Tanzanian Economic Review, Vol. 8 Nos. 1 & 2, 2018: 20–37

Determinants of Consumption Dynamics in Kagera Region in Tanzania, 1991–2010

Innocent Muganyizi Pantaleo*

Abstract

This paper examines the dynamics of consumption in Kagera Region during 1991-2010 period using the Kagera Health and Demographic Survey panel data. It examines the dynamics of household's consumption by employing the fixed effects model and dynamic panel data estimators. The dynamic panel data estimators show that the Life Cycle Hypothesis for consumption smoothing does not hold. Additionally, the results for rural Kagera households and for the whole region show that households recover from shocks, which implies that the consumption path is stable. Thus, pro-poor farming approaches and earmarking resources for consumption stabilization interventions are needed.

1. Introduction

The paper examines the determinants of the dynamics of households' consumption in Kagera region. Understanding the dynamics of consumption provides a framework for examining the transition of households into, or out of poverty. In practice, poverty has been modelled as a binary dependent variable. However, according to Datt and Jollife (2005), this approach tends to suppress information about a household's standard of living above the poverty line. As such, all non-poor households are treated alike as though the data were censored. As a means to analysing poverty, this paper has attempted to examine consumption dynamics, whereby the non-poor households have not been censored.

In this paper, the estimation process of the consumption dynamics derives from the theories of consumption smoothing. These theories assume that when income is affected by transitory shocks, for example, agents' consumption should not change since they can use savings or borrowing to adjust. This implies that the anticipated changes in income will not affect consumption as households are smoothing consumption. However, as argued in the extensions of these theories, and in a world of uncertainty and imperfect credit market, consumption may not be smoothed as theoretically anticipated. In less developed countries, including Tanzania (and for that matter in Kagera Region), households—especially the poor ones—have borrowing constraints due to the lack of bankable collaterals. Hence, in the presence of any shock, even a transitory one, consumption may be negatively affected. Such shocks include, for example, those that afflicted Kagera Region at the end of the 1970s.

* Lecturer, Department of Economics, University of Dar es Salaam: innopanta@yahoo.co.uk

For many years, Kagera Region was vulnerable to internal and external shocks. These include the Kagera War, the high rate of HIV/AIDS spread, the fall in major cash crop prices, the loss of land fertility and different kinds of diseases that affect both cash and food crops. Recently, on the 11th September, 2016, the region was struck by an earthquake of the magnitude of 5.7 on a Richter scale, which left thousands of people homeless, hundreds of people injured or dead, and soil in many areas eroded. The capacity of the households touched by these shocks to smoothen their income and consumption have, in the long-run, been negatively affected (see Beegle et al., 2008; De Weerdt, 2010).

Furthermore, the implications of not insuring consumption against shocks and risks has been examined at length. In particular, empirical studies have dwelt variously with examining the following aspects: whether subsistence economies smoothen consumption (Bhargava & Ravallion, 1993; Fafchamps et al., 1998; Kazianga & Udry, 2006); whether imperfections in the credit market cause consumption instability (Morduch, 1994; 1995); whether consumption of wealthy and poor households grow differently, and if so why (Ogaki & Atkeson, 1997); how transitory shocks affect welfare (Dercon & Krishnan, 2000; Dercon, 2004; Asfaw & von Braun, 2004); whether agricultural households engages in wage labour as a way to smoothen consumption when they face shocks to agricultural income (Davis, 2015). Other writers have examined the conditions needed for initial distribution of wealth and income to affect future income distributions (Jappelli & Pistaferri, 2000).

As for Kagera, a number of studies have assessed the dynamics of consumption, including the effect of shocks by triangulation of regression results and using life history approaches (De Weerdt, 2010); by testing the consumption smoothing hypothesis using risk analysis and different shapes of utility functions that consider issues of insurance (Obara, 2009); by using panel Ordinary Least Square (Beegle et al., 2008); by life-history approaches (Dercon et al., 2006); and by IV regression (De Weerdt & Dercon, 2006). This paper adds a new dimension to the corpus of literature on consumption in Kagera Region by investigating the nature of consumption fluctuations within the theoretical framework of the consumption smoothing Life-Cycle Hypothesis (LCH) and/or the Permanent Income Hypothesis (PIH). It focuses on multiple shocks that manifest through earning processes and accumulation of assets. The test of the life-cycle hypothesis is geared at finding out whether people tend to change their consumption patterns or to retain them when faced with constraints, or whether they conform to the theoretical underpinnings since changing their consumption patterns may lead to drawing down their reserves. The findings are essential for poverty analysis as they highlight the importance of capital accumulation for consumption smoothing, hence poverty reduction. In addition, for proper assessment of the life cycle hypothesis, one requires a panel data covering a period long enough to observe fluctuation in expenditure. Despite the fact that most of the works cited above on Kagera used panel data, none used the 2010 Kagera Health and Development Survey (KHDS) wave. This paper takes the advantage of using this wave of data to capture the longevity needed to observe fluctuation in expenditure.

The rest of the paper provides theoretical and methodological issues underlying the estimation of the consumption dynamics, presents and analyses the results from the estimation of models, and lastly concludes the paper.

2. Consumption Dynamics: Theoretical, Empirical and Methodological Issues

The dynamics of wealth and poverty are explained by a combination of factors, risk being among them (Hoogeveen et al., 2005). For an analysis of dynamic poverty, it is imperative to understand how people or households protect themselves from both income and consumption risks. In the literature, risk issues are linked to poverty status and poverty dynamics in the context of households' decisions to smooth income, consumption or in taking risks. These decisions are based on consumption and human capital models. Hence, they do not only refer to the level of current income or consumption, but to the likelihood of experiencing highly stressful declines in income and consumption levels.

