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# Defining the Middle Class in Developing Countries: Evidence from Uganda's Household Panel Survey

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# 1 Introduction

This paper contributes to the research on the Developing World's "new middle classes" by identifying this newly born middle class in Uganda. While prior research focused on methods that takes into account the current economic situation of the country as an identification strategy of the middle class in Uganda, I use a vulnerability approach by López-Calva and Ortiz-Juarez (2014), which takes into consideration the future welfare of the Ugandan households when identifying the different social groups.

During the last two decades, the middle class from all around the globe has drastically increased. According to Kharas (2017), around 3.2 billion people belonged to the middle class at the end of 2016. That means the middle class will define the majority of the world population in a near future. Notwithstanding, the interesting fact is that this just born global middle class is expected to be located mainly in developing countries.

The precise definition of this new middle class is unclear and it started recently to be a debate in Economics. Among economists, income or expenditure thresholds are usually used to differentiate between social classes. However, no general consensus exists on which thresholds and characteristics exactly define the social middle class (Pritchett, 2006). As economic behavior such as consumption patterns differ between different social groups, it is important to clearly identify these different groups in order to tailor policies adequately. In particular, households' current consumption patterns are highly dependent on their expected future economic situation. Therefore, solely basing their affiliation to any particular social group on their current economic situation may be misleading (Atkinson & Brandolini, 2011). This especially happens when referring to developing countries, where individual income may be highly dependent on the business cycle. Addressing this issue, this paper aims at identifying the middle-class group in developing countries, especially Africa, considering the study case of Uganda and using an approach based on the vulnerability to poverty. That is, when identifying the middle class, I do not only take into account the current economic situation of the household, but also its risk of falling into poverty in the near future.

Uganda's economy has been improving since the 90's, and its development is now being considered one of the most successful economic advances in the world (Collier & Reinikka, 2001). The Ugandan GDP per capita has been increasing steadily, having important consequences for the society, especially for the people's education level. The Ugandans are changing their consumption paths moving from the lower through the middle to the

upper class. This can have important implications on Ugandan lifestyle, especially if consumption patterns start to mirror the industrialized countries ones. That means if the consumption patterns from the middle and upper classes become more important in transport and energy, and these social classes continue increasing, there may be important implications on the environment and climate change. Thus, to design adequate policies and to measure the implications of their growth on the sustainability and the development of their country, it is important to understand who constitutes the middle class and how they behave.

The improvement of Ugandan economic indicators and the higher levels of education has brought improvements in Ugandans' lifestyle. Ssewanyana (2010) predicts an increase in household spending power in Uganda together with a reduction of households' poverty status. Nevertheless, the persistence in poverty is strong in Uganda. Ssewanyana (2010) finds evidence that almost 40% of households suffer transient poverty. For that reason, it is important to take into account the risk of poverty of Ugandan households when defining the middle class in this country.

Using panel data from The Ugandan Bureau of Statistics for the years 2011 and 2013, I follow the methodology developed by López-Calva and Ortiz-Juarez (2014) to identify the middle class according to their vulnerability to poverty. The methodology used by López-Calva and Ortiz-Juarez is compounded by three main steps. First, households are divided into four groups: never poor, always poor, out of poverty, entering into poverty. Second, using a Probit model, the expected probability of falling into poverty is estimated, using control variables such as households characteristics, head of household characteristics and other determinants of poverty. Third, using a linear estimator, the logarithm of expenditure is estimated with the same the controls used for the first regression. Then, the two equations will be used to match the levels of expenditure with the probabilities of falling into poverty. In this way, it is possible to obtain expenditure estimations for each level of risk of poverty and use them to create bounds that identify each social class. The social pyramid will be divided into four sections: the poor class, the vulnerable class, the middle class, and the elite.

There is evidence that the middle class and the vulnerable class' shares of income and population have been significantly incremented during the period under study. Meanwhile, both the income and population shares of the poor class have been decreasing during the period under study whereas for the elite class the population share has increased. In the same period, the income share of the elite has decreased. This is evidence for a more

equal income distribution. Moreover, I test the differences between the social classes' characteristics. This paper shows that those social classes are different from each other and this may have social and economic implications for Uganda. For instance, middle-class households achieve higher levels of education, work in the services sector and have better household sanitation. Furthermore, they use significantly more energy than the other social clusters due to significantly different consumption patterns.

This paper is structured as follows. First, a review of the main literature on the importance of the middle class in Africa, the most influential definitions of the middle class made in the developing world, and facts about the Ugandan middle class are provided. Second, some economic context to the country of Uganda is shown with the purpose of providing a broader picture of the Ugandan economy and putting the following results into perspective. Third, an explanation of the data used and the methodology covered in this paper is given. Next, the results are presented with an analysis of the methodology choices and robustness checks. Finally, those results are applied to the case of Uganda, defining and analyzing the Ugandan middle class.

## **2 Defining a Middle Class**

### **2.1 Importance of the Middle Class in Africa**

Shimeles and Ncube (2015) find evidence that the African middle class has been increasing during the last decades. However, this rise is more modest in Africa in comparison to East Asia or Latin America, taking into consideration the economic growth that Africa has experienced (Giesbert & Schotte, 2016). The increase of the middle class in Africa has brought an increase in investment and consumer demand. This new middle class is a driver of economic development, being probably the fastest growing consumer class in the world (Fletcher, 2014).

Due to the sharp growth of the middle class and the increase of their economic relevance, there is a growing interest in identifying the middle class as political actors and their impact on the African lifestyle (Corral, Molini, & Oseni, 2015). For instance, Chikweche and Fletcher (2014) investigate in their article the factors that influence the African middle-class consumers' purchase decision making. The authors find evidence that the middle class' members shape their lifestyle according to their own social status. An example could be cable television which has contributed to the growth of the continent's

biggest cable television provider, DSTV MultiChoice, which now has a presence all across Africa. Another example could be mobile phones usage which has been increasing in Africa since 2000. In 2016, it was more common to have a mobile phone than access to electricity in African households (The Economist, 2017).

Regarding the role of the middle class in politics and democracy, it might be straightforward to assume that the rise of middle classes would bring more stable democracies, in part due to the increase of educated individuals. Nonetheless, Giesbert and Schotte (2016) found that the connection often made between the rise of a new African middle class and democratic political reforms is weak. On the one hand, Norman, Aviisah, Awiah, Kweku, and Binka (2016) directly blame middle class for the corruption and the economic deterioration in Sub-Sahara Africa. On the other hand, recent studies show an increase in a new young, critical and democratic middle class as a consequence of the higher levels of education achievements (Giesbert & Schotte, 2016).

To sum up, the middle class is an important social and political actor in Africa. Thus, a proper definition of the middle class is important, especially when people behave differently according to their risk of becoming poor.

## **2.2 The Measurement of Middle Class in the Developing World**

The unprecedented growth of the new middle class in developing countries implies a new concern regarding its identification which is as unclear as its importance in the social and political environment. The definition of this new middle class has been subject to numerous debates in sociology but it has received little attention from economists until recently.

Brandi and Büge (2014) highlight the degree of heterogeneity of middle classes in developing countries, identifying nine different types of middle classes, from small and prosperous middle households to large in members with low spending power. Atkinson and Brandolini (2011) argue that household characteristics related to income are not enough to face this task. They claim that, for being able to identify and analyze the middle class, it is necessary to take other factors into consideration such as the type of occupation of the households. Kharas (2010) presents a literature review based on numerous methods under different perspectives to define the middle class. For instance, Banerjee and Duflo (2008) set the links between the middle class and democracy while Acemoglu and Zilibotti (1997) emphasize the role of the middle class as a source of entrepreneurs. Furthermore,

Doepke and Zilibotti (2007) emphasize the contribution of the middle class to human capital and savings. More recently, other authors have contributed to the literature, like Bertocchi, Buonocore, Donovan, Gordon, and Kunreuther (2016) defining the middle class by the desire to maintain the status, economic and political significance and concentration in urban areas. Jayadev, Lahoti, and Reddy (2015) makes three other classifications: the global middle class as the middle of the global income distribution, the global middle class as a sociological category of people who enjoy some level of common achievement of goods and services and the global middle class as consumers of an international basket of goods. Mourits and Kempen (2015) define middle class from a physiological point of view, that is, those who have better mental well-being constitute the middle class.

One popular definition among economists is the use of income or expenditure thresholds to define different social classes. With this purpose, Pritchett (2006) calculates an upper bound and lower bound for the global poverty line based on the question "above what level of income or expenditures is someone truly not poor?". Kharas (2010), Zizzamia, Schotte, Leibbrandt, and Ranchhod (2016), Cruces, Calva, and Battistón (2011) and Sumner (2012) give a review of the main articles on this topic in their respective reports, distinguishing between absolute methods, that is, the use of thresholds, and relative methods, which are methods based on the use of percentiles. In Table I which can be found in Appendix A1, there is a recompilation of these three classifications together. Moreover, Table 1 presents the share of the middle-class population in Uganda according to those classifications. It becomes clear that the method employed to define the middle class changes the results drastically. According to Blackburn and Bloom (1985), more than 61.48% of the population in Uganda belong to the middle class while, according to Birdsall (2010), there exists no middle class in Uganda.

From Table 1 it is apparent that the size of the middle class is, in general, greater when using relative measurements. This might occur, if, for instance, the median of the income or consumption in Uganda lies below the global poverty line, then the households captured with those methodologies are not what we would consider middle class. This kind of methodology is useful to measure income distributions and inequality but they have limitations regarding the identification of the middle class (Abu-Ismaïl & Sarangi, 2015). As Birdsall (2010) advises, relative measures do not give any information of the middle class in each country.

Nonetheless, that does not imply that absolute measurements are perfectly reliable. On the one hand, following the same intuition as Abu-Ismaïl and Sarangi (2015), the



Table 1: Share of MC in Uganda using the most popular definitions based on income/consumption

Type of method	Author	2013	2011
Cumulative Distribution	(Alesina & Perotti, 1996)	29.96%	29.96%
	(Partridge, 1997)	9.99%	9.98%
	(Barro, 1999) (Easterly, 2001)	59.92%	59.92%
	(Solimano, 2009)	59.92%	59.92%
	(Palma, 2011)	39.95%	39.95%
	(Levy, Hirsch, & Woolard, 2014)	29.96%	29.96%
	(Finn, Leibbrandt, & Woolard, 2013)		
Relative Median of the Distribution	(Blackburn & Bloom, 1985)	61.48%	65.99%
	(Wolfon, 1989)	27.68%	30.87%
	(Davies & Hudson, 1992)	55.80%	57.17%
	(Birdsall, Graham, & Pettinato, 2011)	27.67%	30.87%
Absolute	(Bhalla, 2007)	4.04%	3.92%
	(Banerjee & Duflo, 2008)	49.67%	58.49%
	(Ravallion, 2009)	51.44%	60.51%
	(Nomura, 2009)	1.57%	1.37%
	(Kohut, 2009)	4.70%	4.50%
	(Kharas, 2010)	4.04%	4.50%
	(Court & Narasimhan, 2010)	1.76%	1.70%
	(African Development Bank (AfDB), 2011)	53.20%	62.21%
Mixed	(Visagie & Posel, 2013)	7.38%	6.85%
	(Birdsall, 2010)	0%	0%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016). Each definition from each paper can be found in the Appendix A1, Table I. The last two columns are the results of calculating the middle class with each definition in 2013 and 2011.

fixed threshold of \$2 per day (the lowest threshold defined) might be appropriate for the lowest-income countries. However, if we consider middle-income countries then this is not the best approach since, for the majority of the countries in Asia and Latin-America, the poverty line is higher than \$2 per day (Pritchett, 2006). On the other hand, the \$16 per day lower threshold proposed by Court and Narasimhan (2010) or the \$10 per day lower threshold by Banerjee and Duflo and Ravallion are too high, as they are significantly above the national poverty lines of many middle-income countries (Abu-Ismaïl & Sarangi, 2015). Furthermore, the measures of the middle class using this methodology need to rely on Purchasing Power Parity (PPP) adjustments (Deaton, 2001), but with high heterogeneity between countries, PPP adjustments might not be ideal for comparability (Cruces, Calva, & Battistón, 2011).

