, where we find 26%, 37%, and 46% of their respective populations, compared to just 19% of the entire sample.

Table 7. Welfare distribution of households (%) by Agricultural-Ecological Zone

	Asset-poverty category				
Zone:	Consistently low tercile (n=217)	Consistently high tercile (n=249)	Upward (n=34)	Declining (n=37)	Other (n=787)
Coastal lowlands (n= 78)	58	8	2	1	31
Eastern lowlands (n= 152)	11	8	4	7	70
Western lowlands (n= 161)	25	4	4	4	63
Western Transitional (n= 155)	21	3	6	2	68
High-Potential Maize Zone (n= 362)	9	37	2	2	51
Western Highlands (n= 131)	29	3	0	2	66
Central Highlands (n= 246)	5	26	1	1	66
Marginal Rain Shadow (n= 39)	0	46	5	5	44
Total Sample (N=1324)	16	19	3	3	59

Source: TAMPA surveys 1997, 2000, and 2004.

The geographic concentration of poverty is not surprising. Western Kenya is occasionally plagued by drought, while the High-Potential Maize and Marginal Rain Shadow zones provide friendlier agricultural environments. It is important to note that these results reflect only the prevalence of poverty in these zones, not the absolute numbers of poor. That is to say, although low potential areas may have a greater proportion of households in poverty, high potential areas may contain greater numbers of poor people.

The remainder of section 4 will investigate in more detail what household characteristics and decisions are associated with welfare and welfare mobility.

4.1 Land Holdings

Many densely populated areas of East Africa are facing potentially explosive problems of inadequate access to land. As shown in Table 8, average farm sizes within the smallholder sectors of many African countries are trending steadily downward as population growth outstrips available arable land. In Kenya, mean land-to-person ratios have declined from 0.49 hectares per person in the 1960s to 0.23 hectares per person in the 1990s. Moreover, access to land is highly skewed within the smallholder sector. Roughly a quarter of rural farm households in Kenya are virtually landless, controlling less than one acre, including rented land. Half of the farm population in Kenya controls less than 3 acres. The downward trend in farm size, the skewed distribution of land within the small-farm sector, and increasing landlessness will compel rural households to change their livelihood strategies, including the way they allocate their labor, their land, their choice of crops, and their use of livestock.

Table 8. Land to Person Ratio (10-year average) in Selected Countries

	1960-69	1970-79	1980-89	1990-99
	---------- hectares per person in agriculture ----------			
Ethiopia	0.508	0.450	0.363	0.252
Kenya	0.459	0.350	0.280	0.229
Mozambique	0.389	0.367	0.298	0.249
Rwanda	0.215	0.211	0.197	0.161
Zambia	1.367	1.073	0.896	0.779
Zimbabwe	0.726	0.664	0.583	0.525

Sources: FAO STAT.
Note: Land to person ration = (land cultivated to annual and permanent crops) / (population in agriculture).

Table 9 further emphasizes the importance of considering land constraints on poverty alleviation, showing how the area of controlled land varies by poverty mobility groups. We find that the group of households consistently in the lowest wealth tercile is also consistently controlling the least amount of land, on average. The only exception to this trend occurs in 2000, when the group falling from the top assets tercile to the bottom tercile controls only slightly less land than the consistently poor. As expected, we find that the consistently non-poor are in each period controlling 3 to 4 times more land than the consistently poor. Perhaps most importantly, we find the group of upwardly welfare-mobile households experiences an unparalleled 61% average increase in controlled land, rising from just less than 3 acres in 1997 to nearly 5 acres in 2004. Surprisingly, we also find that our sample shows a spike in land use in 2000. It is important to note that our calculations are carried out focusing only on crops for which there are data from all three surveys, thus ruling out the inclusion of new crops in our survey as the cause of this increase in estimated land use. In fact, this phenomenon appears to be legitimate and is examined further in Appendix B, which disaggregates land use by AEZ and crop type.

Table 9. Mean Total Area Controlled (acres) by Asset-Povery Category

	Asset-Poverty Category					
	Consistentl y poor (n=217)	Consistentl y non-poor (n=249)	Upward (n=34)	Downward (n=37)	Other (n=787)	Total Sample (n=1324)
Acres cultivated						
1997	1.82	7.33	2.94	2.61	2.91	3.55
2000	2.30	8.85	4.25	2.66	3.21	4.13
2004	2.10	6.21	4.73	2.77	3.32	3.68

Source: TAMPA survey data 1997, 2000, 2004
Note: Area Controlled is measured as acres farmed during the main harvest season, which includes rented and owned land.

The data in Table 9 clearly indicate that meaningful discussions of rural poverty alleviation must be grounded within the context of prevailing farm size distribution patterns. Curiously, however, very little discussion of rural livelihood and poverty alleviation in Africa pays explicit attention to these fundamental changes in farm size and land-to-labor ratios.[8]

The remainder of section 4 explores different levels of diversification (in section 4.2), commercialization, and importance to total household income (in section 4.3). These sections are respectively seeking to answer: 1) What are households doing for income? 2) How commercialized are these activities (as opposed to being primarily consumption motivated activities)? 3) How important are these activities to income as a whole? We will attempt to examine these questions in the context of poverty mobility, for households with different farm size endowments.

4.2 Income Diversification

In the context of land constraints, it is important to examine investment and income activity decisions of households in various poverty mobility groups. It is widely recognized that low entry-barrier off-farm activities are often entered into for purposes of consumption smoothing or short term poverty alleviation (Daniels 1995; Reardon 1997; Barrett 2000). However, prior research has been largely unable to identify the kinds of decisions made by households whose welfare subsequently improves (and declines) over time.

In Table 10 we examine the cash generating enterprises that each poverty mobility group is engaging in. Here an "enterprise" is defined as any activity providing cash income, regardless of the intensity that the enterprise is used for cash versus consumption. In other words, selling both cows and goats for cash is counted as two cash generating enterprises. This is irrespective of whether the household sells one of each, ten of each, one cow and ten goats, etc. This broad stroke approach allows us to look at the differences in basic patterns of diversification between these groups, as opposed to the degree of commercialization, which will be further examined later. In Table 10, livestock sales includes the selling animals such as bulls, cows, goats, sheep, chickens, and others, while livestock products capture the sale of milk, eggs, honey, and others.

First, we see in all poverty mobility groups that most households rely more heavily on crop enterprises to provide cash income than on any other type of enterprise. Also notice that this number increases among all groups over the 7 year period, more than doubling for the sample as a whole. This is true even though Table 10 reports income only from crops included in all three surveys, and suggests a growing level of crop diversity in rural Kenya. Secondly, notice the consistently poor households average more off-farm activities than any other group in 1997 at .88 activities per household. In 2004 we see that number climb to more than 1 activity per household, suggesting that chronically poor households are depending on a greater variety of off-farm activities in their livelihood strategies. We also see this occurring for those households who have

[8] For example, neither of the World Bank's (2000a) synthesis chapters on "Addressing Poverty and Inequality" or "Spurring Agriculture and Rural Development" contain any references to the role of constrained access to land or land distribution inequalities in contributing to poverty.

fallen from the top tercile to the bottom during this period. This lends support to the theory that many such activities provide only temporary poverty alleviation for the otherwise desperately poor.

The consistently non-poor and "rising" households also show an increase in off-farm activity, albeit not to the same extent, indicating that some off-farm activities may be beneficial indeed. Off-farm activities are considered in more detail later in the paper, and results from Table 10 are examined in more detail in Appendix D.

Table 10. Household Income Diversification in 1997 and 2004 by Asset-Poverty Category

	Asset-Poverty Category					
Enterprises Providing Cash Income	Consistentl y Poor (n=217)	Consistentl y non-poor (n=249)	Rising (n=34)	Declining (n=37)	Other (n=787)	Total Sample (n=1324)
	----------Number of Enterprises----------					
1997:						
-Crops	1.53	2.75	1.74	2.43	2.19	2.18
-Livestock Products[a]	.24	1.23	.79	.73	.78	.78
-Livestock Sales	.65	1.20	.82	1.32	1.07	1.02
-Off-Farm	.88	.42	.62	.49	.65	.64
Total Across Sources[b]	3.05	4.37	3.18	4.24	3.90	3.84
2004:						
-Crop Enterprises	3.76	5.39	4.38	3.92	4.98	4.81
-Livestock Product	.29	1.30	.97	.54	.77	.79
-Livestock Sales	.17	.73	.62	.46	.48	.48
-Off-Farm	1.06	.65	.97	1.05	.87	.87
Total Across Sources	4.99	6.78	5.97	5.43	6.32	6.15

Source: TAMPA surveys 1997, 2000, and 2004
Note: a – Livestock product sales data not available in 1997, because products sold were not distinguished from products consumed. hence these figures reported are from 2000.
b - Excluding Livestock Products

A final observation from Table 10 is the sizable difference between groups in the number of livestock selling enterprises providing cash. Here, each type of livestock sold counts as an enterprise, again regardless of how many animals are sold. In 1997 the sample average was to sell just more than 1 type of livestock, while the households consistently in the top tercile and those who were in the top at the time but later fell to the bottom, the declining group, were selling 18-30% more types than that, suggesting that diverse livestock marketing strategies may play a role in keeping households non-poor, and conversely, that loss of livestock assets may be a contributing factor to movements into poverty (as seen in Kristjanson et al., 2002). Meanwhile, the consistently low and upward-moving households (who were then in the bottom tercile) groups were selling only .65 and .82 types of livestock respectively. Unfortunately data are unavailable for livestock products in 1997, but we see that the households incurring a decline in their

wealth status over time also incurred a sizeable decline between 2000 and 2004 in the number of cash income generating activities from livestock products.