The estimation process in this paper derives from consumption theories: theories on how households decide on how much of their income to consume today *vis á vis* how much to save for the future. The consumption theories provide frameworks for inter-temporal choice, which relate to the dynamics of poverty. Moreover, their propositions theoretically tend to give some clues on the conclusions that may emerge from the study. The studies explaining these theories were independently put forward in the 1950s by Modigliani and Brumberg (1954; 1980) and Friedman (1957). In their explanations, the authors assume rational expectations and demonstrate the applicability of their results using Irving Fisher's model of consumer choice, which provides a framework for analysing how rational, forward-looking consumers make inter-temporal choices (Dornbusch & Fischer, 1990). Fisher's model shows the constraints consumers face, the preferences they have, and how these constraints and preferences together determine choices about consumption and savings. These decisions relate to peoples' and households' characteristics. In this regard, this paper hypothesizes that certain types of households have characteristics that make them more vulnerable and more likely than others to fall into poverty, or to stay in poverty for a long period of time.

In trying to solve the consumption puzzle, Franco Modigliani and Richard Brumberg developed the life-cycle hypothesis in the 1950s, which posits that individuals plan their consumption and saving behaviour over their life-cycle by choosing to maintain stable life styles. Thus, according to the life cycle hypothesis, because people want to smooth consumption over their lives, the young who are working save, while the old who are retired dissave.[1]

Contrary to the life-cycle hypothesis, which emphasizes that income follows a regular pattern over a person's lifetime, Milton Friedman (1957) proposed the permanent

[1]The life-cycle is challenged by the fact that sometimes the elderly do not dissave but may save for precautionary saving or for the aim of accumulating bequest for their children (Shimeles, 2005).

income hypothesis, which emphasizes that people experience random and temporary changes in their income from year to year. This hypothesis explains robustly experienced income patterns, particularly in developing countries, such as Tanzania. It views current income as the sum of permanent income and transitory income. Permanent income is an income that is expected to persist, for example, income based on one's education. Transitory income is an income that is not expected to persist, for example, agricultural income from a bumper harvest. The consumption smoothing process as explained in both the life-cycle hypothesis and permanent income hypotheses relates to peoples' decisions on how to use their assets and labour income, and when to save or dissave.

These theories provide a framework to explain issues related to poverty changes over time within households. That is, whether they are rooted in human capital or physical capital. Finally, these theories have benefitted this paper with respect to understanding what structures, processes and livelihood strategies can affect households over time as they work to get out of poverty.

The life-cycle and permanent income hypotheses have been estimated empirically in many ways, especially depending on the functional form of the underlying utility function. Hall (1978) was the first to test these theories with the assumption of a quadratic utility function with a 'Bliss Point', and a constant rate of discount and interest rates.[2] This assumption provides an estimable equation of the following form (Shimeles, 2005).

$$c_{t+1} = \beta_0 + \gamma c_t + \varepsilon_{t+1} \qquad (1)$$

where c is consumption at time t.

A parsimonious model of consumption growth, i.e., $\gamma = 1$, obtains if the rate of time preference and interest rate are assumed to be equal, such that there is no bliss point. This means that current consumption has a unit root with respect to lagged consumption. Hence, consumption growth is a random walk, except for its trend.[3]

If equation (1) is true, its variant imply that utility is time-separable and additive. In this case households over life time are assumed to be fully insured from income risk, hence income is free from transitory changes in income, i.e., independent of past, current or predictable changes in income.

Empirically, the life-cycle or permanent income hypothesis can be tested if equation (1) is augmented with current disposable income and other wealth variables, x_{kit}'s, as in equation (2):

---

[2]The utility function used by Hall (1978) is $u(C_t) = -\frac{1}{2}(\bar{c} - c_t)^2$, where the constant $c$is considered as a 'Bliss Point' and the intercept term is composed of the constant terms of the Euler Equation. This utility function assumes that households are risk neutral in the Arrow-Pratt sense of measuring risk aversion.

[3]The model can be interpreted as the equality between the marginal rate of substitution between future and current consumption with the marginal rate of transformation.

$$c_{it+1} = \beta_0 + \gamma c_{it} + \sum_{k=1}^{k} \beta_k x_{kit} + \varepsilon_{it} \qquad (2)$$

where β_k are coefficients of the asset variables; and the subscripts refer, respectively, to individual household i, time t, and $k$asset holdings.

The implication of equation (2) in the context of less developing countries has been investigated empirically in various settings (Deaton, 1992; Ravallion & Chaudri, 1997; Jacob & Skoufia, 1998; Skoufias & Quisumbing, 2003; Shimeles, 2005).

Deaton (1992) examines the extent to which households in Ivory Coast save and dissave as a consumption smoothing process. He tests the permanent income hypothesis in a situation of absent credit markets. The situation and nature of farming in Ivory Coast resembled that of Kagera in that a farmer may a prior predict the future income by looking at the current trend of harvest and prices. He consistently found that savings predicts falls in income; hence those who save in one year are likely to experience a fall in income in the next year. He concludes that farmers plan ahead.

Ravallion and Chaudri (1997) examine whether there are consumption insurances among households in India. They find that there is no clear evidence of village level sharing of income risk. Jacob and Skoufia (1998) tests the theories of consumption behaviour, especially to rural agricultural households in India. They examined how the households responds to anticipated and unanticipated seasonal income fluctuations and found no evidence against the assumptions that income fluctuations are smoothed by households.

