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Preface

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Abstract

This study investigates the rate and determinants of income mobility in Uganda using three waves of the household panel survey data (2009-10, 2010-11 and 2011-12). It employs the Markov transition matrices and probit techniques for the analysis and finds a higher rate of income mobility (60 percent) at the bottom of the income distribution than at the top of the income distribution (43 percent). It also finds that capital stock, whether human or physical, has the most economically significant impact on income mobility. The impact of education is more pronounced at higher levels of educational attainment. For example, having a university degree increases the probability of moving up the income distribution level by 36 percentage points. Conversely, having a university degree reduces the probability of moving down the income distribution level by 21 percentage points. Having highly valued physical assets increases the chances of moving up the distribution ladder by 24 percentage points and reduces the movement down by 18 percentage points. Equally important are the gender of the household head, main source of income and geographical location of the household. Hence, there should be increased investments in education, especially at higher levels and strategies should be designed that are aimed at increasing the viability of land as a factor of production. Additionally, efforts aimed at women's empowerment should also be strengthened.

Keywords: Uganda; income mobility; transition matrix.

JEL Classification codes: D30, D31, I30

1. Introduction

Uganda registered impressive poverty reduction leading to the achievement of the millennium development goal (MDG) 1 of halving poverty from 56 percent in 1992-93 to 24.5 percent in 2009-10, five years ahead of time. Much of this progress was attributed to strong economic growth --an average of 7.4 percent in the study period -- and improved human development indicators particularly in education and health. However, the growth was uneven across the country with some areas, particularly the northern region which experienced insurgency for two decades and the rural areas which predominantly earned low incomes from agricultural activities, lagging behind. For instance, between 2006 and 2013, the share of the poor population remained high in the northern region (47 percent from 39 percent earlier) and the eastern region (37 percent from 29 percent) as compared to the western region (10 percent from 17 percent) and the central the (6 percent from 15 percent) (the World Bank, 2016).

This uneven poverty reduction triggered an increase in income inequality from 0.36 in 1992 to 0.43 in 2009-10 (UoBS, 2010) which is an issue of concern. Income inequality can be tolerated if low-income individuals have a chance of moving up the income distribution ladder (Campos and Melendez, 2014). Therefore, it is useful for countries with high levels of inequality to understand the dynamics of income mobility for policymaking. It is believed that countries with segments of the society excluded from the growth process are more likely to experience low upward income mobility and conversely societies that address exclusion reflect high upward mobility (Cuesta et al., 2007). Individuals in societies that are susceptible to macroeconomic shocks and ineffective social protection schemes may experience high levels of downward mobility (Corbacho et al., 2003; Fields et al., 2007).

An analysis of income mobility is useful because it is a measure of change in the well-being of economic agents over time. As economies grow, agents are bound to experience changes in their welfare, whether transitory or permanent, which may improve (upward movement) or worsen (downward movement) their welfare. However, without longitudinal data it is difficult to know those benefiting (moving up the income distribution levels) or losing (moving down the income distribution levels) from the growth process (Fields et al., 2007). A society that has a higher level of income mobility implies that individuals or households are less constrained socially and economically to take advantage of economic opportunities and therefore agents located at the lower end of the income distribution have an opportunity to move up and thus induce equality of income over time. Therefore, greater mobility is often seen as a measure of equality of opportunity although Jarvis and Jenkins (1998) warn that too much income mobility may signal economic insecurity.

This paper analyzes households' income mobility moving along income distribution over time and the determinants of their movements. It uses a binomial probit model to investigate the factors which influence upward and downward mobility. We hypothesize that households endowed with more human and physical capital are more likely to experience upward income mobility. Similarly, due to geographical disparities in economic development, households located in the urban and central regions are more likely to experience upward income mobility than their counterparts located elsewhere.

This paper addresses the following empirical questions: First, what is the estimated rate of income mobility for a given period in Uganda? In other words, what fraction of

households change their position in the income distribution in a given period? Second, is income mobility higher at the bottom or top of the income distribution? Third, what is the role of human capital in the transition from one level to another? For instance, does education encourage upward mobility? Fourth, what is the role of physical capital in the transition? In other words, does the endowment of assets prevent downward mobility?

The aim of this paper is to provide evidence of the fluidity of income mobility in Uganda and the factors influencing income transitions. The study found a higher rate of income mobility (60 percent) at the bottom with income mobility of 43 percent at the top. It also found that a household's asset endowments, whether human or physical, had the most economically significant impact on income mobility.

The rest of the paper is structured as follows: Section 2 gives a review of literature related to this study and Section 3 gives the data and descriptive statistics. Section 4 describes the methodology used and Section 5 discusses the findings of the study. Section 6 gives a conclusion and provides policy implications on the basis of its findings.