To sum up, it is popular among economic experts to consider the middle class as those individuals allocated above the poverty line, even though there is no clear consensus about which is the upper bound of this poverty line (Pritchett, 2006). Moreover, usually

authors only take into consideration poverty (or, in this case, no-poverty) in a world of certainty. Nevertheless, it may be the case that some individuals that are above the poverty line today will not be allocated there in a future period, since there are lots of dynamics within developing countries. From this point of view, a new forward-looking perspective must be adopted. The literature has recently started studying uncertainty as a determinant part of poverty itself, known as the concept "vulnerability to poverty" (Ceriani, 2018). The concept of vulnerability can be understood, according to Ceriani, as a disability to cope with risk, as a risk of poverty (a forward-looking measure of welfare) or as a low expected utility from an expected decrease in future consumption. Focusing on vulnerability as the future probability of being poor, there is a line of research that focuses on vulnerability approaches that constitute an update of the most traditional measurements. This paper follows closely the empirical methodology developed by López-Calva and Ortiz-Juarez (2014), which uses the vulnerability to poverty to identify the middle class. The authors use this empirical approach to define the middle class in Latin-American countries.<sup>1</sup> Moreover, other authors have replicated this method to estimate the size of the middle class in South Africa (Zizzamia et al., 2016) and Nigeria (Corral et al., 2015).

## 2.3 Related Research on the Middle Class in Uganda

The literature that attempts to analyze and identify the middle class in Uganda is sparse.

Ssewanyana (2010) finds strong growth in consumption and a reduction of poverty during the period 2004-2008 based on household panel data, even though the vast majority of Uganda's population remains to be poor. Their findings reveal that the persistence in poverty is still strong and initial conditions do matter. However, during that period, more households escaped poverty than entered it. Furthermore, Thurlow, Resnick, and Ubogu (2015) classify the middle class in Africa based on an indicator that takes into account three main characteristics: head of household had finished secondary education, a dwelling with decent amenities and that the labor activity of the head is skilled and non-farm related. According to this definition and using panel survey data from 2005-2006, only 6.9% of the Ugandan population would belong to the middle class, which allocates Uganda on the worst-off country analyzed in the article.<sup>2</sup> Shimeles and Ncube (2015) also

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<sup>1</sup>López-Calva and Ortiz-Juarez (2014) estimate the middle class' size of the countries Mexico, Chile and Peru.

<sup>2</sup>Thurlow et al. (2015) consider in their research the African countries of Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, South Africa, Uganda and Zambia.

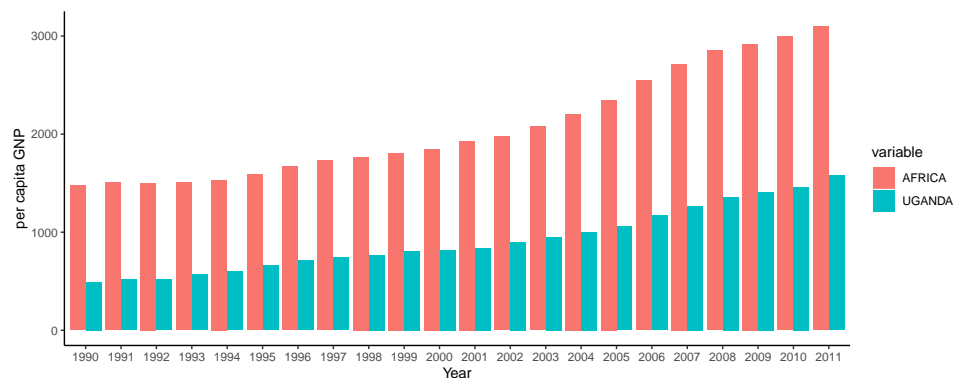
identify the middle class based on their assets. They find that Uganda's change of the middle class from 1995 is a little less than 10%. Even though the change is positive, it is not as strong as in other African countries such as Cote d'Ivoire where this change is more than 60%.

### 3 Uganda's profile

This section aims to provide a broader picture of the Ugandan economic situation by providing some economic and historical context for the case of Uganda. It is important to have a general idea of the economic performance of Uganda to better understand the findings in the following sections.

After the economic decay that Uganda's economy suffered during the 70-80's, their economic performance has been considered as one of the most successful in the world during the 90's according to Collier and Reinikka (2001). The political instability, the civil war, the emigration of skilled workers and the high death rates left Uganda in a difficult situation. This is why Uganda is considered a role model of successful post-conflict recovery in Africa (Collier & Reinikka, 2001).

Figure 1: Per capita GNP in Africa and Uganda (1990-2011)



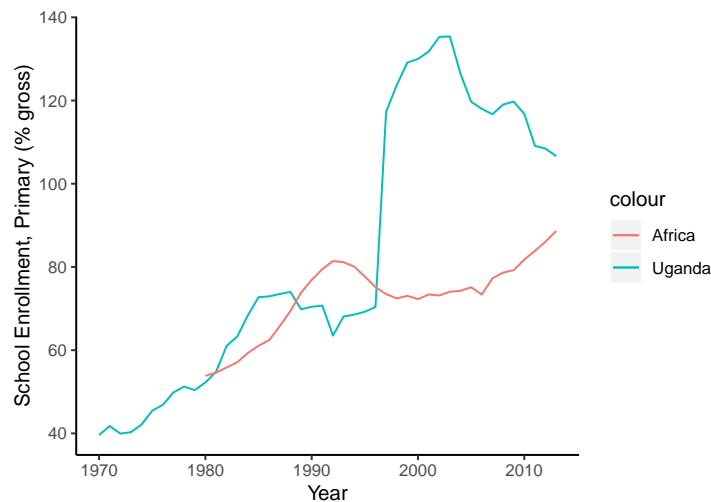
Source: The World Bank (2018a). Data are in 2011 PPP prices. Africa refers to the Sub-Saharan Africa (excluding high income countries).

Figure 1 represents the GNP per capita level (in 2011 PPP) from 1990 until 2011 in Africa (in red) and in Uganda (in blue). Uganda has substantially increased their level of GNP per capita Nevertheless, the GNP per capita remains much lower in Uganda than the average in Africa. Uganda's GDP per capita growth has been steep and steady since 1992, especially during the last decade, at a similar rhythm as the African GDP growth per capita.

This unprecedented period of growth has lead to several changes in the economy and society. Appleton (2001) finds evidence from household survey data (1992-2000) that consumption-based poverty measures decreased, with a higher effect in magnitude in more educated households. According to Appleton (2001), the level of education also has increased, in response to the Universal Primary Education Reform that took place in 1996 (Overseas Development Institute (ODI), 2006).<sup>3</sup>

Figure 2 presents an overview of the enrollment ratio for primary school across time, from 1970 and 2013.<sup>4</sup> There is a clear discontinuity in the year 1996, due to the Universal Primary Education Reform, where the ratio of primary school enrollment significantly increased, reaching higher levels than the Sub-Saharan Africa average, excluding high-income countries.

Figure 2: Primary School enrollment in Uganda (1970-2013)



Source: The World Bank (2018c). Gross enrollment ratio for primary school is calculated by dividing the number of students enrolled in primary education regardless of age by the population of the age group which officially corresponds to primary education, and multiplying by 100. Africa refers to the Sub-Saharan Africa (excluding high income countries)

From the improvement of Ugandan economic indicators and the higher levels of primary schooling, one would presume a change in the pyramid structure of the Ugandan population. In other words, transitions of households from the poor class to the middle class in future periods can be expected and, consequently, improvements in the income distribution. Ssewanyana (2010) already finds an increase in household spending power

<sup>3</sup>Universal Primary Education initiative consists of abolishing the fees for enrolling to state primary schools. With this reform, the number of people enrolled in primary school almost doubled within a year.

<sup>4</sup>Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population in the age group that officially corresponds to the primary education (The World Bank, 2018c). The number of population enrolled in primary school might be higher than the population on the age group that corresponds to primary education. That is why the ratio can be higher than 100.

together with a reduction of poverty in Uganda. Nonetheless, Ssewanyana (2010) also shows that around 40% of households suffer from transient poverty. That is why it is especially important for the case of Uganda to take into consideration the vulnerability degree of the households when defining the middle class.

## 4 Empirical Approach based on Vulnerability

### 4.1 Data

The data used to calculate the middle class in Uganda based on the vulnerability of the households to fall into poverty is taken from the World Bank’s Living Standard Measurement Study (LSMS) created by The Ugandan Bureau of Statistics.

The 2011/12 and 2013/14 Uganda National Panel Survey (UNPS) is the third and fourth in the series of panel surveys that the Uganda Bureau of Statistics (UBOS) has conducted since 2009/10. A sample of 3,123 households has been tracked and re-interviewed during the different waves distributed over the country, in rural and urban regions. Each survey wave was constructed by two face-to-face interviews in two visits: one at the beginning and another one at the end of the period.

After cleaning the data from LSMS, that is, deleting missing values and creating a balance panel data for the two periods 2013/14 and 2011/12, I remain with a sample of 1,532 households for the analysis.

### 4.2 Methodology

The main objective of this paper is to estimate a lower bound and an upper bound to identify the middle class in Uganda. In this way, the Ugandan population is classified into four social classes: poor class, vulnerable class, middle class and upper class or elite.<sup>5</sup>

The lower bound of the middle class is estimated by an endogenous method based on vulnerability, which was first implemented by López-Calva and Ortiz-Juarez (2014). Other authors replicate this method with the same aim: Zizzamia et al. (2016) for South Africa and Corral et al. (2015) for Nigeria. In this paper, some individual assumptions about this method from these three papers are used to calculate a lower bound for the middle class, given the availability of the data. The empirical framework consists of the

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<sup>5</sup>The R code where the methodology of this paper is implemented can be found on: <https://github.com/RocioBF/UgandaMiddleClass>.

following three stages:

1. Estimating the probability of falling into poverty for each household.
2. Estimating the logarithm of the household expenditure.
3. Matching the predicted probability of falling into poverty with the predicted household expenditure. This allows me to create expenditure bounds based on the household risk of poverty.

For the first stage, I estimate a transition matrix, appearing in Table 2. This transition matrix is obtained from a classification of the poverty status of households tracked in two periods. The upper-left cell of Table 2 corresponds to the "always poor" case. The left-down cell, the "entered into poverty" case. The upper-right cell, the case of recovered households from poverty. The lower-right, the households which were never poor. Then, from 2011 to 2013 the share of household who moved from poor status to non-poor status was 57.86%, which corresponds to the lower-left cell.