Skoufias and Quisumbing (2003) synthesize studies done in Bangladesh, Ethiopia, Mali, Mexico and Russia, and find that although food consumption is easily insured than non-food consumption, poor households find it difficult to insure their income in situation where initial wealth is required as collateral. In Ethiopia, Shimeles (2005) finds that current consumption is correlated with household assets and past consumption. Also, he finds that in the long-term consumption dynamics are non-linear.

If either or both the life-cycle or permanent income hypothesis are valid, then consumption equals permanent income. In terms of the evolution of the distribution of income (consumption), and also the persistence of poverty, changes in past income, wealth and other important indicators of wellbeing do not matter (Ogaki et al. 2004). According to Hall (1978), the life-cycle hypothesis may not hold for least-developed countries (LDCs). He argues if consumption is correlated with past income and wealth, including consumption, this could be due to either a consumer facing a liquidity constraint or the variables used are proxies for permanent income. Additional reasons for the failure of the life cycle hypothesis in LDCs include precautionary saving and habit persistence (Shimeles, 2005).

The estimation of equation (2) raises a number of econometric issues, especially because the dependent variables can also be explanatory variables. The first issue raises the problem of correlation between lagged consumption and the random term, that is, $cov(c_{it}, u_{it}) \neq 0$. For panel data, the error term ε_{it} in equation (2) has to take into consideration the unobserved time invariant individual effects, and individual invariant time effects, i.e., $\varepsilon_{it} = \alpha_i + \lambda_i + u_{it}$. Moreover, there can also be simultaneity between consumption and income determinants. Finally, the measurement error, especially when lags are considered, could have a systematic effect across households.

Thus, in a panel setting, equation (2) is modified as:

$$c_{it+1} = \beta_0 + \gamma c_{it} + \sum_{kit}^{k} \beta_k x_{kit} + \alpha_i + \lambda_i + u_{it} \qquad (3)$$

Equation (3) can be estimated as random or fixed effects. Using the fixed effects variant, especially for non-linear panel data models, generates inconsistent estimates due to the 'incidental' parameter problem.[4] On the other hand, treating the effects as random may result in the endogeneity problem of the explanatory variables.

The presence of a lagged independent variable raises the issue of initial condition, if maximum likelihood estimation has to be used (Bond, 2002). The available options to consistently estimate equation (3) are to use either the Instrumental Variable Method (IVM) or Generalised Method of Moment (GMM). However, the GMM involves the loss of at least two period observations during differencing to find instruments, whereas the IVM loses only one observation, with mainly lagged values of the explanatory variable as well as dependent variable as instruments.[5] To test the LCH/PIH, this study focuses on the GMM results because the data satisfied the $T \geq 4$ criterion.

In estimating the determinants of consumption, we follow Datt and Jollife's (2005) approach, in which the log of consumption is derived as a linear function of a set of household and community characteristics that are thought to determine income and expenditure. Borrowing further from Shimeles (2005), a flexible functional

[4]The incidental parameter appears in one finite dimensional probability law, thereby involving one finite number of observations and in consequence, rendering the corresponding maximum likelihood estimator inconsistent. In the context of panel data, the incidental parameter problem typically arises from the presence of individual-specific parameters. These may relate to individual consumer, firm, or country fixed intercept (or mean) effects. They may also involve incidental trends that are specific to each individual in the sample. The challenges presented by incidental parameters are particularly acute in dynamic panels where behavioural effects over time are being measured in conjunction with individual effects. If these are estimated with maximum likelihood estimation, leads to inconsistent estimates of the parameters that govern the dynamics.

[5] If we difference Equation 4.3 without the unobserved time-varying effects as follows: $c_{it+1} - c_{it} = \gamma(c_{it} - c_{it-1}) + \sum_{k=1}^{k} \beta_k (x_{ikt} - x_{ikt-1}) + u_{it} - u_{it-1}$ with OLS to the equation we get inconsistent estimates of γ and β_s since Δu_{it} and $u_{it-1}$are correlated. A two-stage least square (2SLS) with instrumental variables can solve this but it works for panels with large N and small T (see Hsiao, 2004). However, 2SLS becomes asymptotically inefficient with $T \geq 4$. For our case as the model becomes overidentified as the number of orthogonality conditions and instruments increase with T (Bond, 2002).

form is specified. This functional form controls for the interaction effects of closely correlated determinants of consumption or expenditure, as well as for the scale effects of some variables—e.g., household size and land—which are relevant for rural settings. The specification is thus written as follows:

$$ln\, c_{it} = \alpha + \sum_{k}^{K} \beta_k x_{kit} + \sum_{i} \sum_{k} \gamma_k x_{kit} x_{jit} + u_i + \varepsilon_{it} \qquad (4)$$

It is assumed that

$$E(u_{it}) = 0, E(u_i^2) = \sigma_u^2;$$
$$E(\varepsilon_{it}) = 0,$$
$$E(\varepsilon_{it}^2) = \sigma_\varepsilon^2$$
$$cov(x_{kit}, \varepsilon_{it}) = 0, \;\; cov(x_{kit}, u_i) \neq 0 \text{ for some } k$$

Equation (4) is a linear function of k exogenous variables (x_{kit}), plus a non-linear component (the third term) that captures curvatures as well as interaction among households and community characteristics that are correlated with consumption or expenditure. The variables were classified in the following categories of indicators: demographic, wealth, social networks and coping mechanisms, shocks, occupations and location, and proximity to regional markets. Equation (4) can be consistently estimated using either the fixed effects or random effects models. The Hausman Test was used to find out whether to use the fixed or random effect estimation method. The test compares an estimator, say θ_1, known to be consistent (in this case, the fixed effects) with another estimator, say θ_2, which is assumed to be efficient (in this case, the random effects). If the assumption is true, then both estimators are consistent, which implies that there are no systematic differences between the two estimators, thereby confidently confirming the random effect model.