2. Literature review

Income mobility is a dynamic and multifaceted concept which analyzes changes in income for the same economic agents (individuals or households) over time. According to Fields and Zhang (2007) mobility can be viewed either as a time dependent or movement measure of income change. Empirical studies using the time dependent concept assume an influence of past income on income changes (Grootaert, Kanbur and Oh, 1997; Albornoz Facundo and Menendez Marta, 2002; Woolard and Klasen, 2004; Antman and McKenzie, 2007). On the other hand, the movement measure strand of studies considers a change in the rank or position of an agent between two periods (Castro, 2011). Another dimension is an analysis of income mobility within generations (intragenerational) or between generations (intergenerational). Intergenerational income mobility focuses on the influence of parental background on income changes (Björklund and Jäntti, 2000) while intragenerational mobility presupposes the influence of lifetime factors in determining income change (Albornoz and Menendez 2002; Fields et al., 2007; Castro, 2011).

Income mobility has two major dimensions of measurement -- absolute and relative measures. Absolute mobility analyzes the changes in absolute income over time while relative mobility examines the change in an agent's rank along income distribution between two periods. These two measures of mobility have their strengths and weaknesses. For instance, the use of absolute measures or single-stage indices such as Shorrock's rigidity index or Atkinson's index enable a researcher to use all the information inherent in income distribution for doing a comprehensive analysis. However, these measures are sensitive to measurement errors, which is a serious problem when data from two waves is used. Conversely, focusing on relative mobility, in particular using transition matrices, enables a researcher to summarize mobility inherent in income distribution. However, analyzing mobility using transition matrices comes at the cost of losing information on mobility within groups. In this respect, it may be useful to supplement an analysis of the transition matrix with other absolute measures of income mobility (Fields and Ok, 1999).

Literature provides a number of studies on income mobility especially in developed countries with a few in developing countries which are mostly based in Latin America; there are very few studies in sub-Saharan Africa. Most of these studies consider the time dependence dimension of income mobility with studies which consider the movement dimension being limited in number. Both strands of studies investigate the impact of human capital variables (education), physical capital (household assets), individual characteristics of the household head (gender, age, marital status) and geographical location (urban/rural, region) on income changes or change in a household's ranking on its income distribution profile. Studies that investigate the determinants of change in rank along income distribution commonly use the binary probit or logit models (Castro, 2011). However, Scott and Litchfield (1994) used an ordered probit model investigating three states: households that moved to a higher income position, those that stayed in the same position and those that moved to a lower income position.

The transition matrices follow stochastic processes like the Markov chain process where transitions across agents are independent. Notably, the Markovian model of income mobility has limitations that emanate from its two assumptions: stationarity of transitions over time and the probability of moving from one state to another which should be independent of history. Therefore, these results must be interpreted with these caveats. Studies which investigate the movement dimension of income mobility analyze the rate of transition between states and the factors which influence upward or downward mobility. Studies which have analyzed upward and downward mobility find the determinants of the occurrence to be symmetrical. For example, Castro (2011) found in Chile that upward mobility was enhanced by a change from unemployment to employment, higher education, urban residence, being married and female headship but it was inversely influenced by male headship and the number of children. The same factors (apart from gender and marital status) influenced downward mobility except they switched signs. In the case of gender, male headed households were less likely to move either up or down while marital status was only significant for upward movement.

The general observation in literature is that income mobility is higher in developing than in developed countries especially at the bottom of the income distribution. For instance, Scott and Litchfield (1994) cited in Castro (2011) found that half the households at the bottom of the income distribution moved upwards and only 26 percent moved downwards. They note that households that moved upwards did not go far although the extent of upward movement (number of states transited) was normally greater than the extent of downward movement.

Literature on income mobility in developing countries is scarce and is concentrated in Latin America partly because of the availability of longitudinal data and concerns about the high inequality levels amidst targeted social interventions in this region (Woolard and Klasen, 2004; Castro, 2011; Campos and Melendez, 2014). Available studies on Uganda focus on analyzing poverty dynamics rather than income mobility. Mckay (2005), Lawson et al., (2006) and Ssewanyana (2009) examined poverty transitions and factors associated with chronic and transitory poverty using household panel data for 1992-93 and 1999-2000. McKay and Lawson et al. analyzed four forms of poverty transitions: those non-poor in both periods (never poor), poor in 1992-93 but non-poor in 1999-2000 (escaping poverty), non-poor in 1992-93 but poor in 1999-2000 (falling into poverty) and poor in both periods (chronically poor). Mckay (2005) provides a descriptive analysis of income poverty transitions using household consumption per adult as an indicator for

income. His study found significant income mobility (both upward and downward) for the poorest segments of the sample. Further, the results of his study suggest that income changes were unlikely to be permanent with the poorest escaping and falling into poverty reflecting volatility in incomes. Using a multinomial logit model, Lawson et al., (2006) analyzed poverty transitions and found a strong positive association between education and being never poor and a strong correlation between poverty and location of residence.