The Ugandan Bureau of Statistics classifies households into "poor" or "not poor" using a non-constant poverty line in 2005 constant prices. This poverty line oscillates between \$45 – \$52 of monthly consumption, equivalent to daily \$1.5 – \$1.7.<sup>6</sup> I take the lower threshold of \$1.5 for my classification of household in poor/non-poor.<sup>7</sup> This poverty line is close to the \$1.25 PPP line used by the World Bank for Sub-Saharan Africa (The World Bank, 2015).<sup>8</sup> If the monthly household consumption is under \$1.5 (2005 PPP), then the household will be denominated as "poor".

Table 2: Poverty transition matrix: distribution of households in Uganda

2011 \ 2013	Poor	Non-Poor
	Poor	Non-Poor
Poor	42.14%	57.86%
Non-Poor	12.72%	87.28%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Then, for a household  $i$ , the probability of falling into poverty from the initial period (t) and the next period (t+1) corresponds to the following equation

$$p_{i,t} = \mathbb{E}(\text{poor}_{t+1,i}) = F(X'_{i,t}\beta_i) \quad (1)$$

<sup>6</sup>UGX 28165.4 - UGX 32106.2 transformed to \$(2005 PPP), which conversion factor is equal to 619.64 (The World Bank, 2018b).

<sup>7</sup>The differences between using the poverty line of \$1.5 or \$1.7 is analyzed in the section 5.2.

<sup>8</sup>Recently, The World Bank updated this poverty line to 1.9\$ PPP in 2015. Since the data used for this analysis is from 2011 and 2013, I decided to keep the old threshold.

where  $\mathbb{E}$  is the expectation operator and  $F(\cdot)$  the Cumulative Distribution Function (CDF) of the standard normal distribution.<sup>9</sup>  $p_{it}$  is estimated using a probit model and it is interpreted as the probability in period  $t$  of being poor in period  $t + 1$ .  $Poor_{t+1,i}$  is equal to 1 if the household was poor in the following period and 0 otherwise, irrespective of whether it was poor or not in the first period, equal to 21.15% on average for the case of Uganda.

The vector of observable characteristics  $X_{it}$  contains personal information of the head of the household (HoH from now on) such as level of education, labor characteristics and marital status, dwelling conditions and shocks affecting the households (household can also be also called HH).<sup>10</sup>

The level of education of the HoH is defined by a categorical variable which contains the percentage of HoHs that are illiterate, have kindergarten or another kind of basic education, have at least one year of primary or junior or secondary education, have a primary or junior or secondary specialized training and have a university degree. This classification of education follows closely López-Calva and Ortiz-Juarez (2014).

Information about labor activity is given by the sector of the activity of the household. The primary sector contains the activities of agriculture, forestry, fishing or mining. The secondary sector, activities regarding manufacturing. Finally, the tertiary sector or services sector contains those activities related to the supply of services, trade, communication, transportation, administration and so on.

Next, there is information regarding the marital status of the HoH, following a classification and other personal characteristics such as age or sex can be found.

Replicating Shimeles and Ncube (2015) absolute indicators of the middle class status, I use the source of drinking water (piped water), source of toilet (flush toilet), the provision of electricity, the floor material, and the ownership of radio, TV, refrigerator, bicycle, motorcycle, vehicle and telephone to proxy living standards and sanitation of the household.<sup>11</sup> Moreover, I include information regarding the percentage of households living in urban areas, the average of the number of residents in each household, the percentage of residences that are independent (not shared with other households), the percentage of households that owns their residence and the average of the number of rooms in each

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<sup>9</sup>One round of the survey's series by The Ugandan Bureau of Statistics is called "period".

<sup>10</sup>Table II and IV which appear in the Appendix A2 present an overview of the profile of the households in Uganda in 2011.

<sup>11</sup>The floor material that Shimeles and Ncube (2015) include in their paper is excluded due to lack of data.

residence.

Lastly, I take into account the percentage of households that suffer from a health shock during the studied period (2011-2013). A household suffers a health shock if the income earner or another member(s) of the household had an illness or an accident. A death shock occurs when one or more of the members of the household died. Floods, droughts, irregular rains, landslides, erosion and other meteorological phenomenon are called climate shocks. Dwelling shocks are related to the destruction of the farm of residence of the household such as fire or theft. Economic shocks are defined by unusually high costs of agricultural inputs/outputs, reduction in the earnings of currently (off-farm) employed household member(s) and loss of employment of previously employed household member(s) (not due to illness or accident). A household suffers from an agricultural shock if they suffered from an unusually high level of crop pests or unusually high level of livestock disease during the last year. Other kind of shocks that are not specified previously but which can also affect the household welfare are referred to as other shocks.

As a second step of the methodology, the logarithm of the household expenditure is estimated using a linear model with same the independent variables as used in Equation (1). Thus, the following equation is obtained:

$$\ln(Expenditure_{i,t}) = X'_{i,t}\delta + \epsilon_{i,t} \quad (2)$$

where  $\ln(Expenditure_{i,t})$  is the monthly total expenditure of a household in logarithm scale in the initial period.

Thus, Equation (1) is estimated by a probit regression and Equation 2 by a linear model regression. Among the control variables used there are three variables with high standard errors: "HH has flush toilet", "HH has electricity" and "HH owns a vehicle". To check if it is caused by possible multicollinearity problems, multicollinearity is tested using the Variance Inflation Factor (VIF).<sup>12</sup> The results suggest that there is not multicollinearity among the variables, so I suspect this variables have high standard errors due to high variability of the data. The subsequent analysis is performed omitting those variables to avoid possible problems they might cause. The complete regression coefficients and the regression coefficients used in the analysis can be found in Appendix A3, in Tables V and VI, respectively.

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<sup>12</sup>The rule of thumb says that if  $VIF > 5$  then there is multicollinearity. The information regarding how to detect multicollinearity in a regression model using R is provided by Kassambara (2018).



In the third step, the predicted household total expenditure from each household  $\widehat{\ln(Expenditure_{i,t})}$  from Equation (1) is matched with their respective probability of falling into poverty  $\hat{p}_{i,t}$  from Equation (2). I estimate a local linear regression that fits the predicted probability of falling into poverty on the predicted logarithm of the expenditure. This method makes it possible to obtain one value of household expenditure (in logs) for each risk of poverty. The polynomial fit, the variance and the density of this estimator can be found in Appendix A4.

López-Calva and Ortiz-Juarez (2014) recommend to use the predicted expenditure instead of the observed values because the predicted values are less volatile. The threshold that separates the vulnerable class and the middle class is set to 10% of the risk of poverty.<sup>13</sup> That is, those households with a probability of falling into poverty lower than 10% are considered middle class, else they are considered vulnerable. The aim is to find an expenditure bound that corresponds to the 10% risk of poverty to identify the middle class in the sample.

Regarding the construction of an upper-bound that separates the middle class and the upper class, López-Calva and Ortiz-Juarez (2014) set an arbitrary threshold of \$50 per day and Corral et al. (2015) do not consider any threshold for the elite in their paper. I implement the same method that Zizzamia et al. (2016) use, taking the average of the predicted expenditure of the bottom 1% of the predicted probability of the poverty risk distribution. In other words, the households with less than 1% risk of poverty are considered the elite.

Hence, the Ugandan social pyramid is defined as follows. First, the poor class is formed by those households under the poverty line. Second, the vulnerable class consists of those households with more than 10% of risk of poverty. Next, the middle class is compounded by those individuals with less than 10% of risk of poverty and whose expenditure power is below the average of the expenditure of the bottom one percent of the risk of poverty distribution. Last, the upper class or elite are those households that surpass the average of the expenditure power of the households with less than 1% probability of falling into poverty.

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<sup>13</sup>This is the threshold chosen by López-Calva and Ortiz-Juarez (2014), Corral et al. (2015) and Zizzamia et al. (2016).

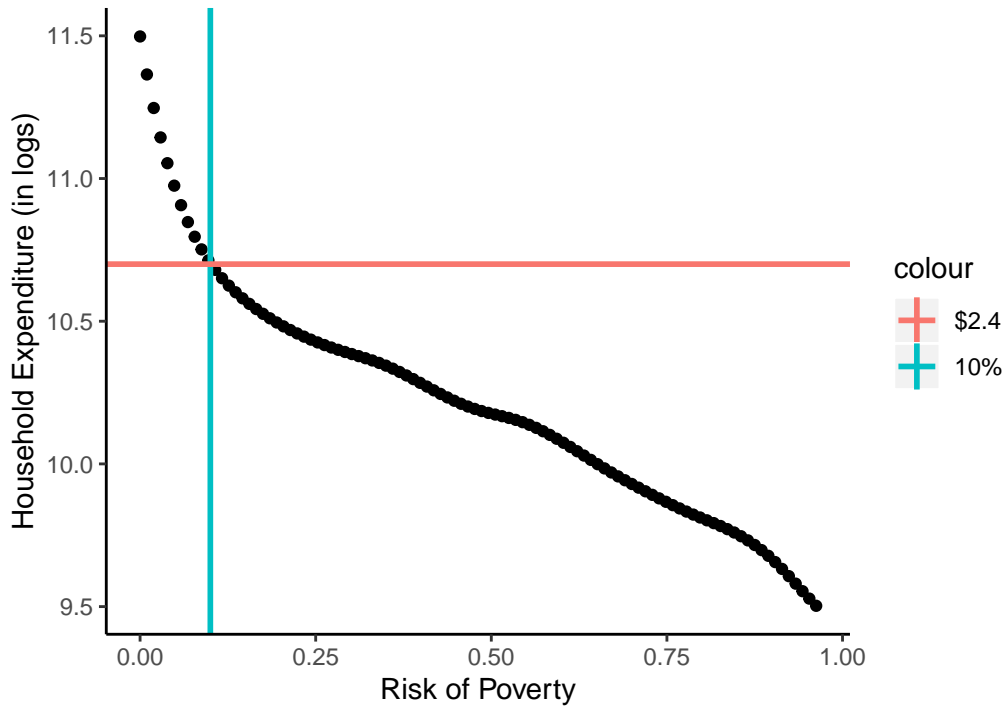
## 5 Results

### 5.1 Main Results

Figure 3 represents the local linear regression used to match the predicted risk of falling into poverty with the predicted household expenditure per month (in logarithms).<sup>14</sup>

The blue dashed line corresponds to the 10% of probability of falling into poverty. This threshold is used to differentiate between the middle class and the vulnerable class. The results suggest that the expenditure bound which corresponds to the 10% of the risk of poverty is equal to \$2.4 a day (2005 PPP), represented by a red dashed line in Figure 3.<sup>15</sup> The result obtained for the upper class threshold is equal to \$5.6 a day (2005 PPP).<sup>16</sup>

Figure 3: Monthly predicted expenditure by probabilities of falling into poverty



Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics. The method used is local linear regression, using a Gaussian Kernel and the Silverman's rule of thumb to calculate the bandwidth (Silverman, 1986).

Thus, those households who daily consume less than \$2.4 and more than \$1.5 (2005 PPP) are classified as the vulnerable class. Households daily consuming more than \$2.4 but less than \$5.6 are classified as the middle class, households consuming less than \$1.5

<sup>14</sup>The figures of the estimation fit, the variance and the density of the local linear estimation are in the Appendix 4.

<sup>15</sup>\$2.4 a day is equal to \$71.58 a month (2005 PPP), equivalent to UGX 44,355.85 a month (which corresponds to 10.7 household expenditure in log-scale).

<sup>16</sup>\$5.6 a day is equivalent to monthly \$ 176.06 or, in other words, UGX 109,097.79 per month.

per day are classified as poor and households with expenditure greater than \$5.6 are considered rich or the elite. Table 3 shows an overview of the expenditure/income bounds for the different social groups using the same method that this project contemplates. According to Table 3, the lower threshold for the middle class can be found in Uganda. Nevertheless, the Ugandan thresholds are, in general, more similar to the ones obtained by Corral et al. (2015) in Nigeria.