3. Data

This paper uses the Kagera Health and Development Survey (KHDS) data set, a dataset rich with data related to long-run wealth, health and other socio-economic correlates. With 2004 re-contact rate of 93 percent of the baseline households, and 2010 re-contact rate of 92 percent of the households, this makes the dataset appropriate since the attrition rates are better to comparable panel datasets. To take care of attrition, in this paper we compiled a balanced panel data set of households and individuals who could be traced in all the waves. The associated data sets on distance and rainfall are used to further our analysis. The dataset has six waves but only four waves -- namely Wave 1, 3, 5 and 6 are selected for use in the analysis. The first four waves were collected between 1991 and 1994, and the fifth wave (wave 5) was collected in 2004 and the last one was done in 2010. The selection of the waves was arbitrary on account of the technical and financial burden, and ensuring that the most current information was reflected in our analysis, without missing the first wave (baseline) information.

The details of the data set are provided in World Bank (2004) and De Weerdt et al., (2010). KHDS sampling procedure involved two stages, starting from selection of sample where 550 primary sampling units (PSUs) were classified according to eight strata defined over four agronomic zones with enumeration areas of households drawn randomly from the PSUs with a probability of selection proportional to the size of the PSU. The household were selected using stratified random sampling with oversampling to households that were expected to experience an adult death. The paper uses the consumption aggregates as compiled by the KHDS team, and measured as per capita consumption.

4. Estimation Results and Discussion of Consumption Dynamics

The paper has analysed consumption dynamics and its determinants using fixed effects models. A test of the LCH/PIH as a measure of consumption persistence is analysed using two of the Arellano-Bond dynamic panel data estimators (Arellano & Bond, 1991), namely difference GMM, and system GMM (Arellano & Bover, 1995). Table 1 provides the definition of variables used in this paper, their scale, and descriptive statistics.

Table 1: Variable description and descriptive statistics

Variable Name	Variable Label	Value Label	Mean (Standard Deviation-Overall)*
headage	Age of household head	Years	51.5 (17.2)
headage2	Age of household head squared	Number	2945.5 (1850.3)
hsize	Household size	Number	5.8 (3.2)
grd	Head's highest grade of schooling	Number/ years	4.3 (3.4)
lrddist_rw	Log of road distance to Rwanda border	Number	5.66 (0.64)
lrddist_ug	Log of road dist. to Uganda border	Number	4.65 (0.91)
hsex	Head's sex	1=Male 0=Female	0.7 (0.5)
bldown	Owning building	1=Yes 0=No	0.9 (0.3)
coffee	Main crop coffee	1=Yes 0=No	0.3 (0.44)
cotton	Main crop cotton	1=Yes 0=No	0.003 (0.05)
cbanana	Main crop banana	1=Yes 0=No	0.3 (0.5)
fmmigrate	Household member migrated	1=Yes 0=No	0.5 (0.5)
hmjoclerical	Household member job clerical	1=Yes 0=No	0.003 (0.1)
hmjoconstr	Household member job construction	1=Yes 0=No	0.02 (0.14)
hmjofarm	Household member job farming	1=Yes 0=No	0.6 (0.5)
hmjofishing	Household member job fishing	1=Yes 0=No	0.01 (0.1)
hmjomerchant	Household member job merchant	1=Yes 0=No	0.04 (0.2)
shambano	Number of plots owned by household	Number	3.6 (2.5)
hhdied	Household head died	1=Yes 0=No	0.04 (0.20)
lrainfall	Log of rainfall	Number (mm)	7.1 (0.13)

Variable Name	Variable Label	Value Label	Mean (Standard Deviation-Overall)*
shamsize	Total size of plots owned by household	Number (Acres)	5.4 (6.6)
sizeland	Interaction of household size and plot size	Number	38.4 (67.2)
sizeed	Interaction of household size and head's education grade	Number	26.2 (27.2)
fremitance	Household member receive remittance	1=Yes 0=No	0.57 (0.50)
L1conspc	Lagged value of consumption	Number	
aduwork	Total household member above 14 years and below 65 years	Number	2.7 (1.7)

Note: *Reported is the Overall Standard Deviation (S.D), the Within and Between S.D is not reported

To estimate the determinants of consumption, two approaches, namely the fixed effects or random effects models, were tested to establish their appropriateness. To establish whether the random effects model is appropriate (i.e., testing for the exogeneity of the regressors), the Hausman's (1978) specification test was used to find out whether the fixed effects and random effects models are distinct, both in rural and in all Kagera households.

Table A1 presents the results of the tests. The χ^2 test in both settings was highly significant, implying that the assumption of an efficient and consistent random effects model could not be confirmed. The study did not invoke the Hausman-Taylor (H-T) (1981)[6] approach, which takes care of the time-invariant variables. The approach was not invoked due to the longevity of the panel and the used unit of analysis -- i.e., the household -- which nullifies the existence of the expected time invariant variables, such as sex, education and location. The longevity of these variables allows changes in household heads' characteristics, leading to change in most of them.

Based on these results and as said before, the paper discusses the results with respect to the fixed effects model. The estimated coefficients of determinants of consumption per-capita for Kagera Region households are given in Table 2.

The results in Table 2 show that consumption dynamics in Kagera Region are influenced by the following factors. For rural households, the results show that all demographic indicators are statistically significant, with some having a positive influence, while others have a negative one on the consumption pattern.

[6]Using H-T means we need to classify the explanatory variables into those that are purely exogenous with respect to any unobserved individual specific characteristics (called $x_2$and z_2). Each group includes both time varying ($x_1$and x_2) and individual specific time invariant ($z_1$and z_2) characteristics. Thus Equation 18 can be written as: $ln\, c_{it} = x_{1it}\beta_1 + x_{2it}\beta_2 + z_{1i}\delta_1 + z_{2i}\delta_2 + u_i + \varepsilon_{it}$.

