Seasonality Revisited

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Climate Variability, Location and Diversification: Livestock assets in consumption smoothing in shock and non-shock seasons in two regions of Kenya

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Climate Variability, Location and Diversification: Livestock Assets in Consumption Smoothing in Shock and Non-shock Seasons in two Regions of Kenya

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Abstract

This study focuses on the coping strategies developed by households in five Kenyan villages, experiencing different climate effects of ENSO in 1998-99, and assesses the consumption smoothing roles played by large and small animals and other strategies through non shock and shock agricultural seasons, using both quantitative analysis and participatory approaches. Our approach builds on past versions of the permanent income hypothesis model that incorporated household characteristics and assets to explain the consumption behavior of households in contexts where incomplete markets exist. Our model incorporates livestock assets as a mechanism to approximate non-monetary savings not captured by the transitory income. The Tropical Livestock Units of large and small ruminants are incorporated to the model to evaluate their impact on consumption by type of liquid asset. Our paper determines whether farm households smooth their consumption in the short term as predicted by the model and we assess whether the model helps to explain consumption smoothing in the different seasons (two seasons of ENSO and three of drought between 1994 and 1999) for the same farm households, and whether ownership of assets (large and small ruminants) play a role as a risk reducing strategy and thus affect the consumption-smoothing behavior of farm households. The vulnerability of communities and individuals was measured through the development of a Food Security Index that measures coping strategies in times of shock. Shock events in the 1990s and coping strategies were identified and ranked by groups in the community. This ranking was used to measure an individual household's food security index. In the process, monetary and non-monetary coping strategies were identified. The use of non-monetary, as well as both short and long-term coping strategies were characteristic of the semi-arid, mixed crop-livestock farming system of Machakos district. The coping strategies and Food Security Index analysis show that both sites at Machakos are more food insecure and hence vulnerable to climatic stress. Proxies to capture non-monetary strategies are proposed.

Key Words: Seasonality, Climate change, permanent income hypothesis model, consumption smoothing, participatory methods

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Introduction

Our study uses the three districts of Machakos, Kilifi and Kwale to assess whether ownership of assets (large and small ruminants) play a role as a risk reducing strategy and thus affect the consumption-smoothing behavior of farm households. Understanding the consumption behavior of households when shock events, such as droughts and floods occur is central to programs focused on rural livelihoods in tropical countries. Findings from several studies have shown varied results. In some cases livestock assets have been instrumental in smoothing consumption (Valdivia 2004), while others have found that asset smoothing may take place, consumption varying in order to protect assets (Zimmerman and Carter, 2003; Kazianga and Udry, 2006). The impact of programs, both in the areas of policy and technology aimed at reducing vulnerability and improving well being, may increase with understanding of the role of the various types of assets, how they are used in shock and non shock periods, in the context of on and off farm diversification. The consumption smoothing strategies of rural households are studied in two regions of Kenya in East Africa, the Coast and Machakos, in five villages, with a model developed as a variant of the permanent income hypothesis model (Sheikh 2000; Deaton, 1995; Morduch, 1995; Valdivia, 2001). The link between consumption and income smoothing, in relation to savings in liquid assets is developed with a data set of changes through the 1990s, a decade of climate variability and ENSO events in the region. Understanding how assets, such as livestock, play a critical role in smoothing consumption in these semi-arid and sub-humid environments has implications in terms of lost future investments in wellbeing. Consumption smoothing strategies and indicators are identified through participatory approaches, which are included as a variable in the analysis.

Research Site

Three regions (districts) of Kilifi and Kwale in the Coastal region and Machakos District in the Eastern region of Kenya form study sites for this paper. Machakos in the Eastern region of Kenya is largely semi-arid with serious water problems, where water is also saline in some cases due to the presence of soluble minerals in the basement rocks. Two Clusters (sites) selected for this study from Machakos fall under the sunflower/maize agro-ecological zone. Kitanga is in a more highland area than Kimutwa and hence higher agricultural potential. Kimutwa has cambisol type of soils that are well-drained red, very friable sandy clay loams. These soils are easily eroded forming deep gullies. The soil types in Kitanga are sandier and have moderate fertility.

Kilifi is composed of four different areas. The first is a narrow belt forming the coastal plain that is 30m above sea level. The second is the foot plateau (60-135 m altitude) sloping towards the sea consisting of grasslands. The third is the coastal range that is 150-420 m high and fourth is the Nyika plateau occupying two thirds of the district and is arid and semi-arid suitable for livestock production. Farm households in the higher potential areas cultivate grow a mixture of crops such as maize, cassava, cowpeas, beans and green grams. These crops are mainly inter-planted with tree crops including cashew nuts, coconuts, mangoes, citrus and bananas). In the drier hinterland, there is more reliance on livestock. Kwale district is composed of the Coastal Plain, the Foot Plateau, Coastal Uplands (medium to high agricultural potential), and the Nyika Plateau (livestock rearing); ranging in altitude from sea level to 842 meters above sea level.