In 2004, although all households are selling fewer types of livestock, dropping the sample average to .48, the consistently non-poor and rising households (now in the top tercile) are selling decidedly more. That is .73 types of livestock for the consistently non-poor, compared to .17 types for the consistently poor. Moreover, 2004 data were able to examine the number of livestock products being sold, and we find the consistently non-poor and rising households at much higher levels of participation (averaging 1.3 and .97 types of livestock respectively) than the consistently poor and declining households (averaging .29 and .54 types respectively). This implies there are profitable opportunities in the livestock product markets that can lead to increased and sustained wealth, and that some households are taking part in these opportunities. The two main types of products represented in Table 10 are milk and eggs, which will be examined in more detail later.

4.3 Commercialization and Importance to Household Income

In order to examine how intensely households are participating in different activities to earn income, we use a Household Commercialization Index (HCI). For each product, this index is the percent of the value of total production that is sold for cash. For example, if a household has an HCI of 50 for staple crops, we know that household sold half of the staple crops they harvested. The results of this analysis are presented in Table 11 as means by asset-poverty groups. Moreover, in order to ground our discussion in the context of prevailing farm sizes, results are further segregated by farm sizes. Households were assigned a farm size of either small, medium, or large, ranked by terciles, according to both rented and owned acres farmed during the 1997 main harvest season. If a household was not producing one of the categorized products, it was not considered in the estimation of cross-tabulated means.

Here we again see the obvious correlation between farm size and wealth, with 182 of the 217 (84%) consistently poor households failing to meet the “large farm” criteria, with most of them being categorized as small. Conversely, 141 of the 249 consistently non-poor (57%) are also in the top farm size tercile in 1997. The weight of the burden on the landless poor is more starkly evident when comparing the HCI of staple crops. The consistently non-poor households who enjoy the benefit of large farms are on average selling more than half of the staples they produce, compared to the consistently poor in the lowest landholding tercile who sold only 5% of their staples in 1997 increasing to 13% in 2004.

Although we are only able to compute an HCI for dairy in 2000 and 2004, we find that it is remarkably different between poverty groups. Consistently poor households, most of which are in the lowest landholding tercile, are on average selling 20 to 34% of the milk they produce in 2004, whereas the consistently non-poor are on average selling more than 50% of their milk. Furthermore, we found that only 17% of the 120 consistently poor small farmers were producing milk at all, compared to 97% of the 141 consistently non-poor large farmers[9]. Moreover, we find that households incurring a decline in their wealth ranking over time incurred steep declines in their dairy commercialization index

[9] A full table of the percent of households producing each category in Table 11 can be found in Appendix C

between 2000 and 2004, whereas households in the other categories generally had small increases or relatively small declines.

Another point of interest may be that among the upward moving households with large farms there was an HCI of 0 for their "other" crops in 1997, but this number increases to 26 by 2004. Although these are only 13 households, and as we will see in a moment, this is a fairly small source of income, this is a dramatic shift. A closer look at these households reveals the crops driving this change. The crops produced by these households in 1997 were groundnuts, animal fodder (leaves), simsim (a Swahili word for a sesame like seed), and soy beans. As shown, however, these households didn't sell any of these crops that year. In 2004 we see that the increase in the average HCI is being driven by 3 households producing and selling 3 different crops on 6 fields. Each of these three households has begun to sell their groundnuts, and two of those have also begun to sell green grams (a bean). The other household has begun to sell soy beans.

In order to observe how different activities are contributing to overall income and ultimately wealth, we calculate their contributions to total gross income. Ideally this would be done using net income. However, based on analysis thus far we desire to separate the contributions of livestock products and the sale of livestock themselves. Although data are available for costs such as veterinary and feeding, we are not able to assign specific costs to specific livestock activities. Thus, for the sake of consistency, all values are reported as shares of gross income. While this may misrepresent the contributions of certain high-overhead activities, it will still allow us to observe behavioral differences between poverty mobility groups. Again, in order to ground our discussion in the context of prevailing farm sizes, we segregate our sample by farm size, and present results in Table 12.

Here we see the vast majority of the poor small farmer's income being generated from off-farm activities, the largest share of which is coming from informal entrepreneurial activities. These include maize trading, carpentry, masonry, shop keeping, tailoring, and others, all characterized by relatively low barriers to entry. This shows, as expected, that without access to land and thus limited opportunity to diversify agricultural investments, poor households are relying on off-farm activities to supplement income. Moreover, given the persistence of poverty in these households, we also see that these off-farm activities seldom lead to long-term growth. This is also apparent amongst the small and medium sized farm households whose welfare declines over the 7 years, as their share of income from informal business rises substantially during the same period.

We now consider the income diversification which characterizes the consistently non-poor group. These results suggest that in 1997 there were three types of relatively wealthy households. The first is small farms, producing on average an approximately equal value of staples and horticultural products from their land, but whose lion's share of income comes from formal, presumably skilled, employment. The second group is composed of medium sized farms who are more likely to be involved in cash crops than their contemporaries, but where the largest share of income is from livestock products. The third, most common type are large farms strongly focused on crop production and, as we saw in Table 9, sale of staple crops.

By 2004 we have observed an unambiguous shift among the non-poor towards livestock products, irrespective of farm size. This is most profound among the small farms of this group, showing a change in the average share from 6 % to 21% of total gross income.

Unlike households that are staying poor, it seems that successful households are investing more in livestock-related sources of income. It is also apparent that this household decision is associated with long-term growth when looking at the upwardly mobile households. This is particularly true for the mid-sized farms in that group, increasing the average share of gross income from livestock products from 2% to 21%.

Table 11. Household Commercialization Index[a] (HCI) in 1997 and 2004 By Asset Poverty Category and Farm Size

	Asset-Poverty Category															
	Consistently low tercile ---------Relative Farm Size--------			Consistently high tercile ---------Relative Farm Size------			Upward ---------Relative Farm Size------			Declining ---------Relative Farm Size------			Other ---------Relative Farm Size------			Total Sample N=1324
	Small (n=120)	Medium (n=62)	Large (n=35)	Small (n=37)	Medium (n=71)	Large (n=141)	Small (n=8)	Medium (n=13)	Large (n=13)	Small (n=12)	Medium (n=16)	Large (n=9)	Small (n=263)	Medium (n=278)	Large (n=246)	
Staple Carbohydrates																
1997	5	13	15	13	20	55	5	15	24	11	26	35	9	14	27	20
2004	13	9	16	25	27	52	22	23	27	13	29	27	14	21	31	24
Horticultural Products																
1997	33	47	45	40	39	40	37	40	50	35	48	49	41	39	43	41
2004	30	34	45	35	33	40	24	22	43	25	37	39	31	35	38	35
Industrial Cash Crops																
1997	93	95	100	90	93	95	50	100	100	100	51	100	90	94	93	93
2004	93	95	99	95	100	97	100	100	100	80	100	na[b]	95	97	97	96
Other Crops																
1997	21	45	40	13	13	14	31	21	0	30	27	34	31	31	27	27
2004	30	20	32	5	8	7	6	5	26	21	35	8	15	18	15	16
Dairy HCI																
2000[c]	34	20	17	51	48	52	31	29	48	48	49	72	36	36	37	40
2004	22	24	14	54	50	51	34	30	38	25	31	35	34	35	31	38

Note: Farm sizes are ranked by terciles, according to acres farmed during the 1997 main season, whether land is owned or rented. Small farms are 0 to 1.6 acres,

medium farms are 1.6 to 3.25 acres, and large farms are larger than 3.25 acres.

If a household was not producing one of the categorized products, it was not considered in the estimation of cross-tabulated mean HCI.

a - HCI for product i is (value of product i sold / value of product i produced)*100.

b - none of the households in this group were selling industrial cash crops in 2004.

c - Data not available for 1997

Table 12. Household Income Shares (%) in 1997 and 2004 by Asset Poverty Category and Farm Size

	Asset-Poverty Category															
	Consistently low tercile			Consistently high tercile			Upward			Declining			Other			
	---------Relative Farm Size-----			---------Relative Farm Size-----			---------Relative Farm Size-----			---------Relative Farm Size-----			---------Relative Farm Size------			Total
Income Shares[b]	Small (n=120)	Medium (n=62)	Large (n=35)	Small (n=37)	Medium (n=71)	Large (n=141)	Small (n=8)	Medium (n=13)	Large (n=13)	Small (n=12)	Medium (n=16)	Large (n=9)	Small (n=263)	Medium (n=278)	Large (n=246)	Sample N=1324
Crops																
Staple Carbohydrates																
1997	21	29	25	17	15	41	18	22	27	22	32	22	19	21	29	24
2004	21	23	17	13	14	29	12	18	15	18	24	22	18	19	25	21
Horticulture Products																
1997	9	11	10	14	11	6	13	2	9	8	13	15	12	10	9	10
2004	12	16	17	11	12	8	13	5	7	11	14	10	15	13	11	12
Industrial Cash Crops																
1997	4	5	6	4	10	7	1	16	16	12	4	0	7	11	13	9
2004	4	7	7	4	10	7	2	8	17	8	4	0	7	9	11	8
Other Crops																
1997	1	2	1	0	0	0	2	2	4	0	3	2	1	1	1	1
2004	2	2	2	3	4	1	2	5	3	1	4	2	3	3	2	2
Off-Farm Activities																
Informal/Ag Wages																
1997	11	10	7	1	1	1	6	2	3	5	0	5	7	3	2	4
2004	3	6	2	2	0	1	0	3	0	1	0	13	2	2	1	2
Informal Business																
1997	23	15	16	14	16	12	18	13	5	14	9	24	19	18	14	17
2004	26	20	31	14	9	13	25	12	11	19	23	13	16	16	14	16
Formal Salaried Income																
1997	20	18	24	37	22	11	13	26	20	20	13	15	18	19	15	18
2004	19	16	14	24	15	10	12	15	13	19	7	12	15	14	12	14
Other[c]																
1997	8	6	9	3	5	6	18	12	6	10	14	3	8	7	5	7
2004	6	4	4	5	4	4	10	8	1	13	4	4	5	4	4	5
Livestock Activities																
Products																
1997	2	1	1	6	14	11	9	2	5	2	8	9	5	7	8	7
2004	5	5	3	21	28	23	20	21	24	10	18	17	16	15	16	16
Animal Sales																
1997	2	2	2	4	6	5	1	4	6	7	5	4	4	4	5	4
2004	2	2	3	4	3	5	4	5	9	1	2	6	4	4	4	4