Table 3: Social groups bounds across countries (\$ 2005 PPP)

Country	Author	Poor	Vulnerable	Middle	Elite
Uganda		<1.5	1.5-2.4	2.4-5.6	5.6+
Nigeria	Corral et al. (2015)	<1.7	1.7-3.3	3.3+	-
South Africa	Zizzamia et al. (2016)	<5.4	5.4-13.0	13.0-43.3	43.3+
Chile, Mexico and Peru	López-Calva and Ortiz-Juarez (2014)	<4	4-10	10-50	50+

Source: Author's calculations

Uganda's threshold are based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Corral et al. used 2010 PPP which amounts corresponds to \$1.4 for the poverty line and \$2.94 for middle class threshold. The transformation factor is taken from The World Bank (2018b).

Table 4: Share of population by social class

	Expenditure bounds (2005 PPP)	Share of population	
		<b>2011</b>	<b>2013</b>
Poor Class	<\$1.5	28.65%	21.15%
Vulnerable Class	\$1.5-2.4	26.17%	27.15%
Middle Class	\$2.4-5.6	31.72%	38.25%
Elite Class	\$5.6+	13.45%	13.45%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Table 4 shows how the poorest class has lost share of the population in favor of the vulnerable and the middle class. The middle class increases from 31% of the households in 2011 to approximately 38% in 2013. Table 5 presents the percentage of households belonging to each social class in 2013, depending on their poverty status in 2011. Approximately 20% of the households that were poor in 2011 belong to the middle class in 2013, while around 45% of the households that were non-poor in 2011 belong to the middle class in 2013. These results are the evidence that there is some stickiness in the initial status. In order to better understand the dynamics between social groups across the two periods, Table 6 represents the movements across social groups during the period 2011-2013. Around 42% of the population is chronically poor. That means, 42% of the households that were poor in 2011 remains poor in 2013, so they have been poor during the two studied periods. Around 56% have belonged to the middle class in both periods and approximately 56% of the elite class in 2011 have maintained their status in 2013.

Table 5: Transition from poverty from 2011 to 2013

2013 →	Poor	Vulnerable	Middle	Elite
was poor in 2011	42.14%	35.08%	20.27%	2.51%
was non-poor in 2011	12.72%	23.97%	45.47%	17.84%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Share of the population of each social class in 2013 depending on their poverty status in 2011. The first row presents the results for those households that were poor in 2011 and in second row for those that weren't poor.

Table 6: Movements across social groups 2011-2013

2011 \ 2013	Poor	Vulnerable	Middle	Elite
Poor	42.14%	35.08%	20.27%	2.51%
Vulnerable	23.94%	35.16%	36.41%	4.49%
Middle	7.82%	23.25%	56.17%	12.76%
Elite	2.43%	3.88%	35.86%	55.83%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Share of population in each social class in 2013 (columns) depending on their social class in 2011 (rows).

Table 7 compares the results for Uganda with other countries where the same method was used to calculate the size of the middle class. What is interesting is that, even though Uganda has the lower GDP per capita among the countries considered<sup>17</sup>, it has a comparably high middle-class share. To understand why this is the case, it is important to remember that it also has the lowest lower bound to define the middle class. In the next section, an analysis of the choices of expenditure boundaries is made, and how sensitive the results are to those choices.

Table 7: Size of middle class (% of population)

Country	Author	Share of MC (%)
Uganda		38.25
Nigeria	Corral et al. (2015)	18.5
South Africa	Zizzamia et al. (2016)	13.5
Chile	López-Calva and Ortiz-Juarez (2014)	53
Peru	López-Calva and Ortiz-Juarez (2014)	40
Mexico	López-Calva and Ortiz-Juarez (2014)	42.3

Source: For Uganda, the result is based on panel survey data from The Ugandan Bureau of Statistics (2016). The rest of countries are the result from each author's calculations.

<sup>17</sup>The GDP per capita measured in \$ PPP of each country from higher to lower amount in 2013: Chile (22,578.7), Mexico (16,848.0), South Africa (12,770.0), Peru (11,828.8), Nigeria (5,670.1) and Uganda (1,667.0) (The World Bank, 2018a).

## 5.2 Sensibility Analysis of Methodology Choices

The lower bound of the middle-class expenditure is calculated using the 10% of poverty risk. This threshold is the same as used in the articles by López-Calva and Ortiz-Juarez (2014), Corral et al. (2015) and Zizzamia et al. (2016). However, this threshold is also somehow arbitrary. For that reason, in this section, I check how sensible my results are to the choice of the probability of falling into poverty threshold.

Table 8 provides the effect of changing this threshold on the middle-class share of the population. The first column corresponds to the different poverty risk. The first row considers the case where the probability of falling into poverty is equal to 3%, which is the minimum considered in this analysis. From this threshold, I increment the poverty risk until 40% of probability of being poor. The third row corresponds to the results of this paper. The second column describes the threshold in 2005 PPP dollars that corresponds to each probability of falling into poverty. The third and fourth column presents the percentage of the middle class obtained from each risk of poverty. Last, the fifth column presents the growth of the middle class from 2011 to 2013.

Table 8: Effect of changing the probability of poverty

Maximum risk of poverty	Threshold (\$ 2005 PPP)	MC size		MC growth (%)
		2011 (%)	2013 (%)	
3%	3.4	15.53	18.14	2.61
5%	2.8	24.28	29.44	5.56
10%	2.4	31.72	38.25	6.53
15%	2.1	39.09	46.93	7.83
20%	1.9	43.47	52.08	8.62
30%	1.7	48.96	58.55	9.59
40%	1.6	55.22	63.12	7.90

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

MC growth = MC size 2013 - MC size 2011.

López-Calva and Ortiz-Juarez (2014) defend the use of the 10% cutoff by the evidence that 10% of people fall into poverty every year according to Cruces, Lanjouw, et al. (2011). Zizzamia et al. (2016) explain that the use of 5% or less would be too demanding for the middle class and the 20% or more might not be enough to differentiate the vulnerable class from the middle class. This has sense since the risk of poverty for the non-poor is approximately 18% in Uganda. However, it could be possible to make an argument for the use of a probability cutoff between 5% and 15%. This choice makes the middle class oscillate approximately from 25% to 40% in 2011 and from 30% to 45% in 2013. This is

a substantial difference and implies that our middle-class calculations are sensitive to the risk of poverty cutoff.

Table 9: Effect of changing the upper bound in the probability distribution

Upper bound in the prob. of poverty	Threshold (\$ 2005 PPP)	MC size		MC growth (%)
		2011 (%)	2013 (%)	
0%	no bound	45.17	51.70	6.53
0.1%	8	37.79	44.71	6.92
1%	5.6	31.72	38.25	6.53

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

MC growth = MC size 2013 - MC size 2011.

Table 9 provides the effect of changing the upper bound of the middle class by changing the upper bound of the risk of poverty distribution. In the first row three cases are defined: the one without any bound, the one where the upper bound is defined by the top 0.1% of the risk distribution and the case that this paper contemplates, which is the upper cutoff calculated from the expenditure average of the top 1% of the risk of poverty distribution, also used by Zizzamia et al. (2016). The results obtained by the use of the different bounds are different from each other so the results are also sensitive to the choice of the risk distribution cutoff.

Furthermore, the estimation of the vulnerability bound depends on where I set the poverty line. There is no consensus among economists regarding where to set a poverty line that distinguishes the poor class from the other social classes. Table 10 displays different possible poverty lines that can be used for the case study of Africa and how they alter the results. The first row corresponds to the poverty line being equal to \$1.25 defined by the World Bank for international comparisons in Africa in 2005 (The World Bank, 2015) and used by Corral et al. (2015). The second row is the case considered in this paper, which is the lower bound of \$1.5 for the poverty line used by The Ugandan Bureau of Statistics (2016). The third row is \$1.7 and corresponds the upper bound calculated by The Ugandan Bureau of Statistics (2016). Then, I consider the poverty line of \$2 that was estimated by Banerjee and Duflo (2008).

Naturally, the higher the poverty line becomes, the lower the middle class share of the population is. The use of different poverty lines changes the results, which implies that the results are sensitive to the choice of the poverty line.

Even though the results are sensitive to the choices of the poverty line, the lower and upper bounds, the direction of the results remains unchanged. All results present a

Table 10: Effect of changing the upper bound in the probability distribution

Poverty Line (\$ 2005 PPP)	MC Thresholds (\$ 2005 PPP)	MC size		MC growth
		2011 (%)	2013 (%)	(%)
1.25	2-4.7	37.27	45.17	7.90
1.5	2.4-5.6	32.96	38.70	5.74
1.7	2.8-7	28.72	33.88	5.16
2	3.4-8.2	22	25.20	3.19

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

MC growth = MC size 2013 - MC size 2011.

positive growth of the middle class during the two periods, which lead me to the conclusion that the middle class has experienced an unambiguous increasing from 2011 to 2013.

## 6 Robustness Check

### 6.1 Model Specifications

As a robustness check, I investigate different model specification where I start with a regression model where the covariant matrix  $X$  only consists of the head of the household characteristics and I finish with the complete model I use for the analysis. Thus, Table 11 contains the bound that differentiates between the middle class and the vulnerable class for each model specification. Table 11 shows that the results are robust to the different model specifications since there are almost no differences between the estimated lower bounds from the different models. The coefficients of both the probit and the linear regressions can be found in Appendix A3, Tables VII and VIII.

Table 11: Model specification

Models:	MC Lower Bound (\$)
(1): HoH Characteristics	2.7
(2): (1) + standard of living variables	2.5
(3): (2) + variables measuring changes	2.4
(4): (3) + shocks	2.4

Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

HoH Characteristics contains age, sex, education, occupation sector and marital status.

## 6.2 Principal Component Analysis

The data does not contain a unique variable which captures the living standards of the households. To capture this effect, I use the variables that Shimeles and Ncube (2015) claim to be the absolute indicators of poverty in Africa in my main estimations. This set of variables consists of eight different indicators on sanitation of the household and assets held by them. To reduce the number of variables used in the regression, I conduct a Principal Component Analysis (PCA), which consists of estimating linear combinations from a large number of variables, capturing the common effect that they have on the explanatory variable. Using this PCA approach, two unique indicators are constructed and used to estimate a more parsimonious model as a robustness check.

Corral et al. (2015) also use this method for their robustness check to calculate an asset index following the methodology by Filmer and Pritchett (2001). First, a principal component (PC) for the living standard indicators and, second, a PC which contains the different shocks is constructed. From all possible linear combinations calculated, I keep the first one as it is the one that captures the greatest proportion of variance. The first PC for standard living conditions captures 27.57% of the variance and the first PC for shocks captures 15% of the variance. The variables used for the living standards and shocks can be found in Table 12 and Table 13, respectively. The Tables display the statistics of the variables used for each PCA and their scoring factors. The scoring factor is the weight of each variable used to calculate the first linear combination of the component analysis.

Table 12: Living standard variables for PCA

Statistic (in 2011)	Scoring Factor	Mean	St. Dev.
HH has piped water	0.42	0.04	1.49
HH has hand washing facility	0.34	0.11	1.21
Ownership of HH appliances	0.41	0.09	0.97
Ownership of a TV	0.49	0.114	0.92
Ownership of a radio	0.32	0.67	0.87
Ownership of a bicycle	0.09	0.45	0.81
Ownership of a motorcycle	0.17	0.08	0.77
Ownership of a mobile phone	0.38	0.64	0.70

Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014). Scoring factor is the weight assigned to each variable for the calculation of the first principal component. St. Dev. is the the standard deviations of the principal components. Mean is the mean of the variables.