Most of the output from the small farmers is for home consumption although some food is sold out. The resources available to the household including land, labor, and capital are allocated to farm and non-farm activities, where farm production activities include annual crops, perennial (tree) crops, and livestock. Jointness in production and consumption exist for some activities. Non-farm activities include formal employment, provision of casual labor, business, petty trade, remittances, and the informal sector. A participatory methodology is developed to identify consumption smoothing strategies in each region. Table 1 shows a historical perspective of climate related shocks experienced in Kenya in the 1990s.

Table 1: A Historical Perspective of Climatic Shocks Experienced in Kenya in the 1990s

Period	**Type of Shock**	**Effects of Shock**
1991/92	Severe drought	Failure of the rains. The worst affected were the pastoral regions and the semi-arid regions of Eastern and Coast Provinces. There was no pasture or water resulting in large deaths of animals. The pastoralists were food insecure and migrated in search of water and food.
1995	Drought	Failure of short rains
1996	Drought	Failure of long rains, and poor short rains in Eastern province.
1997/98	The El-Niño phenomenon	Devastating floods resulting in crop loses, livestock deaths, damage to infrastructure, high incidences of human diseases resulting in a depletion of the asset base of farm households and a national economic crisis. The El-Niño phenomenon started in the short rains of 1997.
1998	Drought	Poor short rains especially in the marginal agricultural areas (Eastern) resulting in crop failure, water and pasture shortages.
1999	Drought	Failure of long rains.

Source: Kenya Situation Analysis and Needs Assessment Report: October 1999. Interministerial Committee on Drought and Food Security, the Government of Kenya

Approach and Data Sources

The overall approach involves two phases. First we held participatory discussions with selected farmers to develop trend lines of weather/climate events during 1994-1999 and tease out strategies used during shock seasons. Secondly, we used data gathered through a series of surveys. A baseline survey of all 100-farm households was done in late 1993 and early 1994. Information gathered include, household characteristics, farm characteristics (land quantity and ownership), crop and livestock activities, facilities (sources of water, type of housing), and prevalent animal health problems. This was to serve as benchmark information. In 1999, a questionnaire similar to the 1994 base line survey tool was administered to capture information on household characteristics, farm characteristics (land quantity and ownership), crop and livestock activities, facilities (sources of water, type of housing), and off-farm activities. Therefore data for three seasons, the short rains of 1994, the short rains of 1998, and the long rains of 1999 are used for the analysis of consumption smoothing using a variant of the permanent income hypothesis model.

The Sample

At the household level selection, the chief of the location and the local agricultural extension officers drew up a list of all the farm households within the village. The farm households to participate were then randomly selected from this list. Twenty farm households were selected from each cluster of Kilifi, Vuga, HPI, Kitanga and Kimutwa. Therefore, 100 farm households were selected. The Matuga or HPI cluster was formed out of farmers attached to Heifer Project International (HPI). These farmers were waiting to receive heifers from HPI.

Analytical Methods

Table 2 gives a description of the predictor variables constructed from survey data over three seasons.

Table 2: The Means and Standard Deviations of Income, Total Consumption, Permanent Income, and Transitory Income for the Whole Sample, Kilifi, Kwale, Kitanga and Kimutwa, Kenya (1994-1999).