Ssewanyana and Kasirye (2013) add to the studies that analyze poverty dynamics in Uganda by using more recent data from 2009-10 and 2010-11; they also attempt to analyze income mobility. They provide a detailed descriptive analysis of poverty and inequality changes in the study period and their findings complement earlier studies that found poverty to be more transient than permanent. Consistently, they also find high household income mobility using household consumption as a proxy for income. They analyze income transitions using quintiles and find higher mobility at the bottom of the welfare distribution with more than half the households located in the lowest quintile in 2009-10 moving up the welfare distribution in 2010-11 and 40 percent of the households in the highest quintile in 2009-10 moving down the welfare distribution in 2010-11. The authors did not analyze the determinants of income changes which we attempt in this study.

3. Data and descriptive statistics

The data used in this study comes from the Uganda National Panel Surveys (UNPS) collected by the Uganda Bureau of Statistics (UBoS). The panel surveys were started in 2009-10 and were preceded by a baseline survey in 2005-06. We used three waves of this data: 2009-10, 2010-11 and 2011-12 because these waves are more comparable than the 2005-06 wave and the most recent wave of 2013-14. The 2005-06 data differs from these three waves because of the changes in the variables where some have been dropped and others introduced, while in the 2013-14 data many of the households covered previously were missing. This would hence give a small sample. The 2009-10 wave of data sought to trace 3,123 households covered in the 2005-06 panel data and consequently it covered 2,975 households while 2,716 and 2,850 households were covered in 2010-11 and 2011-12 respectively. The attrition rate for households in the sample is about 10 percent.

We specifically used data from the socioeconomic module of the data collected both at household and individual levels. The module collected data on household income, household demographics, individual characteristics, consumption and shocks experienced by a household. The survey asked respondents to specify the income that they had earned over the past 12 months from different sources such as household enterprises, property, financial assets and transfers.[1] Similarly, households were also asked to specify consumption expenditure for a month.[2] Both the income and consumption expenditure nominal values were converted into real values using the consumer price index (CPI) considering 2009 as the base year. We accounted for household economies of scale by deflating the real income or consumption with adult equivalent scales adopted from Appleton et al., (1999).

[1] Income excludes formal salaries/wages.
[2] The expenditure excludes non-consumption expenditure.

We compiled descriptive statistics for our estimation sample to establish the household characteristics in the constructed quintiles (Table 1). These quintiles were endogenously determined and all households with reported incomes were distributed in the respective quintiles. As expected, the mean income and consumption increased with the quintile. We note that mean household incomes were more dispersed than mean household consumption and observe that for both well-being measures the gap between quintiles was the widest at the top. We also observe that all other variables increased with quintile except the number of children in the household and percentage of female headed households. Therefore, the raw data suggests a positive correlation between schooling, asset endowments, age and residence in an urban area with income status.

Table 1: Sample Means of the Variables used in the Model

Quintile	Annual HH (equalized)	Monthly HH consumption (equalized)	HH years of schooling	HH assets (log values)	Children	HH age	Female headed HH (%)	Urban (%)
First (lowest) Quintile	160,139	25,629	4.7	14.4	4.45	46.65	22.51	6.99
Second Quintile	270,621	36,758	5.5	15.23	4.76	46.02	19.43	8.27
Third Quintile	356,673	47,497	6.3	15.61	4.66	46.13	22.20	11.72
Fourth Quintile	623,037	65,888	7.2	16.16	4.34	47.38	21.64	22.75
Fifth (highest) Quintile	1,700,520	275,300	9.4	17.38	3.85	48.47	22.59	46.19

Source: Authors' computation using 2009-10, 2010-11 and 2011-12 UNPS data.

Notes: Income and consumption reported in Uganda shillings. HH=household.

4. Methodology

Since we use longitudinal data our major interest is measuring the relative or dynamic aspects of income mobility using transition matrices which specify the state occupied at two points in time. The transition matrices measure relative income mobility by first assigning the households into groups which are endogenously determined such as the quintile. Consequently, we also measure the rate of income mobility using the matrix P_{ij} which follows the Markov chain process, where *i* denotes the initial state occupied by a household and *j* represents the final state occupied by the household. The probability of movement between the states is given by the off-diagonal elements of the matrix. If the off-diagonal components increase at the expense of the diagonal elements this signals a high level of mobility. Conversely, if the diagonal elements increase at the expense of the off-diagonal components then it shows a low level of mobility. Transition matrices are useful in analyzing income mobility because they are able to summarize mobility at different positions in income distribution which is difficult to achieve with single-stage measures. Transitions are also more robust to measurement errors (Woolard and Klasen, 2004). However, they too have limitations of disregarding changes within a group (Fields and Ok, 1999).