Table 14 displays the lower middle class bound resulting from two models, one in which only the first PC using standards of living variables is considered and, another one, in



Table 13: Shock variables for PCA

Statistic (in 2011)	Scoring Factor	Mean	St. Dev.
Health shock	0.04	4.44	1.11
Death shock	-0.07	2.74	1.05
Dwelling shock	-0.55	3.07	0.01
Agriculture shock	-0.22	2.55	0.94
Economic shock	-0.53	1.96	0.97
Climate shock	-0.59	28.59	0.94
Other shocks	0.04	2.35	0.91

Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014). Scoring factor is the weight assigned to each variable for the calculation of the first principal component. St. Dev. is the the standard deviations of the principal components. Mean is the mean of the variables.

which both PCs explained above are included. The regression coefficients can be found in Appendix A3, Tables IX and X. The results obtained do not differ significantly from the ones obtained in the main model this paper contemplates. Furthermore, it offers evidence that more sparse model yields similar and robust results.

Table 14: Model using Principal Component Analysis

Models:	MC Lower Bound (\$)
(1): PCA using standards of living variables	2.37
(2): (1) + PCA using shocks variables	2.39

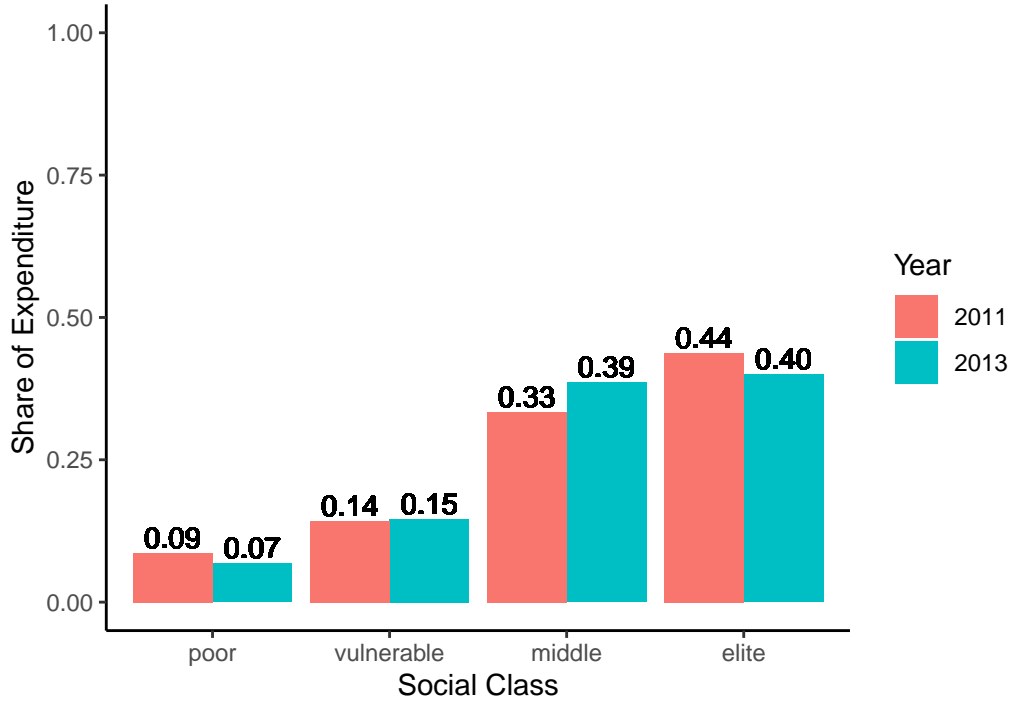
Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

## 7 Who is the Ugandan Middle Class?

The Ugandan middle class did not only experience a change in their demographic profile, as shown in Section 5.1, but also in their income. Taking the expenditure as a proxy of income, Figure 4 represents the share of expenditure by social class for each period. The middle class increased its expenditure by 6% from 2011 to 2013, the vulnerable class by 1%, the poor class decreased its consumption by 2% and the elite's decreases by 4%.

These results become more imminent when looking at the income distribution in Figure 5. The results show that the middle class increased in 2013 with respect to 2011. Furthermore, Figure 6 confirms improvements in the expenditure distribution, as the Lorenz curve moves toward the 45<sup>o</sup> line in 2013. Naturally, the Gini coefficient also becomes

Figure 4: Share of income/expenditure by social class



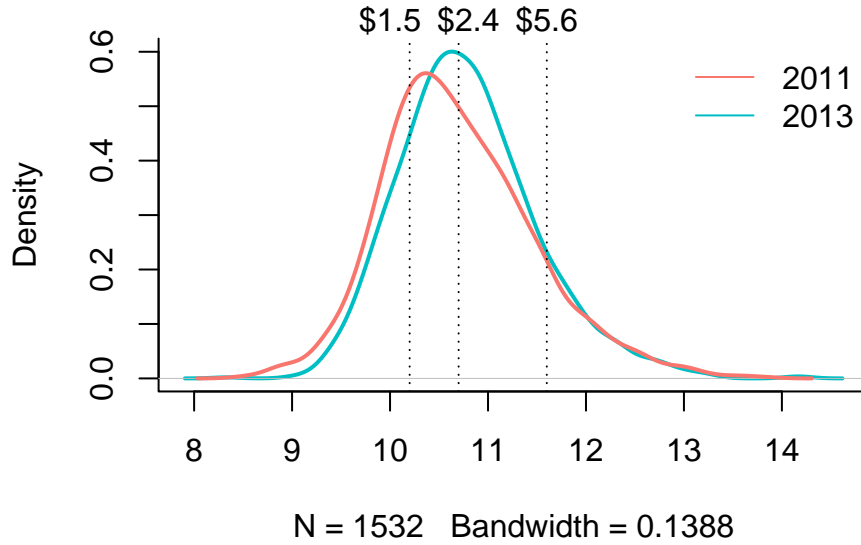
Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

smaller from 0.4579 in 2011 to 0.4232 in 2013.

Following López-Calva and Ortiz-Juarez (2014)'s steps, I estimate a two-sample t-test in order to observe how the socioeconomic characteristics of the middle class compare relative to other groups. Then, the null hypothesis is whether the difference between the mean of the social characteristics is equal to zero. Table XI which appears in Appendix A5 compiles all the t-test information relevant for the purpose. The first four columns contain the mean of the characteristics for each social class, while the three last columns contain the p-value obtained from the t-test. Firstly, the poor class is compared with the middle class, secondly, the vulnerable class against the middle class and, finally, the elite is compared with the middle class. I use a 95% confidence level to reject or not reject the null hypothesis.

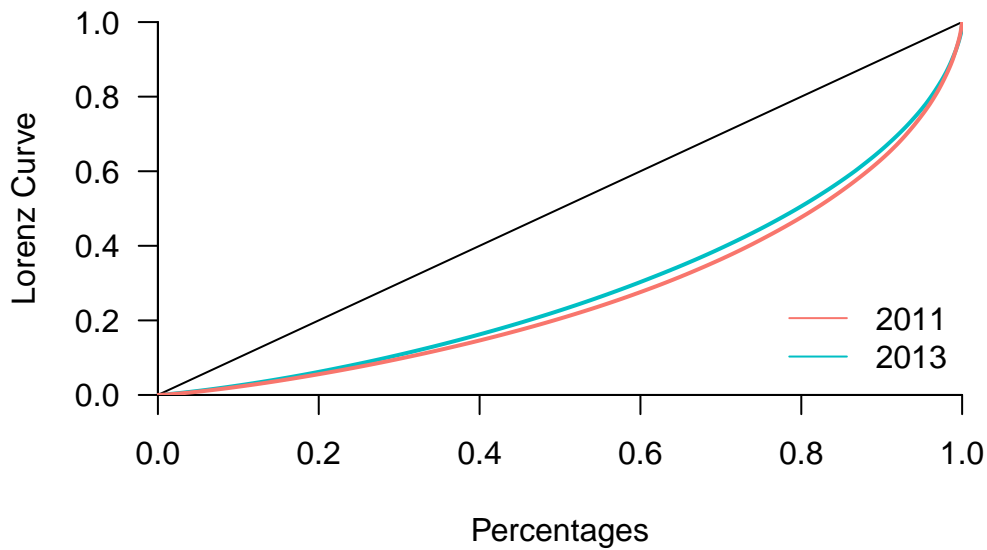
Regarding education, in general, there are significant differences between the poor and the middle class. Approximately 27% of HoHs considered poor are illiterate, considerably greater than the percentage of the other social clusters. In general, the poor class presents greater percentage values on lower levels of education, and the proportion of HoHs becomes greater in the middle class and the elite in higher levels of education. Nevertheless, the majority of the middle-class HoHs only achieves some primary or secondary level of

Figure 5: Kernel distribution of household expenditure



Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016). The \$1.5 line is the poverty line, \$2.4 is the lower middle class bound and \$5.6 is the upper middle class bound. The \$1.5 line is the poverty line, \$2.4 is the lower middle class bound and \$5.6 is the upper middle class bound. The x-axis is the logarithm of the expenditure in UGX prices. The y-axis presents the Kernel density calculated using a Gaussian Kernel and the bandwidth using Silverman's rule of thumb (Silverman, 1986).

Figure 6: Lorenz curves for each period



Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016). The x-axis denotes the percentiles of the Ugandan population.

education, while only a small percentage achieve further education. Around 5.4% achieve some secondary specialized training and only 1.35% attain a University degree, with those levels being significantly higher than the ones present in the poor and vulnerable class. Greater levels of further education are found in the elite cluster, around 10% more HoHs achieve secondary specialized training and a University degree than the middle class, being this difference significant.

Approximately 40% of the middle-class HoHs work in services, which is significantly higher than for the poor HoHs (11%) or the vulnerable HoHs (22%). However, still more than half of the HoHs in the middle class work in the primary sector. This structure changes when speaking about the elite cluster. Around 65% of the elite HoHs work in services and only 29% still work on agriculture.

Middle-class households have, in general, significantly better dwelling and sanitation characteristics than the poor and vulnerable households. Nevertheless, the proportion of households belonging to the middle class and having an independent house is not significantly different compared with all the other clusters. Furthermore, the difference between the number of rooms in a vulnerable and middle-class household is not significant. In addition, there is no evidence that there are more households with flush toilet facilities in the middle class than in the vulnerable and poor class. The middle-class households still have a higher percentage of households provided with electricity (15%) and piped water (3%). However, these values are significantly higher for elite households, as 50% have electricity and 22% have piped water. It is interesting that 94% of the poor households own their own residence, while only around 70% of the middle-class households and 68% elite households do. This phenomenon has sense if the poor households inherit their own residence from their ascendants, while the higher classes rent their residence as they moved from their birthplace looking for a better job or living conditions.

Generally, the percentage of household holding assets is significantly higher in the middle-class group, comparing to the vulnerable and poor class. Meanwhile, this proportion is even higher for elite households. It is interesting that a significantly smaller proportion of middle-class and elite households own a bicycle, comparing to the poor and vulnerable households. The intuition is that, when the households move to a better social class, they change their lifestyle using vehicles and motorcycles instead of the bike as their usual mode of transport. This offers some evidence of a change in the consumption path of the households when they become more rich.