Season/Region	Total Income	Total Consumption	Permanent Income	Transitory Income
Short Rains 1994				
Whole Sample (N=61)	69,720.00 (47,967.97)	20,424.53 (11,565.98)	59,700.22 (33,635.96)	10,019.78 (43,428.30)
Kilifi (n=14)	74,912.05 (54,171.75)	13,357.04 (11,748.25)	60,579.36 (28,412.01)	14,332.69 (43,028.01)
Kwale (n=17)	42,348.79 (29,731.94)	25,399.75 (12,453.93)	70,902.15 (35,718.87)	-28,553.37 (47,030.32)
Kitanga (n=15)	76,371.94 (33,487.91)	20,272.80 (7,906.25)	49,906.31 (33,660.820	27,465.63 (19,583.99)
Kimutwa (n=15)	89,242.87 (60,099.73)	21,534.00 (11,136.83)	56,978.07 (34,958.73)	32,264.80 (27,763.19)
Short Rains 1998				
Whole Sample (N=60)	61,496.58 (51,700.81)	29,887.63 (16,301.27)	57,566.43 (30,327.94)	3,930.15 (38,431.31)
Kilifi (n=15)	55,689.00 (58,024.55)	40.337.41 (15,777.95)	63,193.51 (29,190.56)	-7,504.51 (51,476.55)
Kwale (n=16)	88,802.06 (57,383.13)	27,571.29 (14, 784.34)	67,463.30 (33,615.33)	21,338.76 (44,523.35)
Kitanga (n=14)	33,346.86 (23,053.25)	29,976.14 (17,471.41)	40,857.10 (13,356.66)	-7,510.24 (20,118.48)
Kimutwa (n=15)	64,451.40 (46,758.00)	21,826.00 (12,669.61)	56,978.07 (34,958.73)	7,473.33 (21,070.75)
Long Rains 1999				
Whole Sample (N=61)	64,678.28 (56,973.14)	29,858.00 (16,166.51)	58,845.14 (31,675.70)	5,833.14 (40,918.19)
Kilifi (n=15)	55,689.00 (58,024.55)	40,337.41 (15,777.95)	63,193.51 (29,190.56)	-7,505.51 (51,476.55)
Kwale (n=17)	98,612.53 (68,725.48)	27,601.21 (14,315.40)	71,452.57 (36,467.90)	27,159.96 (49,340.67)
Kitanga (n=14)	33,346.86 (23,053.25)	29,976.14 (17,471.41)	40,877.57 (13,376.14)	-7,530.72 (20,098.38)
Kimutwa (n=14)	64,451.40 (46,758.00)	21,826.00 (12,669.61)	56,978.07 (34,958.73)	7,473.33 (21,070.75)

Note: Standard Deviations in Parenthesis. Source: Survey Data, 1994, 1998 and 1999

Observed income is divided into two different components of permanent income (YPERM) and transitory income (YTRANS) (Friedman, 1957). Permanent income is constructed as the mean income over all years/seasons (1994, 1998, and 1999). Transitory income is the deviation of the average income of all seasons (permanent income) from this season's income. That is,

$Y = Y^P + Y^T$ And $Y^P = Y_{1994} + Y_{1998} + Y_{1999} \big/ 3$

Where Y = Observed income this season; Y^P = Permanent income; and Y^T = Transitory income.

The variant of the permanent income hypothesis model we tested first was whether farm households do save part of transitory income suggesting consumption smoothing relative to income. Second, we assessed the role played by livestock (cattle and goats) in consumption and income smoothing strategies of farm households. The data is analyzed on a per season basis for the three seasons of the short rains of 1994, the short rains of 1998, and the long rains of 1999.

The income smoothing and consumption smoothing mechanisms were related through the permanent income hypothesis, and the following model is estimated:

$TOTALCON = f\left(YPERM, YTRANS, TLUCATLE, TLUGOATS, R1, R2, R3\right)$; where $TOTALCON =$ Total Consumption; $YPERM =$ Permanent Income; $YTRANS =$ Transitory Income; $TLUCATLE =$ Cattle in Tropical Livestock Units (TLUs); $TLUGOATS =$ Goats in Tropical Livestock Units (TLUs); $R1 =$ Dummy for Kilifi Cluster (District); $R2 =$ Dummy for Kitanga Cluster; and $R3 =$ Dummy for Kimutwa Cluster

In the strict permanent income hypothesis, the requirement is that the coefficient for YPERM =1 and that of YTRANS =0. When the model is estimated and the results show that the coefficient for YPERM =1 is > than that of YTRANS then this would imply that a greater part of *YTRANS is saved, and households are acting to smooth their consumption relative to income* (Deaton, 1994). Assumptions need to be made as to how permanent and transitory incomes are computed, especially in developing country contexts. This is because of measurement errors because income is computed from various sources (own production, and off-farm income). In this case measurement error and transitory income may be difficult to tell apart (ibid). To counter this problem various forms of the permanent income model have been used [Musgrave (1978 and 1979), Bhalla (1979 and 1980), and Wolpin (1982), Paxson (1992); in Deaton, 1994]. These models have utilized instrumental variables (IVs) such as assets and education (Musgove), lagged income and averages of income over previous years (Wolpin, 1982), and as long run average rainfall (Bhalla, 1979 and Paxson, 1992). Deaton (1994) notes difficulties with these models such as the choice of IVs, and the difficulty to distinguish transitory from measurement error (as noted above), but also points out that the use of panel data reduces this measurement error.