Given that both measure well-being, while analyzing income mobility a researcher has a choice of using either income or expenditure data. Nonetheless, there are concerns over the use of income rather than expenditure data because the former is less susceptible to measurement errors. Normally, expenditure data is reported with more accuracy because

of lack of stigma attached to expenditure values, a shorter recall period and figures that are fairly constant over time. Further, expenditure reflects the long-term well-being of a household (or its permanent income), since households apply consumption smoothing by using their savings to address erratic shortfalls in income (Deaton, 1997). However, Fields et al., (2003) note that in some instances income data may be more accurately reported than expenditure data. In addition, expenditure data gives limited variations between households because of the lower level of satiation in consumption as compared to income. We use income data because it is the most appropriate way of analyzing income mobility as it enables a researcher to distinguish between demographic and economic events (Woolard and Klasen, 2004). However, we use expenditure data for robustness checks.

An analysis of the dynamic economic well-being of households must take into account household economies of scale. In this respect, scholars have either used income per capita which adjusts for household size (Glewwe and Nguyen, 2002; Fields et al., 2003) or used adult equivalent household income which accounts for household composition based on the calorie intake of household members (Jarvis and Jenkns, 1997; Albornoz and Menendez, 2002; Woolard and Klasen, 2004; Castro, 2011). Another data challenge is an attrition bias where agents that exit from the sample are significantly different from those that remain in the sample and therefore cause biased estimates. Studies that use panel data acknowledge the potential impact of attrition (Albornoz and Menendez, 2002; Ssewanyana and Kasirye, 2013). Albornoz and Menendez (2002) address this by using the inverse probability weight method. We also use the inverse probability weight method to account for an attrition bias.

We follow Castro (2011) and examine the determinants of income mobility using a binomial probit model that analyzes the relative movement of households along the income distribution using quintiles:

$$(1)\quad \Pr(Y_{ij}) = \Phi(\alpha + \beta X_i + \gamma \Delta Z_{ij})$$

where Φ denotes a standard normal cumulative distribution function, *i* indexes the first period and *j* the second period, Y_{ij} is a binary variable where one represents households which changed income quintiles either from the lowest quintile to upper quintiles (upward mobility) or from the highest quintile to lower quintiles (downward mobility) and zero represents households that stayed in the same quintile. The quintiles are computed using predicted real equivalized annual household incomes (we use household consumption expenditure as an identifying variable), X_i denotes a vector of characteristics of a household or individual which do not change over time and are taken at their initial values and Z_{it} represents a vector of household/individual characteristics that change over time; we use mean values in the estimation.

We estimate the probit model using the same individuals differently for upward and downward mobility between two years (2009-10 to 2011-12) and one year (2009-10 to 2010-11). To address measurement errors, we perform robustness checks by estimating model (1) using different samples and using the consumption variable as the dependent variable. We first employ an instrumental variable technique where we regress real equivalized household income on age of the household head, mean of schooling of the household, gender of the household head, geographical location and asset endowments and obtain predicted income values which are used to construct the transition variables for upward and downward income mobility.

In the transition model we analyze the impact of household characteristics such as the age of the household head, education of the household head, marital status of the household head, value of household assets, geographical location and whether a household experienced a shock such as death of the earner or theft of money[3] on the upward or downward movement of the household along income distribution. Upward movement refers to all households occupying the lowest quintile in the initial year moving to an upward quintile in the final year, while downward movement refers to all households occupying the highest quintile in the initial year moving to a lower quintile in the final year.

Because we have an unbalanced sample and observe a difference in sample means in the t-test (results provided in Table A1 in the appendix) for all variables for the households that remain in the sample and those that attrite we account for attrition by using the inverse probability weight method adopted by Baulch and Quisumbing (2011). We first construct an attrition variable *A* where one represents those who exit and zero represents those who remained in the sample for the three waves. In order to construct the inverse probability weight we generate a reverse variable *R* by reversing the attrition variable *A*. Consequently, we obtain predicted probabilities from a non-restricted regression model:

(2) $R_{it} = c_{it}\gamma + a_{it}\delta + v_{it}$

where c_{it} are the control variables affecting only attrition and a_{it} are auxiliary variables that affect both household income and attrition. Subsequently, we compute predicted probabilities from a restricted model that excludes auxiliary variables:

(3) $R_{it} = c_{it}\gamma + \varphi_i$

The inverse probability weight is obtained by the ratio of predicted values of the estimation sample of equations (3) and (4) and is denoted as:

(4) $W_i = \frac{p^r}{p^u}$

where p^r represents predicted values from the restricted model (obtained from equation 2) and p^u represents the predicted values from the unrestricted model (obtained from equation 3). The inverse probability weight is useful because it gives more weight to households with similar characteristics in the initial wave who subsequently attrite than to households with characteristics that make them more likely to remain in the sample.