The proportion of households that suffered a shock does not vary significantly among

groups. The proportion of households that suffered a climate shock during the last period is significantly lower in the middle-class cluster, and even lower in the elite cluster. One reason might be that the majority of the households in poor and vulnerable conditions work in the primary sector, so, if there is a flood or a drought, it affects more those households. The number of working members decreases in every group except for the elite, however, in the middle-class group this decrease is significantly lower. In addition, the number of residents decreases from 2011 to 2013 significantly more in the middle social class than in the vulnerable and poor class but less in comparison with the elite.

## 8 Conclusion

The identification of the new African middle class is important for understanding the changes in the African lifestyle and individual consumption paths. Moreover, the middle class is the main target for policy-makers and, thus, understanding their behavior is important to tailor possible policies. This paper contributes to the literature of the transformation of the global middle class by implementing a method based on vulnerability to identify the new middle class in Uganda. Specifically, this is the first paper that pursues the objective of identifying the middle class in Uganda after the drastic economic transformation that they suffered during the 70's-80's using a vulnerability approach. Their recovery from the civil war is considered one of the most successful in Africa. Moreover, the successful policies to increment schooling enrollment leave Uganda with an enrollment ratio for schooling higher than the African average. After those economic improvements, a growing middle class has appeared, having important consequences on the economic development and income distribution.

Using a regression-based methodology first employed by López-Calva and Ortiz-Juarez (2014), this identifies the new growing middle class in Uganda based on the households' vulnerability of falling into poverty in the future.

Using this method, the paper identifies the Ugandan middle class as those households with a daily expenditure power of more than \$2.4 and less than \$5.6 (2005 PPP). The households with less than \$1.5 per day expenditure are defined as poor. Those households whose expenditure is found between \$1.5 and \$2.4 in Uganda are called vulnerable. Finally, households with expenditure power greater than \$5.6 per day in Uganda are called rich households or elite.

This paper finds evidence that the middle class has increased their share of income

and population from 2011 to 2013. This increment also mirrors an improvement of the Ugandan income distribution, that is reflected in a reduction of the Gini coefficient. The Ugandan middle class is characterized by a significantly better education than the poor and vulnerable groups. Moreover, the proportion of household heads working in the service industry is also significantly greater, they have, in general, better living standard conditions than the poor and vulnerable social class.

The results show also significantly different middle-class households' behavior when comparing them with other social classes. For instance, a smaller share of households hold a bicycle and a greater share holds vehicles or motorcycles when comparing with vulnerable and poor households. That can be translated into a change in their behavior from cheap to more expensive means of transportation but, on the moment they have more expenditure power, they rather use a vehicle or a motorcycle than the bicycle. Moreover, they are also more likely to have a TV, a radio, a mobile phone and other household appliances. This is some evidence for a change in the household's consumption path when climbing in the social pyramid.

Therefore, even for a low-income country, like Uganda, it is possible to see an unambiguous growth of the size and a change in the consumption paths of the middle class. Furthermore, they start to mirror the ones from industrialized countries as they increase their energy and transport consumption. This might have a powerful impact on the environment and society, assuming the rest of low-income countries will follow the same track in their development process. Soon, more programs and interventions will be necessary to transform the middle-class consumption paths into more sustainable ones. For that reason, being able to identify the middle-class households is fundamental to measure their growth and the consequences this growth might have on the society. This paper contributes to that aim in identifying the middle-class in Uganda according to the households' vulnerability to poverty.

# Appendix

## A1 Classification of the definitions of the middle class

Table I: Popular definitions of the MC based on income/consumption

Type of method	Author	Definition Middle Class $x \in MC \leftrightarrow$
Cumulative Distribution	(Alesina & Perotti, 1996)	$D_t^{-1}(p_{50}) \leq y(x) \leq D_t^{-1}(p_{80})$
	(Partridge, 1997)	$D_t^{-1}(p_{50}) \leq y(x) \leq D_t^{-1}(p_{60})$
	(Barro, 1999) (Easterly, 2001)	$D_t^{-1}(p_{20}) \leq y(x) \leq D_t^{-1}(p_{80})$
	(Solimano, 2009)	$D_t^{-1}(p_{30}) \leq y(x) \leq D_t^{-1}(p_{90})$
	(Palma, 2011)	$D_t^{-1}(p_{50}) \leq y(x) \leq D_t^{-1}(p_{90})$
	(Levy et al., 2014)(Finn et al., 2013)	$D_t^{-1}(p_{40}) \leq y(x) \leq D_t^{-1}(p_{70})$
	(Blackburn & Bloom, 1985)	$0.6 * D_t^{-1}(p_{50}) \leq y(x) \leq 2.25 * D_t^{-1}(p_{50})$
	(Wolfon, 1989)	$0.75 * D_t^{-1}(p_{50}) \leq y(x) \leq 1.5 * D_t^{-1}(p_{50})$
	(Davies & Hudson, 1992)	$0.5 * D_t^{-1}(p_{50}) \leq y(x) \leq 1.5 * D_t^{-1}(p_{50})$
	(Birdsall et al., 2011)	$0.75 * D_t^{-1}(p_{50}) \leq y(x) \leq 1.25 * D_t^{-1}(p_{50})$
Absolute	(Bhalla, 2007)	$y(x) \leq \$3900$ a year (2005 PPP)
	(Banerjee & Duflo, 2008)	$\$2 \leq y(x) \leq \$10$ a day (2005 PPP)
	(Ravallion, 2009)	$\$2 \leq y(x) \leq \$13$ a day (2005 PPP)
	(Nomura, 2009)	$\$6000 \leq y(x) \leq \$25000$ a year (2005 PPP)
	(Kohut, 2009)	$\$10 \leq y(x)$ a day (2005 PPP)
	(Kharas, 2010)	$\$10 \leq y(x) \leq \$100$ a day (2005 PPP)
	(Court & Narasimhan, 2010)	$\$16 \leq y(x) \leq \$82$ a day (2005 PPP)
	(African Development Bank (AfDB), 2011)	$\$2 \leq y(x) \leq \$20$ a day (2005 PPP)
	(Visagie & Posel, 2013)	$\$8 \leq y(x) \leq \$58$ a day (2005 PPP)
Mixed	(Birdsall, 2010)	$\$10 \leq y(x) \leq D_t^{-1}(p_{95})$ a day (2005 PPP)

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Note:  $D_t$  denotes the cumulative distribution and  $p_n$  is the  $n^{th}$  percentile.

It is used  $y$  to name the level of income or expenditure of the household  $x$ .

## A2 Characteristics of the Ugandan Households in 2011

Table II: Characteristics of HoH in Uganda (2011)

	Percentage/average
<b>Education of the HoH</b>	
Illiterate	18.28%
Some basic education	0.52%
Some primary education	53.72%
Some junior education	1.63%
Some secondary education	15.27%
Post primary/junior specialized training	4.30%
Post secondary specialized training	4.37%
University degree	1.89%
<b>Sector of Labor Activity</b>	
Primary	67.82%
Secondary	3.33%
Services	28.85%
<b>Marital Status of the HoH</b>	
Monogamously married	54.76%
Polygamously married	19.52%
Single	10.18%
Widowed	13.71%
Divorced	1.83%
<b>Other personal characteristics of HoH</b>	
Age	45.78
Male	68.15%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).



Table III: Standards of living in Uganda (2011)

	Percentage/average
Urban Area	18.73%
Number of regular residents	7.62
Independent residence	69.65%
Ownership of the residence	84.79%
Number of rooms in the residence	3.05
Electricity	10.12%
Piped water	4.44%
Flush toilet	1.04%
Hand washing	10.44%
Ownership of household appliances	9.2%
Ownership of TV	11.36%
Ownership of radio	67.43%
Ownership of bicycle	45.50%
Ownership of motorbike	8.03%
Ownership of vehicle	2.41%
Ownership of mobile phone	64.43%

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Table IV: Households that experienced shocks during 2011-2013

	Percentage/average
Health shock	4.44%
Death shock	2.74%
Dwelling shock	3.07%
Agriculture shock	2.55%
Economic shock	1.96%
Climate shock	28.59%
Other shocks	2.35%
Change in working members	-0.26
Change in number of residents	-2.14

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016)

## A3 Regression Tables

### Main Regressions

Table V: Results (all variables)

	<i>Dependent variable:</i>	
	Prob. Poverty	log(Expenditure)
	<i>probit</i> (1)	<i>OLS</i> (2)
Sex (male=1)	0.122 (0.141)	-0.077* (0.041)
Age	-0.040* (0.021)	0.0002 (0.006)
Squared Age	0.0004* (0.0002)	0.00002 (0.0001)
Education	-0.161*** (0.039)	0.066*** (0.010)
HoH in primary sector	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH in secondary sector	-0.100 (0.262)	0.060 (0.077)
HoH in services	-0.101 (0.135)	0.080** (0.037)
HoH monogamously married	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH polygamously married	-0.037 (0.122)	-0.061 (0.038)
HoH single	0.028 (0.193)	0.144*** (0.055)
HoH widowed	-0.006 (0.184)	0.062 (0.056)
HoH divorced	-1.073* (0.626)	0.165 (0.105)
Number of residents	0.189*** (0.020)	-0.058*** (0.006)
Living in independent HH	-0.287*** (0.107)	0.161*** (0.036)
HH owns their dwelling	0.438 (0.466)	0.235*** (0.079)
Number of rooms	-4.276 (265.843)	0.033 (0.144)
Urban area	-0.374* (0.213)	0.208*** (0.048)
HH has piped water	0.509** (0.198)	-0.123*** (0.047)
HH has flush toilet	-0.077* (0.041)	0.006 (0.011)
HH has hand-washing facilities	-0.524*** (0.176)	0.106*** (0.041)
HH has electricity	-4.374 (95.983)	0.242*** (0.071)
HH owns appliances	-0.115 (0.252)	0.149*** (0.056)
HH owns a TV	-0.092 (0.396)	0.275*** (0.066)
HH owns a radio	-0.267*** (0.101)	0.166*** (0.033)
HH owns a bicycle	-0.177* (0.100)	0.070** (0.031)
HH owns a motorcycle	-0.605** (0.244)	0.286*** (0.052)
HH owns a vehicle	-6.029 (175.022)	0.451*** (0.096)
HH owns a mobile phone	-0.196* (0.107)	0.223*** (0.035)
HH suffered a death shock	0.168 (0.262)	-0.007 (0.083)
HH suffered a climate shock	0.288*** (0.094)	-0.078** (0.032)
HH suffered a dwelling shock	-0.802** (0.351)	0.086 (0.079)
HH suffered a economic shock	-0.474 (0.313)	0.025 (0.099)
HH suffered an agricultural shock	-0.297 (0.309)	-0.094 (0.088)
HH suffered other shocks	0.302 (0.311)	0.047 (0.090)
Change in the number of residents	0.183*** (0.022)	-0.059*** (0.006)
Change in the working members	-0.055** (0.025)	0.054*** (0.008)
Central	. ( <i>omitted</i> )	. ( <i>omitted</i> )
East	0.754*** (0.150)	-0.259*** (0.042)
North	0.685*** (0.153)	-0.214*** (0.042)
West	0.060 (0.165)	-0.159*** (0.042)
Constant	-0.741 (0.523)	10.533*** (0.155)
Observations	1,532	1,532
R <sup>2</sup>		0.551
Adjusted R <sup>2</sup>		0.540

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Source: Author's calculations based on panel data from The Ugandan Bureau of Statistics (2014) and (2016).