Empirical Results

Table 3 shows parameter estimates, the results of the estimated permanent income hypothesis model and consumption smoothing patterns of farm households for the data of the short rains of 1994, short rains of 1998, and long rains of 1999. For each year, the model was run with permanent income, transitory income, and Tropical Livestock Units (TLUs) of cattle and goats as explanatory variables for consumption. Livestock, disaggregated into large and small ruminants, was included as explanatory variables because these assets may be used for consumption in rural settings where the economies may not be so monetized, and credit markets not well developed.

Empirical Results for the Short Rains of 1994

The estimated results for the models in the short rains of 1994 show that the coefficients of permanent income are positive as expected for the whole sample, and for Kilifi, Kwale, and Kitanga. This coefficient was not significant for Kimutwa contrary to expectations. These results imply that farm households do consume out of their permanent income. All the coefficients for permanent income are significant at conventional levels (0.001 and 0.05). This implies that permanent income has a positive and significant impact on consumption.

The coefficient on transitory income was hypothesized to be less than that of permanent income as formulated in the permanent hypothesis model. The coefficients on transitory income are of the expected sign and significant at the acceptable levels of 0.001 and 0.05 for Kitanga, Kwale, Kimutwa and the whole sample. A one-Shilling rise in transitory income led to a 0.32, 0.31, 0.07, 0.07 increase in consumption for Kitanga, Kwale, the whole sample, and Kimutwa respectively. The same coefficient was not significant for Kilifi. According to Friedman's Permanent Income Model, the coefficient for permanent income should be one. According to literature from the developing world (Deaton, 1995) this coefficient was found to be positive and close to 0.5 or above. This shows that farmers in the two regions (Coast and Machakos) of Kenya do smooth their consumption in the short term. The coefficient of transitory income should be zero or close to zero in the strict permanent income model, but not the case with other wealth models such as those used by Townsend (1994), Carroll (1997), Paxson (1992) and Deaton (1997). Since the coefficient on permanent income is greater than that for transitory income, this confirms that farm households in the whole sample, those in Kwale, and those in Kilifi are acting to smooth their consumption using monetized permanent income. In Kilifi, transitory income did not have an impact on consumption.

In the case of farm households in Machakos, the coefficient on transitory income is greater than that on permanent income. The possibility is that farm households in Machakos were using non-monetary assets (livestock in this case) to smooth their consumption in the short rains of 1994. It was hypothesized that livestock would have a positive and significant effect on consumption during a shock year. It is hypothesized that small ruminants will be used more for consumption. Therefore the term on small ruminants is expected to be greater than that on large ruminants. The results show that the coefficient for large ruminants for Kimutwa was 2,918.24 and was significant at conventional levels implying that a one TLU increase in large ruminants was expected to lead to a rise in consumption of Kenya Shillings 2,918.24. The results also show that farm households in Kwale may have been using small ruminants to smooth their consumption. The coefficient on small ruminants for this group of farmers was Kenya Shillings 13,133.46 and significant, meaning that a one TLU increase in small ruminants led to a Kenya Shillings 13,33.46 increases in consumption.

Relating these results to weather shocks, there were no severe stresses (droughts and floods) in all the clusters except Kimutwa during the short rains of 1994. Farm households in Kimutwa reported severe weather shocks and had the highest intensity of food insecurity. It is to be noted that this was the only cluster using large ruminants as a consumption smoothing strategy during the short rains of 1994. Dummy variables were included to capture regional differences. The signs for the dummy variables related to the different regions show that they were negative for Kilifi, Kitanga, and Kimutwa but positive for Kwale. All coefficients for Kilifi, Kwale, Kitanga, and Kimutwa were significant at the conventional levels. The coefficient for

Kwale is captured by the intercept, which also had fixed factors that may not have been explained by the model. This implies that a farm household being in the Kwale cluster had a positive and significant impact on consumption. In other words Kwale farmers smooth their consumption better. The coefficient of Kilifi on the other hand was negative and significant implying that being in Kilifi had a negative impact on consumption smoothing during the short rains of 1994. The differential intercept for Kilifi was Kenya Shillings –14,014.87, that for Kitanga, Kenya Shillings -11,124.46, and that for Kimutwa, Kenya Shillings –12,564.87. The results indicate holding all other factors constant, consumption was lower by Kenya Shillings 5,222.28 for Kilifi, Kenya Shillings 8,112.69 for Kitanga, and Kenya Shillings 6,672.28 for Kimutwa compared to Kwale. Kwale is captured by the intercept term of Kenya Shillings 19,237.15. These results closely tie in with the consumption levels for these clusters during the short rains of 1994. Kwale had the highest average consumption of Kenya Shillings 25,399.75 followed by Kimutwa at Kenya Shillings 21,534.00, followed very closely by Kitanga at Kenya Shillings 20,272.80, and Kilifi had the least at Kenya Shillings 13,357.04. The differential intercepts are all significant which means that regional differences (the agricultural potential as captured by the rainfall pattern and agro-ecological zones, weather shocks, religious and ethnic differences) are an important determinant of the consumption behavior of farm households. Kwale had the higher consumption levels compared to the other regions.