Note: a - Farm sizes are ranked by terciles, according to acres farmed during the 1997 main season, whether land is owned or rented. Small farms are 0 to 1.6 acres, medium farms are 1.6 to 3.25 acres, and large farms are larger than 3.25 acres; b - Full income means valuing of all household production, including crops and livestock products both sold and consumed; c – "Other" includes remittances, pensions, and dividends

We also notice that the declining households also increased their livestock product's share of income from 1997 to 2004, but not as much so as the "rising" and "consistently non-poor" households. Even with income diversification through livestock, the "declining" households are unable to prevent themselves from falling into poverty. There are many possible explanations for this phenomenon, such as the fact that many Kenyan households fall into poverty primarily for health-related reasons (Krishna et al., 2002). It is also important to recognize that for these declining households, this larger share of income from livestock comes from what is likely a smaller total income. Thus, this could simply be reflecting habit persistence, whereby families losing wealth over time are more reluctant to exit livestock product markets. It is also possible that the importance of livestock products has increased during this period for the sample as a whole. Finally, and most likely, the households with different poverty mobility characteristics may be involved in different livestock product markets, and this warrants further exploration.

To summarize, we find that the land constrained persistently poor households are relying on informal off-farm activities to supplement their income, but that these activities are unlikely to translate into long-term growth. On the other hand, we see many of the households who are capable are diversifying into livestock product markets, and that this is associated with growing wealth over time. The households declining in wealth over time are also involved in livestock activities, but they are likely different activities. The ceteris paribus effects of participation in different livestock markets are more closely investigated in the next section of this paper.

5. Econometric Analysis of Factors Associated With Current Welfare and Welfare Mobility

Although illuminating, the descriptive analysis conducted thus far are limited in their ability to generate firm conclusions. First, given the steady rate of 7% attrition between surveys, we must deal with the potential issue of attrition bias. Second, it is necessary to use multivariate techniques in order to control for other factors affecting household indicators of poverty. For example, our conclusions on the importance of livestock activities among the relatively wealthy and "rising" households have left us somewhat perplexed, since the households with declining wealth also show an increase in livestock activities, albeit to a lesser extent. This section presents basic econometric techniques to deal with these problems.

5.1 Determinants of Re-interview

To deal with the potential for attrition bias, we estimate our models using Inverse Probability Weights (IPW), as described by Wooldridge (2002). This is where an auxiliary model is developed, using conditions and household characteristics from initial period observations, to estimate the probability of re-interview in the next period. For our purposes this means separately estimating probabilities of attrition in 2000 and 2004. Then, each observation in the panel is weighted according to the probability of them being interviewed in both 2000 and 2004, or the product of the two probabilities. In this way observations which were less likely to be re-interviewed are assigned a heavier weight to make up for similar households that fell out of the sample. Results from our re-interview model are found in Table 13. Notice that the enumeration team to which they were assigned consistently significant affect the probability of re-interview, indicating that some of the attrition in the sample may be due to enumerator team training and motivation. Re-interviewed households also had larger families, larger farms, a higher share of total income from crops, a lower share of their income derived from livestock and off-farm activities. Reinterviewed households were also more likely to own a land title deed and to have formal employment, factors that would tend to motivate households to remain in their villages. To test the robustness of our results, subsequent models will be shown with and without correction for attrition bias. It should also be noted that in this and all subsequent econometric analyses continuous variables were tested for quadratic relationships. Omitted quadratic terms are an indication that they were not found to be significant.

Table 13. Household-level Re-Interview models, using Probit estimation.

* significant at 10%; ** significant at 5%; *** significant at 1%

	Dependent variable = 1 for re-interviewed households		
	Pooled	2000	2004
Household Characteristics			
Full time adult equivalents	0.008***	0.007**	0.008***
	(3.93)	(2.56)	(3.07)
Any Members over 40=1	0.011	0.005	0.022
	(1.00)	(0.36)	(1.35)
Value of productive assets (2004 ksh)	-0.000*	-0.000	-0.000
	(1.82)	(1.34)	(0.08)
Livestock share of net income	-0.004*	-0.071**	-0.002
	(1.76)	(2.38)	(0.79)
Off-farm share of net income	-0.027	-0.044**	-0.018
	(1.44)	(2.02)	(0.74)
Area under cultivation (acres)	0.003	0.002	0.004*
	(1.57)	(0.79)	(1.87)
Land Tenure with deed=1	0.018*	0.000	0.036***
	(1.94)	(0.03)	(2.85)
Formal employment=1	0.020*	0.012	0.027**
	(1.89)	(0.78)	(2.12)
Any secondary school=1	-0.011	-0.014	-0.006
	(1.12)	(1.06)	(0.45)
Distance to tarmac road (km)	0.003**	0.002	0.003*
	(2.35)	(1.54)	(1.80)
Distance Squared	-0.000**	-0.000	-0.000***
	(2.54)	(1.34)	(2.89)
Enumeration Team Dummies			
Team 2 in 2000	0.059***	0.063***	N/A
	(4.87)	(3.84)	
Team 3 in 2000	0.024*	0.023	N/A
	(1.93)	(1.43)	
Team 4 in 2000	0.034***	0.028*	N/A
	(2.86)	(1.76)	
Team 2 in 2004	0.033***	N/A	0.036***
	(2.61)		(2.61)
Team 3 in 2004	0.026**	N/A	0.037***
	(2.11)		(2.81)
Team 4 in 20004	0.049***	N/A	0.058***
	(3.78)		(4.04)
Joint test on Team Effects	35.39 [0.00]	14.9 [0.00]	19.58 [0.00]
Joint test on Household Effects	38.21 [0.00]	18.57 [0.07]	42.96 [0.00]
E[y]	0.938	0.936	0.945
Observations	2968	1540	1428

z statistics in parentheses, p-values for joint tests in brackets. Estimated with heteroskedasticity robust standard errors (clustered by household in the pooled regression). Estimated coefficients are marginal changes in probability around the data means.

5.2 Probit Analysis on Initial Conditions Associated with Consistent Welfare Status

To better understand the relationship between livestock activities and welfare status, we use a household-level probit model, focusing on initial conditions, to estimate marginal probability effects on belonging to poverty mobility groups. The model uses dummy variables for whether the household sold products in the following livestock markets in 1997: bulls and cows, chickens, goats, other livestock, milk, and eggs. In light of our earlier findings involving the apparent significance of geographic location and access to land, we have also controlled for land tenure, area cultivated, distance to tarmac roads, and agro-ecological zones (AEZs). To control for labor we add variables for the number of full time adult equivalents in 1997, as well as a dummy variable for whether the household experienced the death of a prime aged adult (ages 15 through 59) during the period from 1997 to 2000. We wanted to further control for ability and longevity of the household, using the education level and age of the household head, but these data were not available in 1997. These "initial conditions" were therefore obtained from the 2000 data. Results from these models are shown in Table 14.

The first thing we notice is the similar estimates with and without weighting to correct for attrition bias. This was expected given the reasonably low rate of attrition. Secondly, it should be noted that the models for the consistently poor and the consistently non-poor are not mirror images of each other by construction. That is to say, not being in the group of households consistently in the top tercile is quite different from actually being in the group consistently in the lowest tercile. For this reason, when we observe opposite and significant effects between these models, we can infer robustness in our conclusions.

This brings our attention to the strong positive correlation between milk production and relative wealth. By doing a simple simulation of a household that represents the data means of other variables, we estimate at a 1% level of significance that having produced milk in 1997 increases the probability of consistently (in 2000 and 2004) being among the wealthiest households by 13 percentage points. When setting all explanatory variables at their mean levels, the predicted probability of a household consistently being in the relatively wealthy tercile in all 3 years was 18.8%, whereas households with these same mean conditions but producing milk in 1997 were estimated as having a 31.4% probability of being in the top wealth terciles in 2000 and 2004. Moreover, we estimate with the same significance level an equal and opposite effect on the probability of being consistently among the poorest households.

We notice, again, the importance of land. Using the same simulation as before, we estimate that cultivating 1 additional acre of land in 1997 increases the probability of consistently being among the wealthiest households by 2 percentage points. We further estimate that one additional acre decreases the probability of being persistently poor by three percentage points. Both of these estimates are also significant at the 1% level.