5. Results and discussion

We first investigate the rate of transition of households between quintiles using the transition matrix P_{ij}, over a two and one year period. In Table 2 we present results for mobility within a period of two years. It can be seen from the table that the rate of income mobility at the bottom is higher than at the top but mobility is the highest in the middle quintiles. This finding is consistent with similar studies (Leibbrandt and Woolard, 2001; Cantó, 2002; Woolard and Klasen, 2004; Khor Niny and Pencavel John, 2006). The results suggest that within a period of two years (2009-11), 60 percent of the households in the lowest quintile in 2009 moved to upper quintiles in 2011 although a majority did

[3] These shocks were selected because they were the most prevalent ones.

not go far (25 percent moved to the second quintile and 15 percent to the third). On the other hand, only 43 percent of the households occupying the highest quintile in 2009 moved to a lower quintile in 2011 with a similar pattern that a majority of them (20 percent) went to a nearby quintile (fourth). As a robustness check, we analyze the rate of transition within a one-year period (2009-10) and find that the results are robust (Table 3). We further conduct a robustness check by analyzing the rate of transition using consumption data and the results are consistent with the observation that mobility is the highest at the bottom of the distribution in the two-year period though as expected households portray lower rates of mobility as shown in Tables A3 and A4 in the appendix.

Table 2: Transition Matrix by Quintile (Percentages), 2009-11

	Quintile 2011					
Quintile 2009	1	2	3	4	5	Total
1	40.23	25.20	15.38	11.91	7.28	100
2	23.84	28.10	23.51	16.28	8.26	100
3	12.74	19.29	26.75	26.06	15.15	100
4	8.99	14.67	22.01	30.65	23.67	100
5	3.67	9.45	9.58	20.08	57.22	100

Source: Authors' computation using 2009-10, 2010-11 and 2011-12 UNPS data.

Table 3: Transition Matrix by Quintile (Percentages), 2009-10

	Quintile 2010					
Quintile 2009	1	2	3	4	5	Total
1	41.56	26.58	14.56	10.55	6.75	100
2	26.58	26.14	22.00	17.65	7.63	100
3	13.04	18.91	27.83	26.96	13.26	100
4	7.41	16.54	22.47	32.59	20.99	100
5	4.49	8.71	9.83	21.07	55.90	100

Source: Authors' computation using 2009-10 and 2010-11 UNPS data.

We first estimate equation (1) for upward and downward mobility without accounting for attrition (unweighted model) but later address attrition (weighted model) and obtain marginal effects as shown in Table 4 which gives the results for upward mobility for the two-year period. We observe that the weighted model performs better than the unweighted model. Overall, we find that our results are robust whether we account for attrition or not but we note that the models are sensitive to the period of investigation where a longer period (two years) performs better than the shorter period (one year). The results for the one-year period are available on request. Consequently, we uphold the results for the weighted model for the two-year period as our main results. See Table A2.

Table 4: Determinants of Upward Income Mobility, 2009-11

Variables	Unweighted		Weighted	
	dy/dx	Robust Str. Err	dy/dx	Robust Str. Err
Primary education	0.123*	0.075	0.165***	0.033
Lower secondary	0.228**	0.110	0.054	0.050
Diploma	0.380***	0.189	0.060	0.131
Degree			0.364***	0.140
Female head	0.054	0.076	0.159***	0.037
Age of head	-0.031**	0.012	-0.010	0.007
Age of head squared	0.000**	0.000	0.000**	0.000
Married head	-0.042	0.082	0.014	0.038
Children	-0.040***	0.011	-0.033***	0.004
Urban	0.178*	0.107	0.256***	0.056
Eastern region	-0.076	0.096	-0.120***	0.044
Northern region	-0.199**	0.091	-0.169***	0.043
Western region	-0.289***	0.091	-0.282***	0.041
Owns land	0.026	0.079	0.092***	0.033
Asset endowment	0.319***	0.048	0.243***	0.017
Farm	0.071	0.055	0.076***	0.025
Non-farm	0.512***	0.102	0.301***	0.045
Observations	2,679		3,460	

Notes: Standard errors are clustered at the household level for the unweighted model. For the weighted model we use survey weights * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The reference group for education is no formal education and for region is central. There were no results for education3 – upper secondary education for both models so it was dropped.

According to empirical literature in our model the influence of the variables on income mobility should be symmetrical between upward and downward mobility. We observe this in our results. We, therefore, discuss the determinants of upward and downward income mobility concurrently (Tables 4 and 5). Overall our results are consistent with existing literature which suggests that upward (downward) income changes are positively (negatively) influenced by human capital, physical capital, being female and location (Grootaert, Kanbur and Oh, 1997; Fields, Gary, Hernandez and Robert Duval, 2007; Castro, 2011). For instance, we find evidence that more educated household heads are more likely (less likely) to move up (move down) the income distribution ladder over time as shown in Tables 4 and 5.