This equation is then estimated as the fixed effects regression to obtain consistent estimates of $\beta_1$and β_2 and using these to obtain the within residuals for each household and thereafter regressing the within residual on $z_1$and z_2 using $x_1$and x_2 as instruments to obtain $\delta_1$and δ_2.

Table 2: Determinants of Consumption Dynamics for Kagera Region Households, Fixed Effects (FE) Estimation

	Kagera Rural Households		All Kagera Households	
	Coefficients	*Standard Errors*	*Coefficients*	*Standard Errors*
Demographics				
aduwork	0.0514	0.0110***	0.0485	0.0097***
headage	0.016	0.0048***	0.0138	0.0041***
headage2	-0.0001	0.0000**	-0.0001	0.0000**
hsize	-0.0787	0.0086***	-0.0771	0.0075***
grd	0.0217	0.0097*	0.0315	0.0081***
hsex	0.1478	0.0406***	0.1536	0.0356***
Wealth indicators				
bldown	-0.2462	0.0547***	-0.119	0.0449**
coffee	0.0505	0.0294	0.0431	0.0267
cotton	-0.2126	0.1994	-0.1965	0.1983
cbanana	0.0813	0.0266**	0.0733	0.0239**
shambano	-0.0321	0.0065***	-0.0331	0.0059***
shamsize	-0.0072	0.0049	-0.007	0.0044
sizeland	0.0018	0.0005***	-0.0035	0.0011**
sized	-0.0035	0.0013**	0.0018	0.0005***
Social Networks and Coping mechanism				
fmmigrate	0.0583	0.0234*	0.0723	0.0210***
Shocks				
lrainfall	-0.2603	0.0841**	-0.2476	0.0808**
Occupations				
hmjofarm	-0.1269	0.0281***	-0.1709	0.0254***
hmjofishing	0.09	0.1159	0.0563	0.1091
hmjomerchant	-0.0064	0.0755	-0.0701	0.0614
hmjoclerical			-0.4158	0.1988*
hmjoconstr			0.1789	0.0848*
Location and proximity to regional markets				
lrddist_rw	0.1324	0.4235	0.0041	0.3098
lrddist_ug	1.4211	0.6609*	0.639	0.4284
_cons	7.2387	4.7305	11.5499	2.8874***
N	2650		3257	
Ll	-1399.3***		-1730.4***	

Note(i) Standard errors in third and fifth column; (ii) Refer to Table 1 for variable labels

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' computations.

Indicators found to have a positive influence include number of people within a household who are in the working age group; age and sex of the head of household; and highest school grade by head of household. On the other hand, the household head's age was found to exert a significant negative quadratic effect, implying that the more a household head continues to age, the more his/her negative effect on consumption pattern within a household. The same negative effect applies to household size. These results are similar to what Shimeles (2005) finds for rural Ethiopia; and those of Datt and Joliffe (2005) for Egypt.

As for wealth indicators, the results with respect to size of the farm, growing coffee and growing cotton are not statistically significant, implying that these factors had no influence on consumption over time. These results reflect the situation during the studied period, since cotton and coffee growing was highly affected by the fall in their prices to the extent that some households opted to concentrate on other crops or to uproot these crops altogether. As a result, the significance of these crops in the region took a nosedive as per Narayan (2009: 195-196):

> *Some of communities in Kagera region, Tanzania, have given up coffee farming entirely. The fall in the price of coffee was dramatic over the five years between 1995 and 2000, as much as 90 percent in some communities. In Nyakahura in Kagera, women said they no longer plan for their income… …actually, they have even uprooted a good number of coffee plants.*

Moreover, there has been land fertility concerns in the region, as well crops being attacked by several types of pests and diseases. These factors have negatively affected farm size, thereby negatively influencing household consumption patterns, except for farms with large tracts of arable land. Furthermore, the results show that migration has a positive statistically significant effect on consumption. These results share commonality with those of De Weerdt (2010) and Beegle et al. (2011). Other statistically significant determinants of consumption include rainfall and being a farmer.

For all Kagera Region households (Table 2), all demographic indicators are statistically significant, with a negative sign on the coefficients on the square of the age of head of household and household size. Additionally, undertaking clerical, farming and construction job activities by some members within households were statistically significant.

The life-cycle hypothesis for Kagera Rural and all Kagera Region households was tested. The variables used in testing the life-cycle hypothesis as proxies for human capital included age of the household head, household size, and highest grade reached by any household member. These variables were chosen because they have a bearing on the way households engage in the production process. The proxies for physical capital or the wealth variables for all households included the number of households' farm plots, owning a house, and size of the households' farm plots. As explained before, future income or smoothing capacity may be affected by shocks. Thus, the death of a household head was used as a proxy for shock, and the receiving of remittances was used as a proxy for households' coping mechanism, especially in cases where financial markets are not perfect and there are credit constraints, as was the case with Kagera Region.

The GMM (Arellano & Bond, 1991) was used since there is a lag of the dependent variable. Arellano and Bond (ibid) argue that the Anderson-Hsiao estimator, although consistent, fails to take into account all the potential orthogonality conditions, which renders the estimator relatively less efficient. The Arellano-Bond estimator begins by specifying the model as a system of equations, one per period, and allows the instruments applicable to each equation to differ (for instance, in later periods, more lagged values of instruments are available). The instruments include suitable lags of the levels of the endogenous variables, which enter the equation in differenced form, as well as the strictly exogenous regressors and any other that may be specified. Arellano and Bover (1995) and Blundell and Bond (1998) modified the Arellano and Bond estimator to include lagged levels, as well as lagged differences. Thus, the Arellano and Bond estimators are known as difference GMM, and the modified ones as system GMM.