Table 14. Household level Welfare Probability Models (Probit)

	Maginal probabilities associated with household being consistently *non-poor*		Maginal probabilities associated with household being consistently *poor*	
	Corrected For Attrition	Un-weighted Model	Corrected For Attrition	Un-weighted Model
Sell bulls or cows in 1997=1	0.051**	0.053***	-0.030**	-0.031**
	(2.92)	(3.04)	(2.03)	(2.16)
Sell chickens in 1997=1	-0.055**	-0.054***	0.017	0.019
	(2.99)	(2.89)	(1.23)	(1.41)
Sell goats in 1997=1	0.006	0.006	-0.016	-0.015
	(0.37)	(0.34)	(1.15)	(1.13)
Sell other livestock in 1997=1	0.024	0.022	-0.044**	-0.044***
	(1.33)	(1.23)	(2.56)	(2.66)
Produce milk in 1997=1	0.125**	0.126***	-0.126***	-0.126***
	(5.80)	(5.74)	(7.32)	(7.46)
produce eggs in 1997=1	0.002	0.000	-0.021	-0.024
	(0.10)	(0.01)	(1.38)	(1.59)
Major land tenure with deed=1	0.041*	0.039**	-0.017	-0.018
	(2.36)	(2.25)	(1.37)	(1.51)
Area Cultivated in 1997 (acres)	0.020**	0.020***	-0.026***	-0.025***
	(6.18)	(6.31)	(5.96)	(5.95)
Male head of household in 2000=1	0.028	0.029	-0.007	-0.006
	(1.21)	(1.25)	(0.33)	(0.29)
Age of head of household (years, as of 2000)	0.002**	0.002***	-0.001	-0.001
	(2.81)	(2.79)	(1.50)	(1.49)
Education of the head of household (years, as of 2000)	0.009**	0.009***	-0.002	-0.002
	(4.05)	(4.09)	(1.38)	(1.46)
Full time adult equivalents	-0.026**	-0.027***	0.014***	0.014***
	(6.31)	(6.27)	(4.95)	(5.01)
did hh experience a prime age death (15 to 59) between 1997 and 2000	-0.028	-0.028	0.030	0.023
	(0.79)	(0.76)	(1.10)	(0.90)
Distance to a Tarmac Road (10 km)	-0.0045	-0.0059	-0.0066	-0.0070
	(0.24)	(0.31)	(0.45)	(0.49)
Distance Squared	0.0046	0.0049	0.0014	0.0015
	(1.30)	(1.36)	(0.46)	(0.49)
Zone Dummies	Yes	Yes	Yes[a]	Yes[a]
Observations	1320	1320	1320	1320

Heteroskedasticity robust z statistics in parenthesis, clustered by household.
a - These regressions do not include a dummy for the Marginal Rain Shadow agro-ecological zone, because no observations in this zone were consistently poor.
* significant at 1%; ** significant at 5%; *** significant at 1%

To better understand the importance of these household characteristics and decisions, we've conducted the series of simulations presented in Table 15. First we consider a benchmark case, using data means for all continuous variables and zone dummies, and 0 (No) for all other dummies except male head of household, which is held at 1 (Yes). That is, the benchmark is a hypothetical household that has not had a prime-age death, did not primarily own land, and did not participate in any of the livestock or livestock product markets in 1997. We estimate that such a household has a 2% probability of being in the consistently non-poor poverty group, but a 30% probability of being among consistently poor.

Compare this to a "land rich" household that primarily *does* own land, and that cultivates nearly 9 acres, which is about one standard deviation above the data mean. We estimate that this household's probability of being consistently non-poor rises to 15%, while the probability of being consistently poor falls to only 3%. We compute the same probabilities for a "land poor" household that doesn't primarily own land and is virtually landless at .05 acres farmed (which is the data minimum and less than one standard deviation below the mean). This household has a less than 1% probability of being consistently non-poor, and a staggering 62% probability of being consistently poor. This is very strong evidence supporting the notion that access to land is of utmost importance in poverty alleviation discussions.

Table 15. Probability Simulations of being Poor and Non-Poor for Rural Households[a]

State of Nature	Area Farmed (acres)	Primarily Owns Land	Produce Milk	Sell Bulls or Cows	Probability of being Non-Poor	Probability of being Poor
Benchmark[b]	3.6	No	No	No	.02	.30
Primarily Owns Land	3.6	Yes	No	No	.04	.27
Land Rich[c]	8.98	Yes	No	No	.15	.03
Land Poor[d]	.05	No	No	No	.01	.62
Sell Bulls and Produce Milk	3.6	No	Yes	Yes	.23	.05
Land Rich, Sell Bulls, Produce Milk	8.98	Yes	Yes	Yes	.51	.00

Source: Tegemeo survey data 1997, 2000, 2004

Notes: a - based on Probit estimates controlling for agro-ecological zones, area cultivated in 1997, household head age and years of education in 2000, the number of full time adult equivalents, distance to a tarmac road, that distance squared, as well as dummy variables for whether major land tenure is ownership with deed, male head of household, whether household suffered a prime-age death, and dummies for participation in the following markets in 1997: bulls and cows, chickens, goats, other livestock, milk, and eggs. All controls not shown in this table are held at their data means, unless otherwise specified

b - Using data means for all continuous variables and zone dummies, and 0 (No) for all other dummies except male head of household which is held at 1 (Yes).

c - Land Rich differs from the benchmark in that primary land tenure is own with deed and area cultivated is data mean, plus one standard deviation.

d - Land Poor differs from the benchmark in that primary land tenure is not own with deed, and area cultivated is the data minimum (less than one standard deviation from the data mean).

We now return to our benchmark household, but suppose we allow them to participate in the milk market and to sell bulls or cows in 1997. Based on these initial conditions we estimate that the probability of this household being consistently non-poor rises from 2% to 23%. Conversely, the probability of this household being consistently poor falls from 30% to 5%. Once again, this is strong evidence that relatively well off households are participating in these activities. Incidentally, if we allow this household to be land rich as well, they now have a 51% chance of being non-poor, and almost no chance of being poor throughout the 7 years.

Admittedly this model has limitations. First of all, many of these market participation variables may be endogenous to the level of assets a family has. This may render us unable to make inferences as to causality; however the correlations themselves provide interesting insights. Secondly, fortunately or unfortunately the number of households we were able to categorize as declining or rising in terms of welfare were too few to conduct similar Probit analysis. To address this issue, we conduct estimates of a First Differences model on changes in wealth in the next sub-section of the paper.

5.3 First Difference Model of Factors Associated with Changes in Wealth over time

In order to examine more closely the relationship between livestock markets and changes in wealth over time, and look at how starting and stopping new livestock activities are correlated with household welfare status, we construct a First Differences model. That is, all time-variant variables in the regression are differenced, thereby controlling for all time-invariant unobserved effects, such as geography and innate ability. Since our variables of interest are participation in certain markets, the effects of not changing behavior will also be differenced out of this model. Instead, we include dummy variables for whether a household has entered or exited these markets in the time between surveys. Imposing dummy variables in an FD model in this way is tantamount to conducting Difference in Differences analysis, but controlling for other time-variant factors that may be correlated with the dependant variable (Wooldridge 2002). Results from this analysis are presented in Table 16.

Table 16. First Differences Model for Factors Associated with Changes in Wealth

	Change in Total Value of Household Productive Assets	
	Corrected for Attrition	Un-Weighted Model
Change in area under Cultivation (acres)	2,192.027	1,708.299
	(0.83)	(0.74)
Change in the number of Men age 17-39	2,826.358	2,429.264
	(0.49)	(0.42)
Change in the number of Women age 17-39	1,079.039	1,145.833
	(0.23)	(0.26)
Distance to a Tarmac Road (km)	-557.605	-639.282
	(0.42)	(0.50)
Distance Squared	-844.244	-683.030
	(1.67)	(1.59)
Entered Milk Market=1	33,634.431**	32,341.723**
	(3.19)	(3.21)
Exited Milk Market=1	-6,924.265	-8,849.481
	(0.79)	(1.01)
Entered Egg Market=1	-1,124.272	-2,672.606
	(0.07)	(0.19)
Exited Egg Market=1	10,037.457	8,676.657
	(0.91)	(0.84)
Entered Bull/Cow Market=1	26,504.650*	26,270.287*
	(2.12)	(2.22)
Exited Bull/Cow Market=1	-5,399.276	-6,476.001
	(0.77)	(0.91)
Entered Chicken Market=1	-35,063.170**	-32,061.267**
	(3.07)	(3.02)
Exited Chicken Market=1	-11,701.880	-10,863.636
	(1.47)	(1.40)
Entered Goat/Sheep Market=1	32,556.773**	31,471.612**
	(2.94)	(3.04)
Exited Goat/Sheep Market=1	-5,807.316	-6,850.538
	(0.47)	(0.60)
dummy for period	29,439.941**	28,888.767**
	(3.46)	(3.51)
Constant	-33,291.779**	-32,751.816**
	(3.32)	(3.36)
Observations	2648	2648

Robust t statistics in parentheses, clustered by household
* significant at 5%; ** significant at 1%

Again with this regression we see our results being very similar with and without correction for attrition bias. What immediately stands out is that we find that in addition to being correlated with current wealth, milk production is highly correlated with growing wealth over time. We estimate that the ceteris paribus difference in the change in wealth from one survey to the next for households entering this market to be more than 30,000 Ksh (nearly $500) per household. We also find a correlation of equal magnitude among households who have begun selling small ruminants, such as goats and sheep, and again with bulls and cows. Conversely, we see negative correlation between changes in wealth and beginning to sell chickens and eggs. This suggests that these livestock activities, much like many informal off-farm activities, are more likely poverty alleviation

strategies. It should be noted that, although less significant statistically, these correlations are also found for the income measure of welfare.

To summarize, using econometric analyses we found little attrition bias in our sample, if any. Then, using Probit analysis and controlling for factors exogenous to the household, such as geography and infrastructure, we found a significant and highly positive relationship between sustained wealth and certain livestock activities, specifically milk production and the selling of bulls and cows. The selling of chickens, on the other hand, we found to be associated with the persistently poor. We then, using a First Differences model, found the same activities associated with sustained wealth are highly correlated with growing wealth as well. Given the likely endogenous nature of participation in these activities, it isn't possible to make inferences about causality. One thing, however, is quite clear; whether they are relatively wealthy because of livestock, or involved in livestock because they are relatively wealthy, participation in livestock markets is an unambiguous trend amongst rural Kenya's growing and wealthiest households.