Table 5: Determinants of Downward Income Mobility, 2009-11

Variables	Unweighted		Weighted	
	dy/dx	Robust Str. Err	dy/dx	Robust Str. Err
Primary education	-0.058	0.076	0.039	0.029
Lower secondary	-0.102	0.064	-0.090***	0.023
Upper secondary	-0.121	0.085		
Diploma	-0.150**	0.064	-0.094***	0.025
Degree	-0.207***	0.065		
Female head	-0.009	0.051	-0.065***	0.021
Age of head	0.008	0.006	0.017***	0.003
Age of head squared	-0.000	0.000	-0.000***	0.000
Married head	0.019	0.053	-0.003	0.025
Children	0.012	0.008	0.015***	0.003
Urban	-0.216***	0.031	-0.097***	0.017
Eastern region	0.051	0.051	0.028	0.022
Northern region	0.116*	0.060	0.095***	0.023
Western region	0.042	0.047	0.074***	0.024
Owns land	0.020	0.048	0.009	0.022
Asset endowment	-0.141***	0.022	-0.181***	0.010
Farm	-0.089*	0.048	0.030	0.023
Non-farm	-0.189***	0.045	-0.170***	0.022
Ill hh head	0.065	0.074	-0.078**	0.035
Theft of money			-0.105**	0.045
Observations	2,607		3,759	

Notes: Standard errors are clustered at the household level for the unweighted model. For the weighted model we use survey weights * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The reference group for education is no formal education and for region is central.

Overall, the results of the unweighted and weighted models are robust though the weighted model tends to perform better with more significant variables and a higher level of precision. With reference to education, we find that the probability of upward (downward) mobility increases (decreases) with the level of education which is consistent with existing literature (Castrol, 2011). We note that the models for upward income mobility capture the effects of higher levels of education (for example, a degree) contrary to the downward income mobility models which perform better with lower levels of education. These results suggest that education has a strong effect on income mobility and cushions households against downward income mobility. For instance, in Table 5 (weighted model), if the household head possesses a university degree this increases the chance of the household moving up the income distribution by 36 percentage points which is the greatest impact in the model. Therefore, these results suggest that human capital is the most important determinant of upward income mobility. This is expected given the role of education in earnings.

On the other hand, households with more education are less likely to experience downward income mobility. For example, if a household head holds a diploma in education, the household is less likely to move down the income distribution levels by 9 percentage points.

Consistent with literature (Castrol, 2011), a household headed by a female has a higher chance of moving up (lower chance of moving down) the income distribution ladder than male headed households. In Table 5 (weighted model), the probability of a female headed household moving up the income ladder is higher by 16 percentage points. In Table 5, the probability of the household moving down the income distribution ladder reduces by 6 percentage points if the household head is a female.

As expected, we find that the number of children in a household inversely affect the household's upward income mobility (positively affect downward movement) though marginally. For example, an increase in the number of children reduces the likelihood of a household moving up the income distribution by 3 percentage points and movement down by 1 percentage point. We also find that residing in an urban area increases a household's chances of moving up the income distribution by 26 percentage points which is a large effect. Similarly, if a household resides in an urban area its probability of moving down the income distribution ladder reduces by 10 percentage points.

We also observe strong regional effects. The results suggest that households not residing in the central region have a lower probability of experiencing upward mobility in the range of 12-28 percentage points depending on the region of residence. For example, a household residing in the northern region is less likely to move up the income distribution by 17 percentage points than its counterparts in the central region. Similarly, a household residing in the northern region is more likely to move down the income distribution by 9 percentage points.

Physical assets play a significant role in moving households up (or down) income distribution levels. For instance, if a household is endowed with land[4] it increases its probability of shifting to an upward income position by 9 percentage points while the use of a composite value of all household assets (ranging from small assets such as a phone to big assets like land) further enhances a household's upward movement by 24 percentage points. In our models (Table 5), we investigate whether the main source of income, in particular earnings from farm activities and non-farm activities, affect income mobility. We find evidence of the impact of the source of earning on upward mobility which is higher for non-farm activities than for farm activities. For example, a household earning mainly from farm activities shows an increased likelihood of moving up the income distribution level by 8 percentage points while its earnings from non-farm activities increases the probability of its moving up the income distribution ladder by 30 percentage points. These results suggest that non-farm income plays a greater role in upward income mobility than farm income.

We do not find a significant impact of farm earnings on downward income mobility but find that a household earning from non-farm activities is less likely to move down the income distribution ladder by 17 percentage points. This casts doubts on the effectiveness of the land asset in income generation for households.

[4] Land was captured as a binary variable for those with and without land.

We include the variables of an ill household head and theft of money to capture shocks to a household's social and economic status. We expected these shocks to enhance a household's downward movement along income distribution. Our results are surprising. Perhaps these variables mask other effects like a household with a sick head receiving support from family and friends and being able to sustain its income stream or households that experience theft of money already being financially sound households.