The log of rainfall is used as an instrument for income/consumption shock in both rural and all Kagera Region households. Given the climate of the region, rainfall has a significant role to play in determining income of a household, mainly by influencing the level of output that a household may generate out of its farm(s). Moreover, lagged consumption is used as a proxy for past information on consumption and a household's wealth. The value of a household's farm is used as an instrument of multiple sources of income on the assumption that the value of plots owned by a household may determine how much the owner can borrow[7] to smoothen consumption over time, or even what they can earn if a family decides to sell parts of plots for consumption smoothing. Another instrument for income is whether a family member has been suffering chronic illness, since illness has a bearing on the time household members allocate for productive purposes; thereby decreasing households' income.

The validity of the instruments was tested using the Hansen Test of over-identifying restrictions and that of exogeneity of instruments, including those generated within the GMM approaches, and one- and two-step GMM for rural and all Kagera households. The test concludes that the instruments are valid, and therefore the GMM estimates are consistent.

The results are in Tables 3 and 4. The coefficient on lagged consumption is significant in both rural and all Kagera region households, which indicates that households recover from shocks. These results imply that the consumption path is sometimes stable, even though it takes time to be so. The tests of whether the lagged coefficient is unit was rejected in both rural households, all Kagera Region households, and in all GMM approaches, indicating that the Permanent Income Hypothesis (PIH) failed in this paper, as it did in most of other studies. Hence, for Kagera households, the results imply that persistence of poverty, changes in past income, wealth and other important indicators of wealth matter a lot.

The results on the determinants of consumption persistence in all Kagera Region households is shown on Table 3. Both the one-step and two-step GMM approaches show that all wealth indicators are statistically not significant, which suggests that transitory income shocks, which may sometimes affect consumption, are sometimes not fully insured, hence making households vulnerable to poverty over time.

[7] The farm plot is used as collateral

Table 3: Determinants of Consumption Persistence for all Kagera Region Households

	Difference GMM	System GMM - One Step	System GMM -Two Step
Log of Consumption (Lagged)	-0.3723	0.5358	0.5828
	(0.0273)***	(0.1643)**	(0.2071)**
headage	0.0033	0.0099	0.0103
	(0.0012)**	(0.0075)	(0.0089)
hsize	-0.0555	0.0312	0.0294
	(0.0054)***	(0.0452)	(0.0511)
grd	0.0263	0.0756	0.0856
	(0.0062)***	(0.0319)*	(0.0653)
hsex	0.1250	-0.1065	-0.0109
	(0.0457)**	(0.4003)	(0.4603)
shambano	-0.0485	-0.0003	-0.0033
	(0.0065)***	(0.0496)	(0.0608)
bldown	-0.1330	-1.2878	-1.4266
	(0.0575)*	(0.5788)*	(0.8067)
shamsize	0.0015	-0.0054	0.0009
	(0.0025)	(0.0264)	(0.0354)
hhdied	-0.0369	0.4016	0.7602
	(0.0908)	(0.8861)	(1.1861)
fremitance	-0.0959	-0.8100	-0.8692
	(0.0289)***	(0.2443)***	(0.2817)**
constant	17.7740	6.7103	6.1219
	(0.3574)***	(2.1644)**	(2.4064)*
N	1383	2345	2345

Note: (i) Standard errors in parentheses; (ii) Refer to Table 1 for variable labels
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Authors' computations

However, receiving remittance was statistically significant in all GMM settings, whereas the head's education and owning a house are statistically significant at 10 percent for only the one-step GMM approach. Similar results as those of all Kagera Region households are found by Shimeles (2005) and Asfaw and von Braun (2004) for the category of poor households in Ethiopia, and Deaton (1992) for Ivory Coast.

For rural Kagera households, the household size and sex of head of household is statistically significant in the one-step and two-step GMM approaches (see Table 4). Working as a farmer has a statistically significant negative effect on consumption over time. This negative effect was similarly observed by Higgins (2013), whereby engaging in farming activities results in downward mobility for households in Tanzania.

Table 4: Determinants of Consumption Persistence for Kagera Region Rural Households

	Difference GMM	System GMM-One Step	System GMM-Two Step
Log of Consumption	-0.3839	0.5227	0.5579
(Lagged)	(0.0293)***	(0.1759)**	(0.2349)*
headage	0.0015	0.0049	0.0055
	(0.0013)	(0.0059)	(0.0104)
hsize	-0.0627	-0.0980	-0.0979
	(0.0059)***	(0.0416)*	(0.0478)*
grd	0.0207	0.0771	0.0829
	(0.0069)**	(0.0303)*	(0.0742)
hsex	0.0795	1.0222	1.1038
	(0.0487)	(0.4041)*	(0.5011)*
shambano	-0.0194	0.0090	0.0215
	(0.0077)*	(0.0665)	(0.0765)
hmjofarm	-0.2187	-0.4595	-0.4657
	(0.0312)***	(0.1857)*	(0.2519)
shamsize	0.0024	0.0172	0.0125
	(0.0025)	(0.0329)	(0.0411)
lrainfall	-0.3782	-0.2724	-0.3130
	(0.0946)***	(0.3401)	(0.3746)
constant	20.5658	7.4349	7.1498
	(0.8276)***	(3.9761)	(4.1307)
N	1162	1925	1925

Note: (i) Standard errors in parentheses; (ii) Refer to Table 1 for variable labels
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Source: Authors' computations.