Table VI: Results

	<i>Dependent variable:</i>	
	Prob. Poverty	log(Expenditure)
	<i>probit</i> (1)	<i>OLS</i> (2)
Sex (male=1)	0.113 (0.139)	−0.073* (0.041)
Age	−0.031 (0.021)	−0.0001 (0.006)
Squared Age	0.0003 (0.0002)	0.00003 (0.0001)
Education	−0.158*** (0.039)	0.070*** (0.010)
HoH in primary sector	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH in secondary sector	−0.082 (0.259)	0.061 (0.078)
HoH in services	−0.107 (0.133)	0.100*** (0.038)
HoH monogamously married	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH polygamously married	−0.072 (0.120)	−0.054 (0.038)
HoH single	0.020 (0.191)	0.141** (0.056)
HoH widowed	−0.009 (0.182)	0.055 (0.057)
HoH divorced	−1.082* (0.619)	0.164 (0.106)
Number of residents	0.179*** (0.019)	−0.059*** (0.006)
Living in independent HH	−0.291*** (0.107)	0.154*** (0.036)
HH has piped water	0.280 (0.428)	0.310*** (0.078)
HH has hand-washing facilities	−0.422** (0.211)	0.214*** (0.048)
HH owns their dwelling	0.543*** (0.195)	−0.130*** (0.047)
Number of rooms	−0.078* (0.040)	0.010 (0.011)
Urban area	−0.539*** (0.173)	0.124*** (0.041)
HH owns appliances	−0.163 (0.242)	0.204*** (0.055)
HH owns a TV	−0.422 (0.355)	0.427*** (0.057)
HH owns a radio	−0.260*** (0.101)	0.161*** (0.033)
HH owns a bicycle	−0.165* (0.099)	0.061** (0.031)
HH owns a motorcycle	−0.587** (0.242)	0.268*** (0.053)
HH owns a mobile phone	−0.201* (0.107)	0.224*** (0.035)
HH suffered a death shock	0.189 (0.262)	−0.018 (0.084)
HH suffered a health shock	0.076 (0.207)	0.011 (0.067)
HH suffered a climate shock	0.296*** (0.094)	−0.077** (0.032)
HH suffered a dwelling shock	−0.804** (0.351)	0.081 (0.080)
HH suffered a economic shock	−0.459 (0.313)	0.011 (0.100)
HH suffered an agricultural shock	−0.298 (0.306)	−0.089 (0.089)
HH suffered other shocks	0.321 (0.310)	0.051 (0.091)
Change in the number of residents	0.177*** (0.021)	−0.060*** (0.006)
Change in the working members	−0.047* (0.025)	0.052*** (0.008)
Central	. ( <i>omitted</i> )	. ( <i>omitted</i> )
East	0.776*** (0.149)	−0.262*** (0.043)
North	0.702*** (0.152)	−0.223*** (0.043)
West	0.061 (0.163)	−0.161*** (0.042)
Constant	−0.911* (0.520)	10.532*** (0.157)
Observations	1,532	1,532
R <sup>2</sup>		0.541
Adjusted R <sup>2</sup>		0.530

Note:

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

## Model Specifications

Table VII: Model specification (linear regression)

	<i>Dependent variable:</i>			
	log(Expenditure)			
	(1)	(2)	(3)	(4)
Sex (male=1)	−0.075 (0.048)	−0.075* (0.043)	−0.068 (0.041)	−0.073* (0.041)
Age	0.001 (0.007)	−0.001 (0.007)	−0.001 (0.006)	−0.0001 (0.006)
Squared Age	0.00004 (0.0001)	0.0001 (0.0001)	0.00004 (0.0001)	0.00003 (0.0001)
Education	0.168*** (0.011)	0.081*** (0.011)	0.072*** (0.010)	0.070*** (0.010)
HoH in primary sector	(omitted)	(omitted)	(omitted)	(omitted)
HoH in secondary sector	0.165* (0.090)	0.074 (0.080)	0.068 (0.078)	0.061 (0.078)
HoH in services	0.346*** (0.040)	0.121*** (0.039)	0.107*** (0.037)	0.100*** (0.038)
HoH monogamously married	(omitted)	(omitted)	(omitted)	(omitted)
HoH polygamously married	−0.057 (0.045)	−0.042 (0.039)	−0.057 (0.038)	−0.054 (0.038)
HoH single	0.133** (0.063)	0.178*** (0.058)	0.154*** (0.056)	0.141** (0.056)
HoH widowed	0.141** (0.066)	0.105* (0.058)	0.058 (0.057)	0.055 (0.057)
HoH divorced	0.142 (0.123)	0.206* (0.110)	0.159 (0.106)	0.164 (0.106)
Number of residents		−0.030*** (0.005)	−0.060*** (0.006)	−0.059*** (0.006)
Living in independent HH		0.165*** (0.037)	0.165*** (0.036)	0.154*** (0.036)
HH has piped water		0.361*** (0.080)	0.305*** (0.078)	0.310*** (0.078)
HH has hand-washing facilities		0.218*** (0.050)	0.214*** (0.048)	0.214*** (0.048)
HH owns their dwelling		−0.152*** (0.049)	−0.138*** (0.047)	−0.130*** (0.047)
Number of rooms		0.012 (0.011)	0.010 (0.011)	0.010 (0.011)
Urban area		0.138*** (0.042)	0.130*** (0.041)	0.124*** (0.041)
HH owns appliances		0.218*** (0.057)	0.199*** (0.055)	0.204*** (0.055)
HH owns a TV		0.452*** (0.058)	0.436*** (0.056)	0.427*** (0.057)
HH owns a radio		0.160*** (0.035)	0.163*** (0.033)	0.161*** (0.033)
HH owns a bicycle		0.054* (0.032)	0.059* (0.031)	0.061** (0.031)
HH owns a motorcycle		0.264*** (0.054)	0.269*** (0.053)	0.268*** (0.053)
HH owns a mobile phone		0.206*** (0.036)	0.225*** (0.035)	0.224*** (0.035)
HH suffered a death shock				−0.018 (0.084)
HH suffered a health shock				0.011 (0.067)
HH suffered a climate shock				−0.077** (0.032)
HH suffered a dwelling shock				0.081 (0.080)
HH suffered a economic shock				0.011 (0.100)
HH suffered an agricultural shock				−0.089 (0.089)
HH suffered other shocks				0.051 (0.091)
Change in the number of residents			−0.062*** (0.006)	−0.060*** (0.006)
Change in the working members			0.053*** (0.008)	0.052*** (0.008)
Central	(omitted)	(omitted)	(omitted)	(omitted)
East	−0.567*** (0.046)	−0.314*** (0.043)	−0.255*** (0.042)	−0.262*** (0.043)
North	−0.533*** (0.045)	−0.264*** (0.043)	−0.221*** (0.042)	−0.223*** (0.043)
West	−0.304*** (0.047)	−0.196*** (0.043)	−0.158*** (0.042)	−0.161*** (0.042)
Constant	10.433*** (0.177)	10.382*** (0.160)	10.523*** (0.157)	10.532*** (0.157)
Observations	1,532	1,532	1,532	1,532
R <sup>2</sup>	0.353	0.504	0.538	0.541
Adjusted R <sup>2</sup>	0.348	0.496	0.529	0.530
Residual Std. Error	0.625 (df = 1518)	0.550 (df = 1505)	0.531 (df = 1503)	0.531 (df = 1496)
F Statistic	63.765*** (df = 13; 1518)	58.921*** (df = 26; 1505)	62.467*** (df = 28; 1503)	50.282*** (df = 35; 1496)

Note:

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Table VIII: Model specification (probit)

	<i>Dependent variable:</i>			
	Prob. Poverty			
	(1)	(2)	(3)	(4)
Sex (male=1)	0.136 (0.120)	0.127 (0.131)	0.125 (0.137)	0.113 (0.139)
Age	−0.011 (0.018)	−0.026 (0.020)	−0.027 (0.020)	−0.031 (0.021)
Squared Age	0.00003 (0.0002)	0.0002 (0.0002)	0.0002 (0.0002)	0.0003 (0.0002)
Education	−0.239*** (0.032)	−0.179*** (0.037)	−0.168*** (0.038)	−0.158*** (0.039)
HoH in primary sector	(omitted)	(omitted)	(omitted)	(omitted)
HoH in secondary sector	−0.262 (0.233)	−0.204 (0.254)	−0.126 (0.255)	−0.082 (0.259)
HoH in services	−0.425*** (0.111)	−0.114 (0.127)	−0.129 (0.131)	−0.107 (0.133)
HoH monogamously married	(omitted)	(omitted)	(omitted)	(omitted)
HoH polygamously married	−0.023 (0.108)	−0.075 (0.114)	−0.052 (0.119)	−0.072 (0.120)
HoH single	−0.133 (0.166)	−0.049 (0.180)	0.009 (0.189)	0.020 (0.191)
HoH widowed	−0.151 (0.163)	−0.139 (0.172)	−0.006 (0.180)	−0.009 (0.182)
HoH divorced	−1.225** (0.579)	−1.273** (0.618)	−0.990 (0.607)	−1.082* (0.619)
Number of residents		0.081*** (0.014)	0.179*** (0.019)	0.179*** (0.019)
Living in independent HH		−0.311*** (0.102)	−0.335*** (0.104)	−0.291*** (0.107)
HH has piped water		0.191 (0.402)	0.332 (0.422)	0.280 (0.428)
HH has hand-washing facilities		−0.398** (0.197)	−0.448** (0.210)	−0.422** (0.211)
HH owns their dwelling		0.562*** (0.187)	0.563*** (0.193)	0.543*** (0.195)
Number of rooms		−0.055 (0.038)	−0.067* (0.039)	−0.078* (0.040)
Urban area		−0.572*** (0.163)	−0.558*** (0.171)	−0.539*** (0.173)
HH owns appliances		−0.267 (0.235)	−0.129 (0.238)	−0.163 (0.242)
HH owns a TV		−0.685** (0.348)	−0.498 (0.351)	−0.422 (0.355)
HH owns a radio		−0.263*** (0.096)	−0.261*** (0.099)	−0.260*** (0.101)
HH owns a bicycle		−0.177* (0.095)	−0.180* (0.098)	−0.165* (0.099)
HH owns a motorcycle		−0.627*** (0.233)	−0.589** (0.239)	−0.587** (0.242)
HH owns a mobile phone		−0.116 (0.101)	−0.203* (0.105)	−0.201* (0.107)
HH suffered a death shock				0.189 (0.262)
HH suffered a health shock				0.076 (0.207)
HH suffered a climate shock				0.296*** (0.094)
HH suffered a dwelling shock				−0.804** (0.351)
HH suffered a economic shock				−0.459 (0.313)
HH suffered an agricultural shock				−0.298 (0.306)
HH suffered other shocks				0.321 (0.310)
Change in the number of residents			0.177*** (0.021)	0.177*** (0.021)
Change in the working members			−0.050** (0.025)	−0.047* (0.025)
Central	(omitted)	(omitted)	(omitted)	(omitted)
East	1.118*** (0.128)	0.884*** (0.140)	0.744*** (0.144)	0.776*** (0.149)
North	1.034*** (0.124)	0.786*** (0.143)	0.666*** (0.148)	0.702*** (0.152)
West	0.224 (0.142)	0.201 (0.152)	0.050 (0.159)	0.061 (0.163)
Constant	−0.517 (0.445)	−0.478 (0.488)	−0.891* (0.509)	−0.911* (0.520)
Observations	1,532	1,532	1,532	1,532
Log Likelihood	−649.800	−594.347	−555.199	−545.416
Akaike Inf. Crit.	1,327.599	1,242.694	1,168.399	1,162.832