In summary, the 1994 data and subsequent analysis using the permanent income model supports that farm households do consume out of permanent income as well as transitory income, and they hence do smooth their consumption in the short term. Livestock (large and small ruminants) did contribute to consumption and hence were significantly used for consumption smoothing purposes in some of the regions 1994 (both large and small ruminants for the whole sample and small ruminants for Kitanga and Kwale).

Empirical Results for the Short Rains of 1998

The coefficient on permanent income was positive and significant for the whole cluster as well as regional regressions. This again confirms that consumption responds to changes in permanent income. Kitanga had the highest coefficient on permanent income of 0.78 followed by Kilifi (0.20), followed by Kwale (0.12), the whole sample (0.12) and lastly Kimutwa (0.11). The model predicts that levels of consumption are expected to be rise by 0.78, 0.20, 0.12, 0.12, and 0.11 for every one Kenya Shilling rise in permanent income for Kitanga, Kilifi, Kwale, whole sample, and Kimutwa respectively. The coefficients on permanent income are significant at conventional levels for all regressions for the short rains of 1998.

The term on transitory income was negative and significant at conventional levels for Kwale, and positive and significant for Kitanga. The results indicate that the levels of consumption were expected to be lower by 0.09 for Kwale. This implies that farm households in Kwale consumed all their transitory income and were also dissaving. It is to be noted that during the 1990’s there have been recurrent droughts and El Niño floods. There were severe droughts in the short rains of 1991, the long rains of 1992, the short rains of 1995, the long rains of 1996, the short rains of 1998 and the long rains of 1999. The rains had failed in all these seasons. The floods of the El Niño (ENSO) event were experienced during the short rains of 1997 and the long rains of 1998. All these shocks could have resulted in the farm households eroding their assets, transitory income and savings. The results show that the shocks of the short rains of 1998 had this effect in Kwale where the term on transitory income was significantly negative. The effect of the shock on Kitanga was however different. Households were consuming out of their transitory income during this season. Kwale had significantly higher mean transitory income compared to all other clusters during this season.

During the short rains of 1998, farm households were also using livestock for consumption smoothing. In the case of Kwale, both large and small ruminants had an effect on consumption. A one TLU increase in large ruminants was expected to increase consumption by Kenya Shillings 4,392.54, and a one TLU increase in small ruminants increased consumption by Kenya Shillings 10,646.73. Small ruminants contributed more to consumption, and hence consumption smoothing when compared to large ruminants in Kwale during the short rains of 1998. In Kilifi, small ruminants were used for consumption smoothing. A one TLU rise in small ruminants led to Kenya Shillings 18,941.44 increase in consumption. This increment (Shillings 18,941.44) is greater than in Kwale (Shillings 10,646.73), implying that small ruminants contribute more to consumption in Kilifi compared to Kwale. The dummy variables included to capture regional differences show that Kilifi had significantly higher levels of consumption by Kenya Shillings 11,478.06 compared to Kwale

In conclusion, the comparisons from the short rains of 1998 indicate that households in Kilifi and Kitanga were affected by weather related shocks, whereas those in Kwale and Kimutwa did not. The effect of the absence of shock during the short rains of 1998 in Kwale has been the dis-saving on the transitory income as indicated by the negative and significant coefficient on the term on transitory income. The term on livestock assets (both large and small ruminants) were positive and significant, reflecting the role of livestock assets in consumption smoothing. The clusters that were affected by shocks during this season (Kilifi and Kitanga) behaved differently with respect to consumption smoothing. Small ruminants played a role in consumption smoothing in Kilifi as reflected by the positive and significant coefficient of small ruminants. In Kitanga however, transitory income played a role in consumption smoothing as shown by the positive and significant coefficient on transitory income.

Empirical Results for the Long Rains of 1999

All coefficients on permanent income are positive and significant and in all the regressions, the coefficient for permanent income is greater than that for transitory income as expected. Kitanga had the highest significant coefficient on permanent income of 0.87; Kilifi was next with 0.22, and Kwale followed with 0.10. The results once more confirm that farm households in all the clusters do consume out of their permanent income as expected, but the coefficients on permanent income for the last two clusters are low compared to that of Kitanga.