We further check the robustness of our results by estimating equation (1) using consumption expenditure data (the results are presented in Tables A5 and A6 in the appendix). We present results both for the weighted and unweighted models for the two-year period. We find that the results are robust, except in two scenarios: lower levels of education (lower secondary and below) which reduce upward mobility and owning land which reduces upward mobility and increases downward mobility. The results for lower levels of education are plausible and are consistent with Castro (2011) who found that for education to enhance upward mobility it had to be higher than high-school education. The results for land are surprising but could be a signal for low factor productivity manifested in subsistence agricultural production in Uganda which has a limited impact on household welfare. As noted earlier, the weighted model performs better and confirms that education has the greatest positive (negative) economic significance on upward (downward) mobility.

6. Conclusion and policy recommendations

This study investigated the rate and determinants of households' income mobility in Uganda. It analyzed income mobility using a transition matrix that measured relative income mobility. Using predicted real equivalized household income, it assigned households into quintiles which were endogenously determined. Since we had data from three waves of the panel survey (2009-10, 2010-11 and 2011-12) we analyzed income mobility for a period of two years (2009-11) and one year (2009-10). We investigated the determinants of income mobility using a probit model separately for households that moved up the income distribution ladder (upward mobility) and down the income distribution level (downward mobility). Further, since there was evidence that attrition could potentially bias our estimates we used the inverse probability weight method to address this issue. The paper presents results for both the unweighted model (attrition not addressed) and the weighted model (attrition addressed) for all our estimated models.

We investigated the fluidity of income mobility and found a higher rate of income mobility at the bottom (60 percent) than at the top (43 percent) for the two-year period. This finding was robust even when we reduced the period from two to one year and even when quintiles were constructed using monthly household consumption expenditure. While investigating the determinants of income mobility we found the human capital variable (education) to have the most economically significant impact on income mobility which increased with the level of education. For instance, if a household head held a university degree it increased the probability of the household moving up the income distribution ladder by 36 percentage points. Equally important was the physical asset variable (value of assets) which had a high economic significance. For example, a household more endowed with assets increased its chance of moving up the income distribution ladder by 24 percentage points and reduced the likelihood of its moving down the distribution ladder by 18 percentage points.

In case of gender, female headed households had a 16 percent higher chance of moving up and a 7 percent lower chance of moving down the income distribution level than their male counterparts. The study found a mixed impact of land on income mobility. When we used the income variable we obtained the expected results of land enhancing upward mobility. However, when we used the consumption variable we found that owning land reduced the probability of moving up by 17 percentage points and increased the chances of moving down by 15 percentage points. Our finding reinforces the stylized fact that most of the agricultural production in Uganda is subsistence and may not cushion households from a decline in welfare.

This study also establishes that the source of income matters, with incomes from non-farm activities playing a more significant role than income from farm activities. For instance, households whose main income source was farm activities increased their chances of moving up the income distribution ladder by 8 percentage points while earnings from non-farm activities were 30 percent more likely to help households move up the income ladder. Conversely, households earning from farm activities were 3 percent (though not statistically significant) less likely to move down the income distribution level and earnings from non-farm activities meant that households were less likely to go down the income ladder by 17 percent.

In conclusion, our study found that the education level and gender of the household head, marital status, physical capital, household composition, location and source of income determined whether a household was more (less) likely to move up (down) the income distribution ladder. Addressing the attrition bias made our results more robust and precise. We performed various robustness checks which confirmed the robustness of our results.

Based on our results we recommend increased investments in human capital, particularly in education which greatly enhances upward income mobility and at the same time protects households against downward mobility. We note that it is higher education (higher than the secondary level) that matters most; hence, this should be promoted. The study also establishes that investments in women pay dividends since they have a higher chance of moving up the income ladder than their male counterparts. Therefore, we recommend increasing women's empowerment for households to reap more dividends.

We find glaring differences in income mobility in household's geographical location in favor of households residing in urban areas or the central region. To promote equality in welfare, the government should encourage the dispersion of development to enable households in less developed areas to benefit from the development process.

There is also an urgent need to make the land asset in Uganda more economically viable by enhancing incomes from it. The government should design strategies that are aimed at increasing the viability of land as a factor of production. In this respect, the commercialization and modernization of agricultural programs should be promoted to address the limited role that land plays in income generation. Since our results show that income from non-farm activities plays a greater role in enhancing household incomes as compared to income from farm activities, households need to devise strategies that promote the diversification of income not only to spread economic risks but also to participate in more lucrative markets by selling high value products or services.

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Appendix

Table A1: A Comparison of Sample Means for Exit and Panel Households

Variable	Remained (balanced sample)	Exited	P-value
Education level of household head	1.02	0.89	0.0000
Age of head	47.04	46.53	0.0333
Female headed	0.22	0.40	0.0000
Married head	0.82	0.67	0.0000
Farm income	0.54	0.37	0.0000
Non-farm income	0.20	0.26	0.0000
Urban	0.17	0.30	0.0000
Children	4.48	3.46	0.0000
Log assets	15.72	14.86	0.0000
Land	0.90	0.70	0.0000

Source: Authors' computation using the 2009-10, 2010-11 and 2011-12 UNPS data.