5. Conclusion

The paper has examined consumption dynamics by estimating the fixed effects to establish determinants of consumption. The random effects model was ruled out as inappropriate by the Hausman Test. In addition, the life-cycle hypothesis was tested through analysing consumption persistence. the life-cycle hypothesis was tested using a dynamic panel data approach, which follows the Arellano-Bond Approach (1991), and a two-step GMM and its extensions.

The results with respect to consumption dynamics showed that demographic factors are statistically significant determinants of mean consumption for both Kagera rural households and all households in the region. The PIH was rejected in all partitioning. Additionally, the results for rural Kagera households and of the whole region show that households recover from shocks, which implies that the consumption path is stable.

The implications that emanate from these findings are as follows: (i) migrating from one's original location has a positive effect on final consumption since those migrating manage to have more opportunities such as more land with diversified agriculture in a new location. Thus, the policy response would be to ensure pro-poor farming approaches in their original location; (ii) wealth indicators are not statistically significant determinants of consumption. Hence, they cannot be relied on to cover households from transitory shocks. In this regard, the associated wealth creation systems, such as markets for agricultural produce, need to be vibrant.

References

Arellano, M. & S. Bond. 1991. Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, 58(2): 277–297.

Arellano, M. & O. Bover. 1995. Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1): 29–51.

Asfaw, A & J. Von Braun. 2004. Is Consumption Insured against Illness? Evidence on Vulnerability of Households to Health Shocks in Rural Ethiopia. *Economic Development and Cultural Change*, 53(1): 115–129.

Beegle, K., J. De Weerdt & S. Dercon. 2011. Migration and Economic Mobility in Tanzania: Evidence from a Tracking Survey. *Review of Economics and Statistics*, 93(3): 1010–1033.

Beegle, K., J. De Weerdt & S. Dercon. 2008. Adult Mortality and Consumption Growth in the Age of HIV/AIDS. *Economic Development and Cultural Change*, 56(2): 299–326.

Bhargava, A. & M. Ravallion. 1993. Does Household Consumption Behave as a Martingale? A Test for Rural South India, *Review of Economics and Statistics*, 75: 500–504.

Blundell, R. & S. Bond. 1998. Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*, 87: 115–143.

Bond, S. 2002. Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice. *CEMMAP Working Paper*, WP09/02.

Datt, G. & D. Jolliffe. 2005. Poverty in Egypt: Modelling and Policy Simulations. *Economic Development and Cultural Change*, 53(2): 327–346.

Deaton, A. 1992. Saving and Income Smoothing in Cote d'Ivoire. *Journal of African Economies*, 1(1): 1–24.

De Weerdt, J. 2010. Moving Out of Poverty in Tanzania: Evidence from Kagera. *Journal of Development Economics,* 46(2): 331–349.

De Weerdt, J., K. Beegle, H. B. Lilleør, S. Dercon, K. Hirvonen, M. Kirchberger & S. Krutikov. 2010. Kagera Health and Development Survey 2010: Basic Information Document. *Rockwool Foundation Working Paper Series, Study Paper No .XX.*

De Weerdt, J. & S. Dercon. 2006. Risk-sharing Networks and Insurance Against Illness. *Journal of Development Economics*, 81: 337–356.

Dercon, S. 2004. Growth and Shocks: Evidence From rural Ethiopia. *Journal of Development Economics*, 74: 309–329.

Dercon, S., J. De Weerdt, T. Bold & A. Pankhurst. 2006. Group-based Funeral Insurance in Ethiopia and Tanzania. *World Development*, 34(4): 685–703.

Dercon, S. & P. Krishnan. 2000. Vulnerability, Seasonality and Poverty in Ethiopia. *The Journal of Development Studies*, 36(6): 25–53.

Dornbusch, R. & S. Fischer. 1990. *Macroeconomics.* McGraw-Hill International Edition, Singapore, Fifth Edition.

Fafchamps, M., C. Udry & K. Czukas. 1998. Drought and Saving in West Africa: Are Livestock a Buffer Stock? *Journal of Development Economics*, 55(2): 273–305.

Friedman, M. 1957. The Permanent Income Hypothesis. In M. Friedman (ed.). *A Theory of Consumption Function*, Princeton University Press), pp. 20 – 37.

Hall, R. E. 1978. Source Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence. *Journal of Political Economy*, 86: 971–987.

Hausman, J. A. 1978. Specification Tests in Econometrics. *Econometrica*, 46(6): 1251–1271.

Hausman, J.A. & W.E. Taylor. 1981. Panel Data and Unobservable Individual Effects. *Econometrica*, 49(6): 1377–1398.

Higgins, K. 2013. Escaping Poverty in Tanzania: What Can We Learn from Cases of Success? In F. Kessy, O. Mashindano, A. Shepherd & L. Scott (eds.). *Translating Growth into Poverty Reduction beyond Numbers*. Dar es Salaam: Mkuki na Nyota Publishers.

Hoogeveen, J., E. Tesliuc, R. Vakis, S. Dercon. 2005. *A Guide to the Analysis of Risk, Vulnerability and Vulnerable Groups*, World Bank, Washington D.C.

Jacoby, H. G. & E. Skoufias. 1998. Testing Theories of Consumption Behavior Using Information on Aggregate Shocks: Income Seasonality and Rainfall in Rural India. *American Journal of Agricultural Economics*, 80(1): 1–14.

Jappelli, T. & L. Pistaferri. 2000. The Dynamics of Household Wealth Accumulation in Italy. *Fiscal Studies*, 21(2): 269–295.

Kazianga, H. & C. Udry. 2006. Consumption Smoothing? Livestock, Insurance and Drought in Rural Burkina Faso. *Journal of Development Economics*, 79(2): 413–446.