The coefficient on transitory income was negative in all clusters and the whole sample except for Kitanga. These results show that consumption levels were expected to decline by 0.19 for Kwale, 0.09 each for Kimutwa and the whole sample, and 0.03 for Kilifi. All farm households except those in Kitanga not only consumed their transitory incomes but also were dis-saving during the long rains of 1999. During the long rains of 1999 all the clusters were affected by weather shocks. Large ruminants contributed to consumption for Kwale whereas small ruminants played a role in Kilifi. Therefore livestock assets did contribute to consumption smoothing for the coast clusters during the shock season of the long rains of 1999. In Kimutwa, only large ruminants affected consumption.

Kwale, Kimutwa and Kilifi were all using large ruminants as a consumption smoothing strategy. A one TLU increase in large ruminants was expected to lead to Shillings 5,290.53, 4,126.63, and 1,019.70 increases in consumption for Kwale, Kimutwa, and Kilifi farm households respectively. Kitanga however, had a different pattern. A one TLU rise in large ruminants was expected to lead to a Kenya Shillings 3,435.44 decline in consumption. The coast clusters of Kilifi and Kwale used small ruminants for consumption smoothing during the long rains of 1999, with Kilifi registering the higher level of a Shillings 14,658.17 compared to Shillings 5,491.99 for Kwale. Small ruminants were not used for consumption, and hence consumption smoothing, by the Machakos clusters during the long rains of 1999. It could be possible that Machakos farmers being more affected by weather variability and noting the 1990s had persistent and severe stress periods, is using other (non-agricultural and non-monetary) consumption smoothing strategies. The analysis showed that the Machakos clusters do use more non-monetary coping strategies during stress periods compared to the Coast clusters that use more monetary strategies. The Machakos clusters are the only ones using long-term coping strategies as they are harder hit by weather related shocks compared to the coast sites.

Seasonal Comparisons

Comparing all the three seasons of the short rains of 1994, the short rains of 1998, and the long rains of 1999, permanent income has behaved as expected being positive and greater than transitory income except in two cases. The regression for Kitanga during the short rains of 1994 where the coefficient on transitory income was greater than that for permanent income; and the regression for Kimutwa during the same season where the coefficient for permanent income was negative but not significant. The regressions in general have shown very good predictive power. The coefficient for transitory income was positive (except for Kilifi) for all regressions in the short rains of 1994. These results suggest that farm households do consume out of their transitory income, which is less than out of permanent income as expected. The results also show that, as indicated by Friedman (1957) and Deaton (1997), rural households have low marginal propensities to consume out of their permanent income.

During the short rains of 1994, all clusters experienced no shocks but Kimutwa had experienced a shock the prior season (Long rains of 1994). Kwale and Kitanga farm households used small ruminants as a consumption smoothing strategy during the short rains of 1994. In the short rains of 1998, small ruminants as a strategy to smooth consumption became more important. During this period, Kwale continued to use small ruminants for consumption but Kitanga was dissaving from this strategy, implying it had used up this strategy. During the long rains of 1999, the coast clusters of Kilifi and Kwale were the only ones using small ruminants for consumption. The short rain of 1994 was a shock season for only Kimutwa. With respect to large ruminants, only Kimutwa was using them for consumption in the short rains of 1994. During the short rains of 1998, both Kimutwa and Kwale used large ruminants for consumption. During the long rains of 1999, all clusters except Kitanga were using large ruminants for consumption. In the case of Kitanga, except for the short rains of 1994, livestock have not contributed significantly to consumption in both the short rains of 1998 and the long rains of 1999. In Kimutwa large ruminants rather than small ruminants have played a significant role in consumption and hence consumption smoothing in all the three seasons on which this study is based. Kilifi however, has moved from a state of not using livestock for consumption during the short rains of 1994, to the use of small ruminants in the short rains of 1998 and to the use of both large and small ruminants in the long rains of 1999. Kwale has moved from the use of small ruminants during the short rains of 1994, to the use of both large and small ruminants in the short rains of 1998 and the long rains of 1999.

The results show that Kilifi has shifted to small ruminants for consumption smoothing as indicated by the significance of the coefficient on small ruminants in the short rains of 1998 and the long rains of 1999. The results also indicate that large ruminants have gained importance in consumption smoothing in Kwale as reflected by the positive and significant coefficient on large ruminants for the short rains of 1998 and the long rains of 1999. Large ruminants played an important role in consumption smoothing in Kimutwa during the short rains of 1994. The permanent income model does not explain consumption behavior in Kimutwa during the next two seasons of 1998 and 1999. The Machakos clusters rely on non-monetary coping strategies that are not captured by the permanent income model.