6. Summary and Implications

Using an asset-based measure of welfare and looking at household poverty movements from 1997 to 2004 for 1324 rural households across Kenya, we found that the majority of households (57%) remained at the same relative poverty level in 2004 as they were at in 1997. Twenty-two percent of households made some progress out of poverty, while 21% experienced a decline in welfare. The distribution of wealth across these households is highly unequal, with the value of assets owned by the poorest households being only 13% of the value of the median household, compared to 808% for the wealthiest group.

Some of the factors helping to explain variation in asset-poverty levels across rural households in Kenya include the age and education of the household head, whether someone in the family has a formal job, land ownership, family size and the distance to a tarmac road. We found that while geographic location is an important factor, household characteristics explain more of the variation in asset-poverty than do geographic factors.

Farm sizes have been steadily declining across Kenya, and our findings show that access to land continues to be a major determinant of rural household welfare. The consistently non-poor group cultivates 3-4 times more land on average than the chronically poor. Households that had made positive progress out of poverty had significantly increased the amount of land they controlled, from an average of 3 acres in 1997 to 5 acres in 2004. The direction of causality is not clear. Differences in landholding sizes at any given point in time may reflect differences in prior motivation and initiative, intergenerational differences in households' standing in the community, closeness to traditional authorities, or other social factors.

More types of crops were grown in 2004 than in 1997 by poorer as well as non-poor households. We see an increasing diversity in off-farm income sources by the poorest households. There has also been an increase in the types of livestock sold, particularly by non-poor households, who sell four times as many types of livestock and livestock products than do the poor.

What are the successful households (i.e. those that are consistently non-poor and those that have improved) doing that other households aren't? Answering this question requires distinguishing groups by landholding size, because the patterns of "success stories" are somewhat different between these 3 groups:

- Small (0-1.6 acres) crop-livestock farms with the majority of income coming from off-farm
- Medium-sized farms (1.6-3.25 acres) with cash crops and the largest share of income coming from livestock
- Large farms (more than 3.25 acres) focused on the sale of staple crops

The importance of livestock production and marketing (especially milk) to the welfare of successful households shows up clearly, and this holds irrespective of farm size.

Why are some households able to remain non-poor while others remain poor? Households that sell milk and cattle, have more access to land and have smaller, more educated families, are more likely to be consistently non-poor. Conversely, the probability of staying poor is higher for households that aren't selling cattle, are selling chickens, have little land and large families. In fact, we estimate that, all else equal, a household who is initially land poor, not selling cattle, and not producing milk has a 62% probability of remaining consistently poor, and only a 1% probability of being non-poor. By contrast, a household with over 3.25 acres of land and that is producing milk and selling cattle has a 51% chance of being consistently non-poor, and almost no chance of being consistently poor.

Although the group of households we were able to identify as rising from poverty over time was relatively small (34 households), we were able to see some trends from that group. We noticed these households increased the number of income-earning activities, and that most of these additional activities come from crops. For the small and medium sized farms in this group, this was coupled with an increased commercialization of staple grain crops, while the larger farms became more commercialized in various other bean-like crops. For all these households, regardless of farm size, the largest increase over time in any particular activity's share of total income comes from livestock products. Although more research is needed in this area, this and our findings about the consistently non-poor households suggests that various crops may provide lower entry barrier pathways from poverty, and that livestock activities (primarily dairy sales) provide sustainable wealth once a household can enter those markets.

The group of households we characterize as declining into poverty is also relatively small (37 households), but this group too provides some interesting insights. We have seen that this group has also become more diversified in their cash generating crop activities. However, unlike the upwardly mobile households, this group has decidedly decreasing numbers of livestock related cash generating activities, and an increasing numbers of off-farm activities. Moreover, despite the diversification, crop activities for these households are generally characterized by decreasing commercialization. Across all farm sizes the level of commercialization for dairy decreases significantly from 2000 to 2004. Consistent with the theory that households struck by poverty will often rely on low entry-barrier off-farm activities to smooth consumption, we observe informal activities becoming increasingly important for these households. The small and medium farmers of this group show an increase in the informal business share of income, while the large farms show an increasing dependence on informal agricultural wages. Interestingly, livestock products are an increasing share of total income for this group as

well. We must recall, however, that this in an increased share of what is very likely a smaller income. Thus, the real level of income from these activities may be changing very little, suggesting that livestock activities may provide a steady source of income, even for those households who are otherwise falling into poverty.

The findings from this study have a number of important implications for the design of strategies, policies, and instruments for reducing poverty and supporting agricultural growth in rural areas of Africa. The study finding is that of limited mobility between poverty groups co-existing with a high level of inequality. This finding may suggest that there are relatively few profitable growth opportunities in rural Kenya that have low entry barriers which would allow poor households to become engaged in. The most profitable opportunities tend to be skewed towards better off households with larger and better quality asset endowments. Strategies to bring about sustainable improvements in poverty need to encompass growth options and targeted interventions that address inequalities in the distribution of key livelihood assets such as land. In this regard it is important to note that location-level poverty analysis help identify key area-level determinants of poverty including markets, public goods, rural institutions, and governance. These variables shape the contexts in which households assets are used and define available livelihood opportunities, such engagement in commercialization activities and of off-farm rural employment. Notwithstanding this, the analysis demonstrates that the primary sources of variations in asset-poverty are at the household level where asset holdings define their capability to pursue different livelihood activities that generate income. This study shows that insufficient access to key assets such as land, livestock, and human capital and low returns to asset are important causes of chronic poverty among rural populations in Kenya. Sustainable poverty reduction needs to be built on solid understanding of household asset positions and the contexts where assets are used as the basis for identifying livelihood strategies that leads to pathways out of poverty.

Given the importance of land in household asset portfolios, agricultural growth and poverty reduction strategies need to take into account the realities of declining farm sizes and inequalities in access to land. The practical implication of declining available cultivated land per agricultural person is that raising labor and crop productivity on small farms under any plausible productivity growth scenarios is necessary, but it will be inadequate to drive rural economic growth in many rural areas of Africa. Most rural households pursue multiple livelihood strategies. Poverty reduction and growth strategies need to recognize the multi-dimensionality of rural livelihoods and the importance of farm-non farm linkages in facilitating rural growth. Policy and interventions that support farming as well as diversification into higher return off-farm and non-farm activities are likely to have relatively high payoffs than those that focus only on crop productivity growth. Policy priority therefore needs to be given to providing an enabling rural environment for commercial activities such as institutional innovations that support competitiveness of household producers, lower level of formal and informal taxes, and increased investment in public goods such as agricultural research, extension, and infrastructure.

Diversification into off-farm strategies can lock households into poverty traps or put them on an accumulation and growth path. Many poor people engage in low-return and high-risk off-farm activities that lock them into poverty traps. In other cases, some households engage in off-farm activities that provide virtuous ladders out of poverty. The growing importance of a diversified set of livelihood activities in household livelihood strategies

points to the need for better understanding of entry barriers into high return activities, risk management strategies, and pathways from poverty that strengthen the growth potential from diversification opportunities.

These findings have highlighted the seldom recognized, yet critical role that livestock play in helping to alleviate poverty through accumulation strategies or serving as safety nets. This suggests that poverty intervention options that fully exploit the opportunities created by livestock assets need to be given serious consideration on the development agenda. In some cases income generation from livestock and livestock activities, for example cattle and milk sales, provide pathways out of poverty in successful diversification strategies. In other cases, livestock activities, such as back yard poultry keeping do not provide growth opportunities but are important safety nets, particularly for the poor. Livestock-mediated pathways out of poverty therefore need to encompass growth options that improve livestock productivity and support participation in markets as well as those that reduce vulnerability to food insecurity by protecting their livestock assets. In many respects, efforts to improve access to, and functioning of, rural livestock and dairy markets would involve a range of appropriate institutional arrangements including collective action, private, and public-private partnerships.

A key overall implication of this study is that successful poverty reduction and agricultural growth strategy in Africa must consciously integrate current trends of declining farm sizes, inequality in land distribution, and diversification into livestock and other higher-return activities. Future strategies that strengthen these linkages will be crucial in designing and implementing strategies that help rural communities work their way out of poverty and achieve the poverty and hunger targets that the development community aspires to.

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Appendix A: Income-based Poverty Measure

The following are results from the descriptive and econometric analysis using the income-based measurement of relative poverty. These tables are occasionally referenced throughout the main body of the paper.

There are three major sources of income that need to be extracted from the data and then added together before the rest of the analysis can take place. These sources are crop income, livestock income, and non-farm income. Crop income is the value of production of all crops observed in all three surveys less the fertilizer and land preparation costs. Notice that production retained for consumption is included in this measurement, since this too is a valuable return on investments. Of course there are other production costs not accounted for (such as seed cost), but some can't be accounted for because they are not available throughout the data pool. Livestock income is measured as the value of livestock sold, plus the value of livestock products produced (such as milk), minus money spent on veterinary services, salaried workers, and animal feed. Unfortunately, the cost of livestock purchases cannot be included, since it was not asked in 1997. Finally, non-farm income is a sum of salaries, remittances, pensions, and money earned in the informal sector throughout the year.

Once aggregated, these figures are similarly inflated to values in 2004 Ksh, divided by the households total FTAE, converted to a ratio of that figure to the 1997 median figure, and ranked into terciles to observe household level poverty mobility relative to the sample population. This, of course, is the same method as described in more detail above. The results of this analysis can be seen in Table A1 and Figure A1.