Table A2: Factors Influencing Attrition

Variable	dy/dx	Str. Err
Education head	-0.006	0.005
Female head	0.026*	0.013
Age head	-0.000	0.002
Age head squared	0.000	0.000
Married head	-0.007	0.014
Owns land	-0.043***	0.013
Eastern region	-0.080***	0.016
Northern region	-0.077***	0.016
Western region	-0.048***	0.018
Urban	0.064***	0.013
Children	-0.001	-0.001
Asset endowment	-0.032***	0.005
Farm income	-0.015	0.011
Non-farm income	-0.024*	0.013
Ill head	0.004	0.016
Theft of money	0.007	0.020
lnconsumption	0.023***	0.007
Year dummy - 2010	-0.037***	0.007
Year dummy - 2011	0.017***	0.005

Notes: The standard errors are clustered at household level, *p<0.10, **p<0.005, ***p<0.01

Table A3: Transition Matrix by Quintile (Percentages), 2009-11 Using Consumption

	Quintile 2011					
Quintile 2009	1	2	3	4	5	Total
1	56.45	24.64	11.71	5.49	1.72	100
2	33.48	30.35	19.63	12.87	3.67	100
3	16.63	27.88	28.83	19.24	7.42	100
4	6.59	16.69	27.43	29.82	19.47	100
5	2.18	3.15	6.88	24.57	63.22	100

Source: Authors' computation using the 2009-10, 2010-11 and 2011-12 UNPS data.

Table A4: Transition Matrix by Quintile (Percentages), 2009-10 Using Consumption

	Quintile 2010					
Quintile 2009	1	2	3	4	5	Total
1	62.42	20.99	9.96	5.35	1.28	100
2	40.95	28.37	17.85	9.70	3.13	100
3	20.62	27.40	27.97	16.24	7.77	100
4	7.74	19.09	30.31	23.90	18.95	100
5	3.13	2.90	7.33	23.30	63.33	100

Source: Authors' computation using the 2009-10, 2010-11 and 2011-12 UNPS data.

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Table A5: Determinants of Upward Mobility using Consumption data

Variables	Unweighted		Weighted	
	dy/dx	Robust Str. Err	dy/dx	Robust Str. Err
Primary education	-0.142*	0.079	-0.062*	0.033
Lower secondary	-0.078	0.076	-0.088***	0.026
Diploma	0.340***	0.124	0.141*	0.077
Female head	0.040	0.090	0.084*	0.044
Age of head	-0.028**	0.012	-0.013***	0.005
Age of head squared	0.000*	0.000	0.000***	0.000
Married head	-0.053	0.102	0.063	0.043
Children	-0.011	0.012	-0.016***	0.005
Urban	0.014	0.102	0.069*	0.039
Eastern region	0.074	0.100	-0.117***	0.043
Northern region	-0.012	0.098	-0.039	0.042
Western region	0.002	0.105	-0.051	0.044
Owns land	-0.076	0.097	-0.165***	0.041
Asset endowment	0.091***	0.031	0.061***	0.012
Farm	0.032	0.067	-0.070**	0.029
Non-farm	0.059	0.093	0.057	0.039
Observation	3,521		4,117	

Notes: Standard errors are clustered at the household level for the unweighted model. For the weighted model we use survey weights * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The reference group for education is no formal education and for region is central.

Table A6: Determinants of Downward Mobility using Consumption data

Variables	Unweighted		Weighted	
	dy/dx	Robust Str. Err	dy/dx	Robust Str. Err
Primary education	-0.102	0.082	-0.062*	0.033
Lower secondary	-0.018	0.073	-0.088***	0.026
Upper secondary	-0.060	0.123	0.084	0.051
Diploma	-0.203***	0.066	-0.173***	0.026
Degree	-0.276***	0.068	-0.188***	0.040
Female head	-0.093*	0.056	-0.055**	0.025
Age of head	-0.004	0.008	-0.002	0.004
Age of head squared	0.000	0.000	0.000	0.000
Married head	-0.084	0.070	-0.059**	0.029
Children	0.029**	0.012	0.014***	0.004
Urban	-0.103**	0.048	-0.042**	0.019
Eastern region	-0.036	0.063	0.186***	0.027
Northern region	0.059	0.078	0.047*	0.027
Western region	-0.035	0.067	0.085***	0.025
Owns land	0.075	0.055	0.148***	0.020
Asset endowment	-0.074***	0.014	-0.082***	0.006
Farm	0.074	0.014	0.006	0.024
Non-farm	0.093*	0.054	-0.055**	0.021
Ill hh head	0.120	0.094	-0.009	0.038
Theft of money	-0.039	0.091	-0.048	0.048
Observations	3,116		4,651	

Notes: Standard errors are clustered at the household level for the unweighted model. For the weighted model we use survey weights * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The reference group for education is no formal education and for region is central.