Modigliani, F. & R. H. Brumberg. 1954. Utility Analysis and the Consumption Function: An Interpretation of Cross-section Data. In K. K. Kurihara (ed.). *Post Keynesian Economics*, New Brunswick, NJ. Rutgers University Press, pp. 388–436.

Modigliani, F. & R. H. Brumberg. 1980. Utility Analysis and Aggregate Consumption Functions: An Attempt at Integration. In A. Abel (ed.). *The Collected Papers of Franco Modigliani: Volume 2, The Life Cycle Hypothesis of Saving*, Cambridge, MA. The MIT Press, pp. 128–197.

Morduch, J. 1995. Income Smoothing and Consumption Smoothing. *The Journal of Economic Perspective,* 9(3): 103–114.

Morduch, J. 1994. Poverty and Vulnerability. *The American Economic Review,* 84(2). Papers and proceedings of the Hundred and Sixth Annual Meeting of the American Economic Association): 221–225

Narayan, D., L. Pritchett & S. Kapoor. 2009. *Moving Out of Poverty: Success from the Bottom Up, 2.* World Bank Publication in collaboration with Palgave and Macmillan.

Obare, S. 2009. Household Consumption Smoothing in Tanzania's Kagera Region. World Bank Working Paper 1507.

Ogaki, M. & A. Atkeson. 1997. Rate of Time Preference, Inter-temporal Elasticity of Substitution and Level of Wealth. *The Review of Economics and Statistics*, 79(4): 564–572.

Ravallion, M. & S. Chaudhuri. 1997. Source Risk and Insurance in Village India: Comment. *Econometrica*, 65(1): 171–184.

Skoufias, E. & A.R. Quisumbing. 2003. Consumption Insurance and Vulnerability to Poverty: A Synthesis of the Evidence from Bangladesh, Ethiopia, Mali, Mexico and Russia. *FCND Discussion Paper No. 155*, August.

Shimeles, A. 2005. Essays on Poverty, Risk and Consumption Dynamics in Ethiopia. PhD thesis in Economics, Gothernburg University, ISBN 91-85169-14-5.

World Bank. 2004. *User's Guide to the Kagera Health and Development Survey Dataset*, Development Research Group, December.

Appendix

Table A1: Hausman Specification Test between Fixed and Random effects for Kagera Region Households

Variable Name	KAGERA RURAL HOUSEHOLDS				ALL KAGERA HOUSEHOLDS			
	Coefficients		Difference	S.E	Coefficients		Difference	S.E
	Fixed Effects (a)	*R'ndom Effects (B)*	*(b-B)*	*Sqrt (diag (V_b -V_B))*	*Fixed Effects (b)*	*R'ndom Effects (B)*	*(b-B)*	*Sqrt (diag (V_b -V_B))*
aduwork	0.0573	0.0647	-0.0134	0.0046	0.0485	0.0658	-0.0173	0.0040
headage	0.0160	0.0174	-0.0014	0.0027	0.0138	0.0159	-0.0021	0.0023
headage2	-0.0001	-0.0001	1.53e-06	0.0000	-0.0001	-0.0001	0.579e-06	0.0002
hsize	-0.0787	-0.0687	-0.0100	0.0046	-0.0771	-0.6978	-0.0074	0.0039
sizeed	-0.0035	-0.0034	-0.0001	0.0075	-0.0035	-0.0031	-0.0004	0.0006
sizeland	0.0018	0.0013	0.0005	0.0026	O.0018	0.0012	0.0006	0.0002
grd	0.0217	0.0446	-0.0229	0.0061	0.0315	0.0466	-0.0151	0.0049
lrddist_rw	0.1324	0.1199	0.0126	0.4225	0.0041	0.1326	-0.1286	0.3086
lrddist_ug	0.4211	-0.0328	1.4539	0.6606	0.6390	-0.0327	0.6717	0.4280
hsex	0.1478	0.0747	0.0731	0.0272	0.1536	0.0640	0.0896	0.0244
bldown	-0.2462	-0.3048	0.0586	0.0297	-0.1190	-0.2105	0.0916	0.0253
coffee	0.0505	-0.1263	0.0075	0.0127	0.0431	0.0289	0.0142	0.0114
cotton	-0.2126	0.0418	-0.0864	0.0945	-0.1965	-0.1190	-0.0775	0.0969
cbanana	0.0813	0.0816	0.0395	0.0114	0.0733	0.0362	0.0371	0.0103
fmmigrate	0.0583	-0.1989	-0.0234	0.0083	0.0723	0.0848	-0.0125	0.0073
hmjoclerical					-0.4159	-0.1948	-0.2210	0.9075
hmjoconstr					0.1789	0.0940	0.0849	0.0424
hmjofarm	-0.1269	0.0617	0.0721	0.0129	-0.1709	-0.2320	0.0611	0.0115
hmjofishing	0.0900	0.1253	0.0284	0.0529	0.5626	0.0183	0.0376	0.0478
hmjomerchant	-0.0064	0.1253	-0.1317	0.0348	-0.0701	0.0557	-0.1258	0.0285
shambano	-0.0321	--0.0297	-0.0024	0.0028	-0.033	-0.0303	-0.0029	0.0025
shamsize	-0.0072	0.0009	-0.0081	0.0025	-0.0070	0.0017	-0.0087	0.0022
lrainfall	-0.2602	-0.3390	0.0787	0.0273	-0.2476	-0.3535	0.1059	0.2484
	$Chi^2(19) = 132.69$				$chi^2(21) = 163.40$			
	$Prob>chi^2 = 0.0000$				$Prob>chi^2 = 0.0000$			