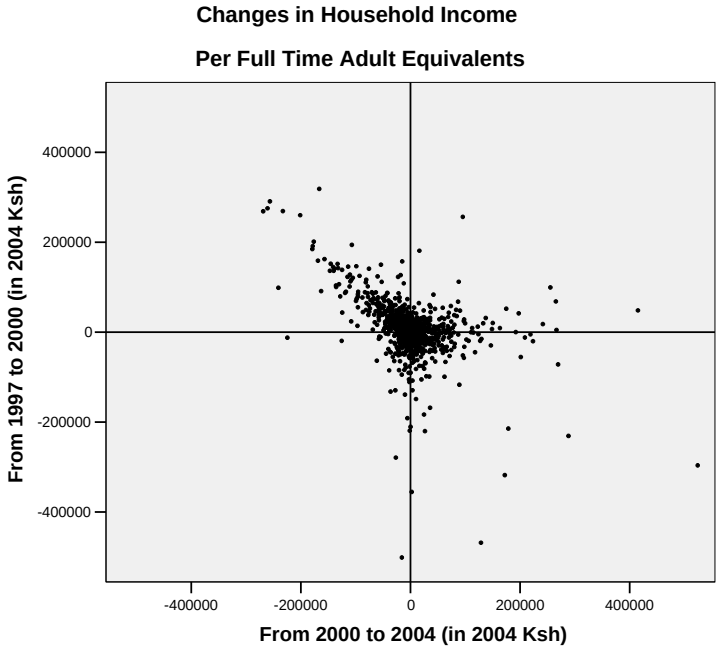
We now examine income-based measures of poverty mobility in the same way we did the asset-based measurement discussed thus far, and assess the robustness of the results. As should be expected, the income measurement of poverty demonstrates much more 'movement' of households between poverty terciles. Notice that only 27.2% of the sample is static throughout the seven year period, compared to the 43.3% when using the asset based measurement of poverty. This seems to confirm the hypothesis that income measurements are less stable and likely to respond more drastically to random shocks. Indeed, evidence of some such shock seems to be apparent in Figure 3. Notice the trend of household falling on or near an imaginary line stretching from the origin to the upper-left hand corner in the first quadrant. Given the scale of the graph, households falling on this line demonstrate an increase in income during the first period (1997 to 2000), and a decrease of the exact same amount during the second period (2000 to 2004). This suggests that many households in the sample experienced some kind of income- increasing shock between 1997 and 2000 and then fell back to 1997 levels in the 2004 season. Upon closer inspection, the relative volatility of the income based measure of welfare is also evident in Table A1. Here we see that 194 households, or 14.7% of the sample, jumped up one or more terciles between 1997 and 2000, only to fall back one or more between 2000 and 2004. That is compared to only 8.7% of the sample having done so according to the more stable asset based measurement of welfare.

Table A1

Dynamic Household Ranking
by Total Value of Household Icome per Full Time Adult Equivalents

	2000								
1997	Bottom 3rd			Middle 3rd			Top 3rd		
Bottom 3rd		2004:			2004:			2004:	
	bottom 3rd :	151	(11.4%)	bottom 3rd :	61	(4.6%)	bottom 3rd :	21	(1.6%)
	middle 3rd :	66	(5.0%)	middle 3rd :	57	(4.3%)	middle 3rd :	14	(1.1%)
	top 3rd :	21	(1.6%)	top 3rd :	25	(1.9%)	top 3rd :	25	(1.9%)
Middle 3rd		2004:			2004:			2004:	
	bottom 3rd :	73	(5.5%)	bottom 3rd :	47	(3.5%)	bottom 3rd :	18	(1.4%)
	middle 3rd :	55	(4.2%)	middle 3rd :	81	(6.1%)	middle 3rd :	43	(3.2%)
	top 3rd :	15	(1.1%)	top 3rd :	46	(3.5%)	top 3rd :	64	(4.8%)
Top 3rd		2004:			2004:			2004:	
	bottom 3rd :	29	(2.2%)	bottom 3rd :	29	(2.2%)	bottom 3rd :	12	(0.9%)
	middle 3rd :	17	(1.3%)	middle 3rd :	44	(3.3%)	middle 3rd :	65	(4.9%)
	top 3rd :	14	(1.1%)	top 3rd :	52	(3.9%)	top 3rd :	179	(13.5%)

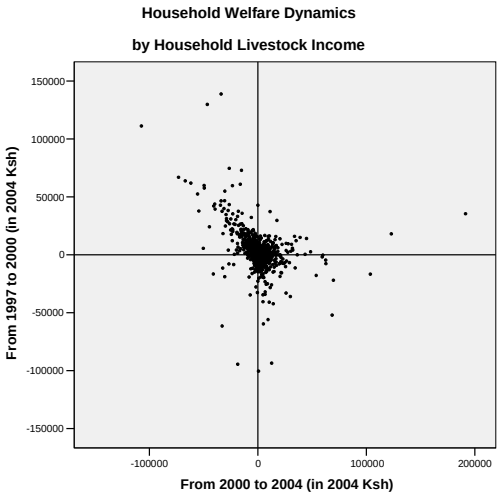
Figure A1

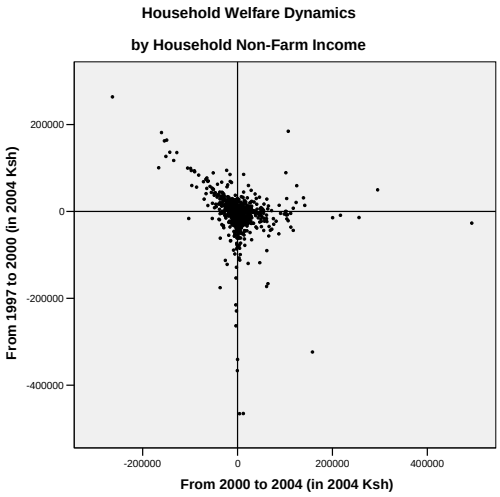


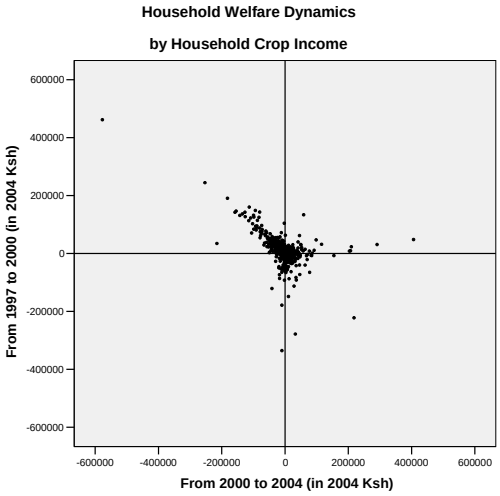
Source: Tegemeo survey data

To investigate this matter further, similar graphs were derived for each of the three income sources separately. These results are shown in Figure A2, where the numbers inside each graph indicate the household identification number assigned to each case during the survey. In each the livestock and non-farm income graphs this trend is slight, if at all apparent by this simple analysis. By stark contrast, however, the crop income graph shows clearly the source for the overall trend discussed above. This realization would seem to indicate that the suspected shock to which our income measurement so drastically responded was simply the weather, specifically rainfall.

Figure A2


Household Welfare Dynamics
by Household Livestock Income
From 1997 to 2000 (in 2004 Ksh)
From 2000 to 2004 (in 2004 Ksh)
150000
100000
50000
0
-50000
-100000
-150000
-100000
0
100000
200000


Household Welfare Dynamics
by Household Non-Farm Income
From 1997 to 2000 (in 2004 Ksh)
From 2000 to 2004 (in 2004 Ksh)
200000
0
-200000
-400000
-200000
0
200000
400000


Household Welfare Dynamics
by Household Crop Income
From 1997 to 2000 (in 2004 Ksh)
From 2000 to 2004 (in 2004 Ksh)
600000
400000
200000
0
-200000
-400000
-600000
-600000
-400000
-200000
0
200000
400000
600000

To further explore this question we conducted some simple regressions that are tantamount to ANOVA's, but provide interesting (albeit unsurprising) results. We analyzed changes in the main season's rainfall and changes in the short season's rainfall data as separate variables. Note that this means the exclusion of certain divisions who don't have a short planting season in the regression analysis.[10] An F-test was used to determine that a linear model would be more appropriate than a quadratic model when using these data.. Initially changes in all income combined was regressed against these variables, then changes in each of three components of that income were regressed separately. Finally, for comparison, the change in asset values is regressed using the same model. Results of these regressions are found in Table A2.

The main findings of these models are in the R^2 values of each. Changes in rainfall alone have been demonstrated to explain 9% of the variation in change in total income for the households included in the analysis, compared to explaining only 1% of the variation in their change in value of assets. Furthermore, it can be seen that this effect on total income, unsurprisingly, is most likely attributed to effects of change in rainfall on changes in crop income. When income was disaggregated into the three categories of crop, off-farm, and livestock incomes, we see that changes in rainfall explains 11% of the variation in crop income, and only 1% of either off-farm or livestock income. This descriptive regression suggests that livestock and off-farm income sources may play an important role in stabilizing household income in response to weather shocks.