Table 3: Summary Results of the Cross-sectional Permanent Income Model Estimates for the Short Rains of 1994 and 1998, and Long rains of 1999

SEASON/REGION	INTERCEPT	PERMANENT INCOME	TRANSITORY INCOME	LARGE RUMINANTS	SMALL RUMINANTS	KILIFI	KITANGA	KIMUTWA	R2
Short Rains 1994									
Whole Sample (N=61)	1,9237.15 (4.88)***	0.09 (2.17)**	0.07 (2.01)**	1,467.65 (1.95)**	4,158.57 (1.02)	-14,014.87 (-3.67)***	-11,124.46 (-2.76)**	-12,564.87 (-2.82)**	0.412
Kilifi (n=14)	-7,227.91 (-1.35)	0.37 (3.99)**	-0.07 (-1.47)	-241.50 (-0.11)	-1,219.73 (-0.22)				0.773
Kwale (n=17)	5,686.70 (0.81)	0.33 (3.43)**	0.31 (4.21)***	106.05 (0.06)	13,133.46 (2.058)**				0.686
Kitanga (n=15)	17.77 (0.004)	0.16(3.50)**	0.32 (3.53)**	-1,362.08 (-0.96)	12,657.17 (2.32)**				0.712
Kimutwa (n=15)	10,592.04 (2.83)**	-0.03 (-0.28)	0.07 (0.56)	2,918.24 (2.97)**	-1,404.89 (-0.12)				0.737
Short Rains 1998									
Whole Sample (N=60)	15,413.73 (2.90)**	0.12 (1.78)*	-0.06 (-1.33)	1,108.36 (1.29)	7,766.96 (1.96)*	11,478.06 (2.33)**	2,502 (0.47)	-7,188.73 (-1.33)	0.429
Kilifi (n=15)	18,154.14 (2.42)	0.20 (1.62)*	-0.04 (-0.57)	-1,534.60 (-0.99)	18,941.44 (2.62)**				0.654
Kwale (n=16)	10,821.85 (2.51)**	0.12 (2.04)**	-0.09 (-2.05)**	4,392.54 (4.55)***	10,646.73 (3.21)**				0.860
Kitanga (n=14)	14,963.06 (1.06)	0.78 (2.21)**	0.58 (2.26)**	-2,629.36 (-0.74)	-11,594.10 (-1.14)				0.477
Kimutwa (n=15)	11,725.20 (1.86)*	0.11 (0.82)	-0.22 (-1.27)	1,576.89 (1.04)	-721.23 (-0.6)				0.353
Long Rains 1999									
Whole Sample (N=61)	16339.37 (3.03)***	0.14 (2.10)**	-0.09 (-1.88)*	1,640.78 (1.84)*	3,985.36 (1.17)	11,167.59 (2.25)**	1,252.03 (0.23)	-9,064.96 (-1.69)*	0.405
Kilifi (n=15)	18,548.48 (2.09)**	0.22 (1.50)*	-0.03 (-0.48)	1,019.70 (0.72)	14,658.17 (1.63)*				0.547
Kwale (n=17)	16,607.26 (3.01)**	0.10 (1.49)*	-0.19 (-3.75)**	5,290.53 (2.86)**	5,491.99 (1.36)				0.662
Kitanga (n=14)	9,486.09 (0.68)	0.87 (2.26)**	0.50 (1.98)*	-3,435.44 (-1.14)	-5,419.62 (-0.76)				0.437
Kimutwa (n=15)	7,703.00 (1.39)	0.09 (0.88)	-0.09 (-0.59)	4,126.63 (2.61)**	-11,330.53 (-1.18)				0.569

* Significant at 10 Percent ** Significant at 5 Percent *** Significant at 1 Percent

Discussion and Conclusions

Farm households smooth their consumption as predicted by the variants of permanent income model for rural populations, indicating that the proportionality hypothesis does not hold. Consumption smoothing takes place in most cases, as the coefficients on the permanent income are larger than transitory income. Livestock assets were significant in explaining consumption behavior in Kwale, Kilifi, and Kitanga. Small ruminants in Kwale and Kimutwa were significant in non-shock years, while Kilifi was significant during shock years.

No studies have previously been done in Kenya and very few in most developing countries to assess the consumption behavior of farm families. The limitations of such studies have been the unavailability of time series data however short this may be. The consumption behavior of rural farm families was formally tested using a variant of the permanent income hypothesis model showing the importance of livestock in consumption smoothing.

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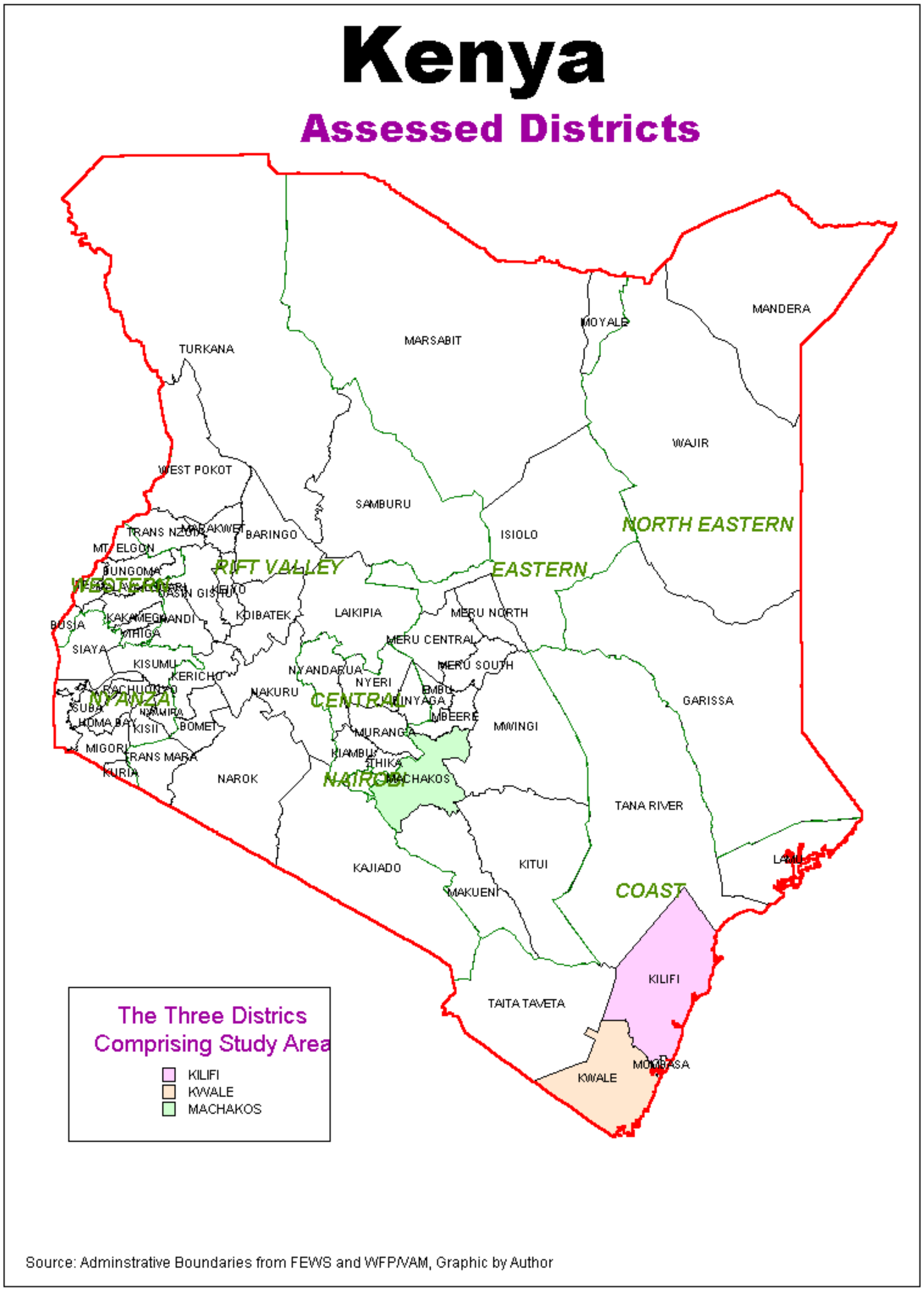
Kenya
Assessed Districts
TURKANA
MARSABIT
MOYALE
MANDERA
WAJIR
WEST POKOT
SAMBURU
ISIOLO
NORTH EASTERN
TRANS NZOIA
BARINGO
MT. ELGON
BUNGOMA
RIFT VALLEY
EASTERN
KOIBATEK
LAIKIPIA
MERU NORTH
BUSIA
SIAYA
MERU CENTRAL
KISUMU
MERU SOUTH
KERICHO
NYANDARUA
NAKURU
NYERI
EMBU
NYANZA
CENTRAL
GARISSA
MBEERE
KISII
BOMET
MWINGI
MURANGA
MIGORI
KIAMBU
THIKA
KURIA
NAROK
TANA RIVER
KAJIADO
KITUI
MAKUENI
COAST
KILIFI
TAITA TAVETA
MOMBASA
KWALE
The Three Districs
Comprising Study Area
KILIFI
KWALE
MACHAKOS
Source: Adminstrative Boundaries from FEWS and WFP/VAM, Graphic by Author