Table A2

Household Welfare Measurements (2004 Ksh per FTAE)				
Explanatory Variables	Change in Total Income	Change in Crop Income	Change in Livestock Income	Change in Non-Farm Income
Dmain	40.038**	42.026**	4.303	-6.292*
	(3.03)	(5.19)	(0.52)	(2.03)
Mainpd	-36.217*	-37.613**	-6.382	7.778*
	(2.41)	(4.08)	(0.68)	(2.20)
Dshort	78.429**	53.795**	31.851*	-7.216
	(3.34)	(3.74)	(2.17)	(1.31)
Shortpd	-72.396**	-60.608**	-18.319	6.532
	(2.70)	(3.69)	(1.09)	(1.04)
Period dummy 1997 - 2000=0	-3,909.905	-10,688.716**	9,592.029**	-2,813.218**
	(1.40)	(6.24)	(5.49)	(4.29)
Constant	2,326.919	5,768.885**	-6,115.414**	2,673.448**
	(1.17)	(4.74)	(4.93)	(5.74)
Observations	2082	2082	2082	2082
R-squared	0.01	0.04	0.02	0.01

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

So, our exploration of these pooled data seems to confirm that an asset value based measurement of welfare would be most telling in our research into poverty mobility in Kenya. We've seen that, for several reasons, this measurement may better serve us if it excludes land values. Finally, we've seen indications that this measurement is less likely to be affected by random shocks, such as rainfall. With income based measurements, we've seen that such shocks could cause temporary, and misleading, changes in relative poverty. Nonetheless, to test the robustness of our results, the results of poverty dynamics analysis using land values in measurement of welfare can be found in Table A3. Results from

[10] These divisions are Kinango, Kimilili, Tongaren, Lugari, Kimulot, Cherangani, Saboti, Ainabkoi, and Moiben.

regression analysis using the income-based measures of welfare and the same models as in the main body of the paper can be found in Tables A4 (probit analysis) and A5 (First Differences Analysis).

Table A3.

Dynamic Household Ranking
by Total Value of Household Assest and Land per Full Time Adult Equivalents

	2000								
1997	Bottom 3rd			Middle 3rd			Top 3rd		
Bottom 3rd		2004:			2004:			2004:	
	bottom 3rd :	225	(17.0%)	bottom 3rd	47	(3.6%)	bottom 3rd	8	(0.6%)
	middle 3rd :	73	(5.5%)	middle 3rd	53	(4.0%)	middle 3rd	7	(0.5%)
	top 3rd :	4	(0.3%)	top 3rd :	14	(1.1%)	top 3rd :	7	(0.5%)
Middle 3rd		2004:			2004:			2004:	
	bottom 3rd :	58	(4.4%)	bottom 3rd	62	(4.7%)	bottom 3rd	16	(1.2%)
	middle 3rd :	48	(3.6%)	middle 3rd	120	(9.1%)	middle 3rd	39	(3.0%)
	top 3rd :	7	(0.5%)	top 3rd :	42	(3.2%)	top 3rd :	49	(3.7%)
Top 3rd		2004:			2004:			2004:	
	bottom 3rd :	10	(0.8%)	bottom 3rd	13	(1.0%)	bottom 3rd	1	(0.1%)
	middle 3rd :	11	(0.8%)	middle 3rd	40	(3.0%)	middle 3rd	50	(3.8%)
	top 3rd :	4	(0.3%)	top 3rd :	50	(3.8%)	top 3rd :	262	(19.8%)

Table A4. Household level Income Based Welfare Probability Models (Probit)

	Consistently Non-poor		Consistently Poor	
	Corrected For Attrition	Un-weighted Model	Corrected For Attrition	Un-weighted Model
Sell bulls or cows in 1997=1	0.029**	0.029**	-0.032**	-0.031**
	(3.35)	(3.22)	(3.31)	(3.31)
Sell chickens in 1997=1	-0.004	-0.003	-0.001	-0.000
	(0.45)	(0.31)	(0.06)	(0.04)
Sell goats in 1997=1	-0.006	-0.004	0.015	0.014
	(0.67)	(0.43)	(1.37)	(1.39)
Sell other livestock in 1997=1	0.014	0.014	-0.004	-0.007
	(1.56)	(1.45)	(0.36)	(0.59)
Produce milk in 1997=1	0.029**	0.030**	-0.008	-0.007
	(3.07)	(3.04)	(0.74)	(0.70)
produce eggs in 1997=1	-0.004	-0.004	-0.010	-0.011
	(0.43)	(0.45)	(0.98)	(1.08)
Major land tenure with deed=1	0.023**	0.024**	-0.010	-0.009
	(2.71)	(2.65)	(1.04)	(1.03)
Area Cultivated in 1997 (acres)	0.003**	0.004**	-0.018**	-0.017**
	(3.42)	(3.49)	(5.46)	(5.47)
Male head of household in 2000=1	-0.005	-0.006	-0.024	-0.020
	(0.30)	(0.35)	(1.57)	(1.38)
Age of head of household (years, as of 2000)	0.001**	0.001**	-0.000	-0.000
	(3.42)	(3.32)	(0.93)	(0.96)
Education of the head of household (years, as of 2000)	0.010**	0.010**	-0.005**	-0.005**
	(8.25)	(8.09)	(4.01)	(4.09)
Full time adult equivalents	-0.011**	-0.011**	0.014**	0.014**
	(4.67)	(4.74)	(6.65)	(6.64)
did hh experience a prime age death (15 to 59) between 1997 and 2000	-0.015	-0.016	0.025	0.025
	(0.88)	(0.92)	(1.37)	(1.44)
Distance to a Tarmac Road (10 km)	0.068**	0.072**	-0.0043	-0.0050
	(3.81)	(3.74)	(0.42)	(0.51)
Distance Squared	-0.023**	-0.024**	0.0018	0.0019
	(2.89)	(2.83)	(0.87)	(1.00)
Zone Dummies	Yes	Yes	Yes[a]	Yes[a]
Observations	1320	1320	1320	1320

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Table A5. First Differences Model for Factors Associated with Changes in Income

	Changes in Total Household Income	
	Corrected for Attrition	Un-Weighted Model
Change in area under Cultivation (acres)	4,122.868	4,034.158
	(0.75)	(0.73)
Change in the number of Men age 17-39	21,160.277**	21,532.451**
	(3.19)	(3.23)
Change in the number of Women age 17-39	2,270.426	1,610.830
	(0.31)	(0.22)
Distance to a Tarmac Road (km)	555.280	808.011
	(0.18)	(0.25)
Distance Squared	-695.740*	-639.121*
	(2.51)	(2.50)
Entered Milk Market=1	10,352.722	12,668.950
	(0.44)	(0.52)
Exited Milk Market=1	-747.385	-271.611
	(0.03)	(0.01)
Entered Egg Market=1	-18,445.745	-19,224.993
	(0.82)	(0.85)
Exited Egg Market=1	-60,244.620*	-65,539.071*
	(2.18)	(2.31)
Entered Bull/Cow Market=1	34,038.286	35,331.010
	(1.50)	(1.54)
Exited Bull/Cow Market=1	-39,629.308	-41,798.285
	(0.85)	(0.88)
Entered Chicken Market=1	-8,468.598	-5,414.331
	(0.40)	(0.26)
Exited Chicken Market=1	37,615.106	39,316.461
	(1.34)	(1.36)
Entered Goat/Sheep Market=1	15,632.524	16,113.456
	(0.84)	(0.86)
Exited Goat/Sheep Market=1	-13,676.822	-14,071.006
	(0.60)	(0.60)
dummy for period	-278,505.798**	-282,231.054**
	(11.31)	(11.39)
Constant	149,664.334**	149,947.471**
	(7.45)	(7.43)
Observations	2648	2648
R-squared	0.12	0.13

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Appendix B: Land Use in Rural Kenya

The following is a table developed to investigate the apparent spike in 2000 in land use amongst the households in our sample. Although the spike remains largely unexplained, the randomness of changes in land use seems to indicate that it was genuine, as opposed to being a data problem.

Table B1. Area Farmed (acres) Each Year by Zone and Crop Type

		Agriculture-regional zones								
Crop Types		Coastal Lowlands	Eastern Lowlands	Western Lowlands	Western Tran-sitiona	High Potential Maize	Western Highland	Central Highland	Marginal Rain Shadow	Total by Crop Type
Staples	1997	0.41	0.38	0.49	0.58	3.21	0.21	0.14	0.06	1.12
	2000	0.65	0.64	0.50	0.47	3.58	0.13	0.16	0.13	1.25
	2004	0.37	0.51	0.53	0.46	1.92	0.11	0.35	0.15	0.81
Horticulture	1997	0.25	0.14	0.03	0.21	0.22	0.16	0.26	0.46	0.20
	2000	0.33	0.72	0.07	0.30	0.37	0.21	0.41	0.52	0.36
	2004	0.33	0.68	0.12	0.18	0.26	0.12	0.30	0.32	0.28
Industural Cash Crops	1997	0.00	0.08	0.36	2.03	0.19	0.31	0.54	0.00	0.48
	2000	0.00	0.02	0.33	1.97	0.24	0.15	0.62	0.00	0.47
	2004	0.00	0.01	0.47	1.48	0.19	0.19	0.49	0.00	0.39
Other (non-intercropping)	1997	0.00	0.06	0.03	0.10	0.09	0.11	0.09	0.03	0.08
	2000	0.00	0.33	0.05	0.14	0.07	0.15	0.29	0.03	0.15
	2004	0.19	0.11	0.08	0.07	0.15	0.17	0.20	0.08	0.14
Maize , Legumes and Horticulture Intercropping	1997	1.32	2.03	0.95	1.36	1.91	0.74	0.76	1.43	1.36
	2000	2.41	2.73	1.31	1.70	2.91	1.10	0.76	1.11	1.89
	2004	2.12	2.29	1.34	1.49	2.18	1.02	0.63	1.18	1.57
Maize and Other Intercropping	1997	0.33	0.04	0.23	0.02	0.00	0.05	0.00	0.00	0.06
	2000	0.09	0.05	0.23	0.00	0.00	0.01	0.01	0.00	0.04
	2004	0.12	0.05	0.18	0.00	0.02	0.02	0.01	0.00	0.05
Other (non-maize) Intercropping	1997	0.45	0.33	0.14	0.01	0.34	0.08	0.43	0.00	0.26
	2000	0.77	0.73	0.45	0.50	0.24	0.51	0.31	0.10	0.42
	2004	0.77	0.71	0.48	0.45	0.30	0.39	0.47	0.14	0.45
Total by Zone	1997	2.76	3.05	2.23	4.31	5.95	1.66	2.23	1.98	3.55
	2000	4.26	5.21	2.94	5.08	7.42	2.27	2.56	1.88	4.59
	2004	3.91	4.35	3.20	4.14	5.02	2.02	2.45	1.86	3.68

Appendix C: Income Generating Activity Involvement

The following table lends more weight to observations made in reference to Table 11 in the main body of the paper, but was too cumbersome to report. This was also referenced in a footnote.

Table C1. Share of Households Reporting for HCI by Asset Poverty category and Farm Size (%)

	Asset-Poverty Category															
	Consistently low tercile --Relative Farm Size--			Consistently high tercile --Relative Farm Size--			Upward --Relative Farm Size--			Downward --Relative Farm Size--			Other --Relative Farm Size--			Total Sample
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	
Staple Carbohydrates																
1997	97	98	97	97	94	100	75	92	100	100	100	100	98	99	99	98
2004	98	100	94	100	100	99	100	100	100	100	94	100	100	100	100	99
Horticultural Products																
1997	58	68	77	86	79	70	100	46	62	58	69	89	63	69	63	67
2004	98	100	97	100	100	97	100	92	100	100	100	100	100	99	99	99
Industrial Cash Crops																
1997	23	31	17	24	37	27	25	46	31	33	19	11	37	45	39	35
2004	28	32	20	27	39	25	25	31	46	42	13	0	44	42	33	35
Other Crops 1997	23	27	23	11	7	14	38	31	31	17	31	22	20	17	24	20
2004	51	56	46	73	66	48	88	69	62	58	44	56	70	67	56	61
Dairy 2004	17	29	11	95	94	97	75	85	92	33	44	78	70	72	78	68

Note:Farm sizes are ranked by terciles, according to acres farmed during the 1997 main season, whether land is owned or rented. Small farms are 0 to 1.6 acres, medium farms are 1.6 to 3.2 acres, and large farms are larger than 3.2 acres.
HCI for product i is (value of product i sold / value of product i produced)*100.

Appendix D

Table D1. Crop Enterprises Providing Cash by Asset-Welfare Groups Over Time

	1997		2004	
	Asset Poverty Category			
Crop	Rising (n=34)	Declining (n=37)	Rising (n=34)	Declining (n=37
	Number of Households in Group Generating Cash			
dry maize	9	10	19	15
dry beans	6	6	11	8
Sorghum	1	0	2	1
Millet	1	2	0	3
Bananas	7	9	11	13
coffee mbuni	2	6	3	1
Tea	2	2	2	2
Wheat	2	0	0	2
Cotton	3	0	1	1
industrial sugarcane	4	0	7	1
Cowpeas	2	1	3	1
Fodder	0	1	0	4
french beans	1	6	0	3
irish potatoes	1	2	2	3
Cassava	1	6	3	3
Groundnuts	0	1	4	0
green grams	0	0	2	1
sweet potatoes	2	6	8	5
Tomatoes	3	4	5	7
sukuma wiki	2	2	11	14
Spinach	0	0	1	3
Capsicum	0	0	2	0
Pawpaws	0	0	3	3
Guava	1	0	3	2
Mangoes	1	1	4	1
lemons or oranges	1	0	6	2
Pumpkin	0	0	4	1
Snowpeas	0	0	0	2
Cabbage	1	7	2	6
Onions	1	3	4	7
Avocado	1	8	6	13
Lugard	0	3	1	3
Matomoko	0	0	0	2
Pineapples	1	0	1	0
passion fruit and mero	0	0	2	2
indigenous vegetables	0	0	9	6
chewing sugarcane	2	1	4	4
Total	59	90	149	145

Source: Tegemeo survey data 1997, 2000, 2004.
Note: Coconut, sunflower, rice, arrow roots, carrots, soyabeans, and green peas were omitted from this table. In each case only one household used these crops to generate cash income across all welfare groups and time periods.

In Table D1 we look more carefully at the crop activities from which different mobile welfare groups generate cash income. We first observe the overall increase in cash generating activities throughout these two groups. In 1997 the 34 households identified as rising in wealth over our survey period have only 59 cash generating crop enterprises, compared to 90 such enterprises for the 37 households in the group identified as declining over time. By 2004, we see the number of cash generating crop enterprises for the rising group increase more than 250% to 149, while the declining group's number of enterprises increases only 161% , to 145. Rising households seem to be outpacing the declining group in important crops such as maize, beans, and industrial Sugarcane, as well as several tree fruits.

Table D2 we examine the non-farm activities from which the mobile welfare groups generate cash income. These results, consistent with other findings in the main body of the paper, show informal activities to be of increasing importance to households of declining wealth. Of the 37 households in this group, only 16 participated in such activities in 1997, increasing to 24 households by 2004. Conversely, among the 34 households in the group rising in relative wealth, this number decreases from 19 to 18 over the same period. This decrease in the importance of informal activities for this group is even more evident when looking at wages, where the number of households involved declines from 7 to 2 over the period of increasing wealth.

Table D2. Non-Farm Activities by Welfare Group Over Time

	1997		2004	
	Asset Poverty Category			
Non-Farm Activity Type	Rising (n=34)	Declining (n=37)	Rising (n=34)	Declining (n=37
	Number of Households in Group Generating Cash			
Informal/Agricultural Wages	7	4	2	5
Informal Business	12	12	16	19
Formal Salaried Income	12	13	11	10
Other[a]	15	13	11	14

Source: Tegemeo Survey Data 1997, 2000, 2004
Note: a – "Other" includes remittances, pensions, and dividends.

Appendix E. Maize Market Participation

The role and effectiveness of government price supports in the maize market has long been debated in Kenya. Both sides of the debate have been subject to speculation driven by preconceived notions, which until recently was compounded by a dearth of household level information on how such policies effect various types of farmers. Prior to the late 1990's, conventional wisdom was that the majority of Kenyan farmers wanted and would benefit from higher maize prices. Since then, research has shown the majority of rural farmers in Kenya are fact either only buying maize or they are net buyers. Moreover, the relatively well off households are more likely to benefit from price supports (Jayne et al. 2001).

This paper is uniquely capable of revisiting this issue in the context of welfare dynamics. Table E1 shows the various roles different poverty mobility groups play in Kenya's maize market. In general, we find strong evidence that price supports would not only primarily benefit the relatively non-poor, but would also be detrimental to the consistently poorest households. We see in 1997 that a staggering 80% of the persistently poor are entirely or net buyers of maize and maize meal, an overwhelming share of which are not selling maize at all. This trend continues into 2004 when 71% of the poorest are still buyers of maize. Conversely, 46% of the continuously non-poor are sellers of maize in 1997, the vast majority of which are not buying maize at all. By 2004 we see this share climb to over half of this group of households.

Table E1. changes in position in agricultural markets, by asset poverty category.

	Asset-poverty category					
	Consistently low tercile (n=217)	Consistently high tercile (n=249)	Upward (n=34)	Declining (n=37)	Other (n= 787)	Total sample (n=1324)
Net maize + maize meal sales (kgs / hh)						
- 1997	-398.78	2479.73	-344.29	-106.42	-6.59	385.26
- 2004	-148.80	2398.87	233.19	258.69	270.33	644.32
% of households that are:						
only sellers of maize/meal						
- 1997	5	43	9	14	14	18
- 2004	10	49	24	19	18	23
only buyers of maize/meal						
- 1997	75	26	62	65	58	55
- 2004	64	23	35	51	48	46
net buyers						
- 1997	5	13	9	11	8	8
- 2004	7	16	24	16	16	15
net sellers						
- 1997	6	3	9	3	6	6
- 2004	10	2	9	5	6	6
neither buy nor sell						
- 1997	9	14	12	8	14	13
- 2004	8	10	9	8	11	10

The issue of farmer preferences was also addressed in our 1997 and 2000 surveys. Each of the 1324 households in our sample were asked in 1997 whether they preferred higher or lower maize prices. Then, after a period of reform during which many price controls were relaxed, in 2000 they were asked if they preferred the current system or the old controlled system. Responses to these questions are summarized by asset poverty category in Table E2.

Table E2. Household Preferences Concerning the Maize Market by Asset Poverty Mobility Group

	Whether household prefers higher or lower maize prices (1997)		Preference for current marketing system vs. system during control period (2000)		
	High prices	Lower prices	current system	control system	no change
	---- % of households responding ---		--- % of households responding ---		
Consistently Poor	11	89	60	36	4
Consistently Non-Poor	67	31	68	32	0
Upward	24	77	77	19	3
Declining	30	70	60	40	0
Other	29	71	66	32	2
National Average	33	67	66	32	2

Source: Tegemeo Institute/Egerton University/KARI//MSU Rural Household Survey, 1997, 2000.

As the expected based on the results previously discussed, we see lower prices are preferred by greater part of our national sample in 1997. Unsurprisingly, the only group of households whose majority preference is for higher prices is the consistently non-poor, whom we've shown to be maize sellers. By 2000 we find the bulk of our sample responding in support of the current (uncontrolled) maize market. Astonishingly, we see the strongest support for the uncontrolled system coming from the groups of consistently non-poor and upwardly mobile households.

To summarize, our analysis finds unambiguous support for the notion that controlled maize prices will primarily benefit the relatively well off, if anyone, and burden the relatively poor. Moreover, after the initial period of reform, we find strong support for uncontrolled maize markets among all poverty mobility groups.