Note:

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

## Regressions using Principal Component Analysis

Table IX: Results (PCA with standards of living)

	<i>Dependent variable:</i>	
	Prob. Poverty	log(Expenditure)
	<i>probit</i> (1)	<i>OLS</i> (2)
Sex (male=1)	0.026 (0.136)	−0.023 (0.042)
Age	−0.038* (0.020)	0.003 (0.007)
Squared Age	0.0003* (0.0002)	−0.00001 (0.0001)
Education	−0.165*** (0.038)	0.082*** (0.010)
HoH in primary sector	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH in secondary sector	−0.079 (0.257)	0.063 (0.079)
HoH in services	−0.104 (0.131)	0.115*** (0.038)
HoH monogamously married	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH polygamously married	−0.082 (0.117)	−0.044 (0.039)
HoH single	0.005 (0.190)	0.138** (0.057)
HoH widowed	−0.023 (0.181)	0.069 (0.058)
HoH divorced	−0.964 (0.608)	0.124 (0.108)
Number of rooms	−0.119*** (0.038)	0.041*** (0.011)
HH owns their dwelling	0.401** (0.191)	−0.062 (0.046)
PCA living standard	−0.400*** (0.088)	0.168*** (0.011)
number of residents	0.173*** (0.018)	−0.052*** (0.006)
Urban area	−0.438*** (0.169)	0.094** (0.042)
HH suffered a death shock	0.231 (0.257)	0.006 (0.086)
HH suffered a health shock	0.018 (0.205)	0.034 (0.068)
HH suffered a climate shock	0.341*** (0.092)	−0.103*** (0.032)
HH suffered a dwelling shock	−0.864** (0.349)	0.126 (0.081)
HH suffered a economic shock	−0.470 (0.312)	0.040 (0.102)
HH suffered an agricultural shock	−0.258 (0.305)	−0.071 (0.091)
HH suffered other shocks	0.350 (0.308)	0.046 (0.093)
Change in the number of residents	0.172*** (0.021)	−0.054*** (0.007)
Change in the working members	−0.043* (0.025)	0.049*** (0.008)
Central	. ( <i>omitted</i> )	. ( <i>omitted</i> )
East	0.858*** (0.147)	−0.303*** (0.043)
North	0.814*** (0.146)	−0.289*** (0.042)
West	0.114 (0.161)	−0.161*** (0.042)
Constant	−1.349*** (0.515)	10.775*** (0.158)
Observations	1,532	1,532
R <sup>2</sup>		0.541
Adjusted R <sup>2</sup>		0.530

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

Table X: Results (PCAs with living standards and shocks)

	<i>Dependent variable:</i>	
	Prob. Poverty	log(Expenditure)
	<i>probit</i> (1)	<i>OLS</i> (2)
Sex (male=1)	0.029 (0.134)	−0.020 (0.042)
Age	−0.034* (0.020)	0.002 (0.007)
Squared Age	0.0003 (0.0002)	0.00000 (0.0001)
Education	−0.176*** (0.037)	0.085*** (0.010)
HoH in primary sector	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH in secondary sector	−0.138 (0.253)	0.067 (0.079)
HoH in services	−0.129 (0.129)	0.120*** (0.038)
HoH monogamously married	. ( <i>omitted</i> )	. ( <i>omitted</i> )
HoH polygamously married	−0.063 (0.116)	−0.047 (0.039)
HoH single	−0.013 (0.189)	0.148*** (0.057)
HoH widowed	−0.023 (0.178)	0.072 (0.058)
HoH divorced	−0.844 (0.592)	0.123 (0.108)
Number of rooms	−0.112*** (0.038)	0.041*** (0.011)
HH owns their dwelling	0.400** (0.188)	−0.063 (0.046)
PCA living standard	−0.403*** (0.086)	0.168*** (0.011)
number of residents	0.174*** (0.018)	−0.052*** (0.006)
Urban area	−0.464*** (0.168)	0.099** (0.042)
PCA shocks	−0.009 (0.038)	0.024* (0.013)
Change in the number of residents	0.172*** (0.021)	−0.055*** (0.007)
Change in the working members	−0.046* (0.024)	0.049*** (0.008)
Central	. ( <i>omitted</i> )	. ( <i>omitted</i> )
East	0.830*** (0.143)	−0.306*** (0.042)
North	0.793*** (0.141)	−0.294*** (0.041)
West	0.112 (0.157)	−0.168*** (0.042)
Constant	−1.317*** (0.503)	10.771*** (0.157)
Observations	1,532	1,532
R <sup>2</sup>		0.517
Adjusted R <sup>2</sup>		0.508

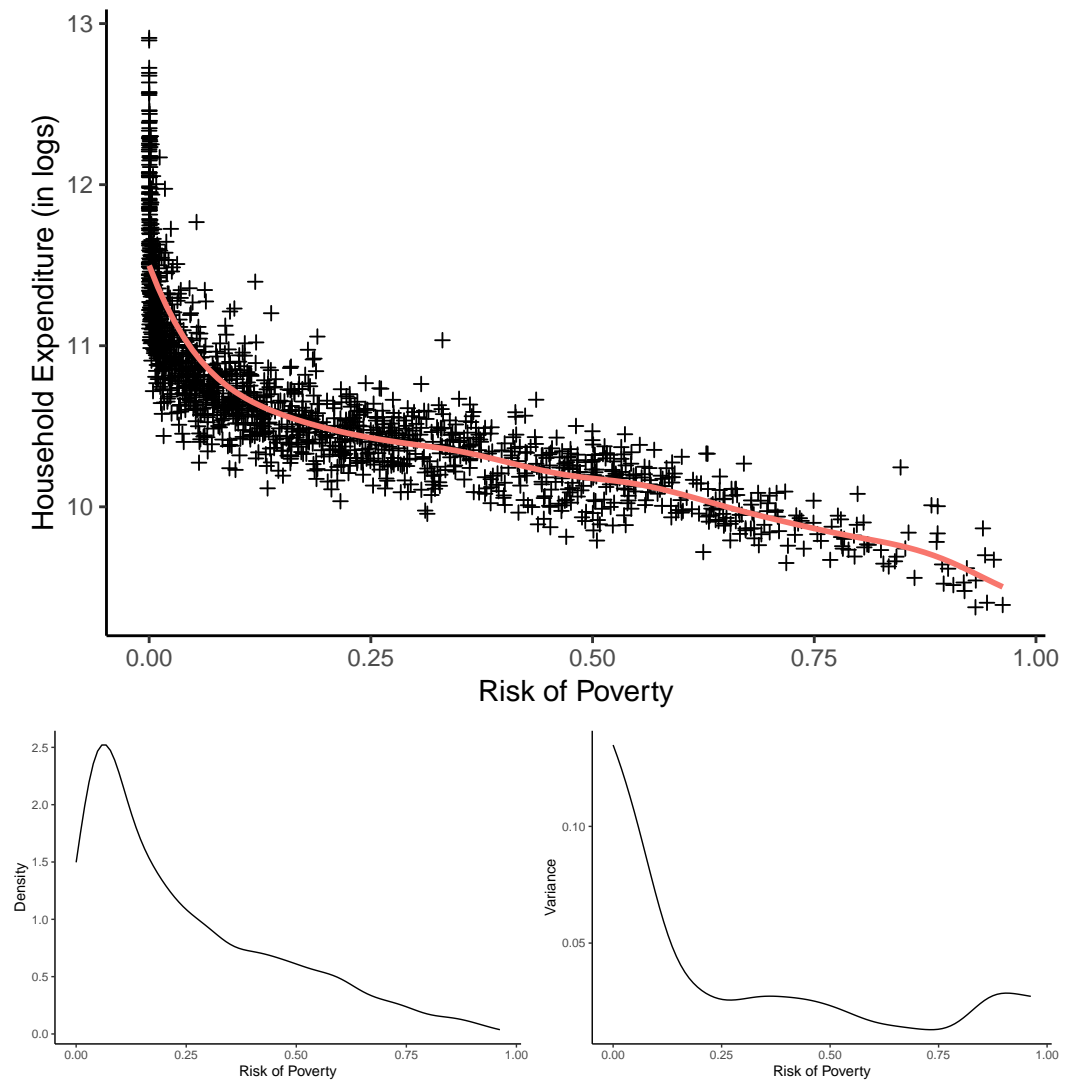
Note:

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).

## A4 Local Linear Regression

Figure X: Local linear regression results



Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics. The method used is local linear regression, using a Gaussian Kernel and the Silverman's rule of thumb to calculate the bandwidth (Silverman, 1986). The first graph presents the estimated risk of poverty against the estimated household expenditure. The red line local polynomial fit. The second and third graph are the prob. of falling into poverty density and variance estimations from the local linear estimations.



## A5 Comparing the middle class with the rest of the social classes

Table XI: Welch Two Sample t-test for mean comparison among social groups

	Mean by social class				P-value of $H_0$ among groups		
	Poor <\$1.5	Vulnerable \$1.5-\$2.5	Middle \$2.5-5.6	Elite >\$5.6	PC/MC	VC/MC	EC/MC
<b>Education of the HoH</b>							
Illiterate	27.18%	17.25%	14.37%	6.00%	0.000	0.078	0.000
Some basic education	0.84%	0.15%	0.61%	0.57%	0.126	0.878	0.759
Some primary education	60.14%	61.37%	49.02%	28.57%	0.000	0.000	0.000
Some junior education	0.99%	1.83%	2.58%	1.43%	0.016	0.268	0.361
Some secondary education	8.17%	13.28%	21.87%	31.71%	0.000	0.000	0.000
Post primary/junior specialized training	2.39%	3.21%	4.79%	6.29%	0.000	0.086	0.021
Post secondary specialized training	0.28%	2.29%	5.40%	14.29%	0.000	0.004	0.000
University degree	0.00%	0.62%	1.35%	11.14%	0.000	0.016	0.000
<b>Labor Activity</b>							
Primary	86.20%	74.05%	55.04%	28.86%	0.000	0.000	0.000
Secondary	2.53%	3.82%	3.32%	5.71%	0.372	0.230	0.113
Services	11.27%	22.13%	41.65%	65.43%	0.000	0.000	0.000
<b>Dwelling and Sanitation characteristics</b>							
Urban Area	7.46%	11.91%	24.44%	49.71%	0.000	0.000	0.000
Number of regular residents	7.74	7.75	7.29%	7.42%	0.000	0.000	0.036
Independent residence	59.44%	72.52%	70.15%	67.74%	0.966	0.053	0.544
Ownership of the residence	93.66%	89.16%	73.83%	64.00%	0.000	0.000	0.260
Number of rooms in the residence	2.62	2.93	3.02	3.50	0.000	0.512	0.000
Electricity	0.42%	1.22%	14.99%	51.71%	0.000	0.000	0.000
Piped water	0.42%	1.22%	3.44%	22.28%	0.000	0.007	0.000
Flush toilet	0.28%	0.30%	0.86%	8.28%	0.187	0.177	0.000
Hand washing	3.38%	6.72%	11.92%	30.86%	0.000	0.000	0.000
Ownership of household appliances	2.82%	4.12%	10.81%	37.53%	0.000	0.000	0.000
Ownership of TV	0.14%	3.05%	14.99%	52.00%	0.000	0.000	0.000
Ownership of radio	48.17%	66.41%	77.76%	82.57%	0.000	0.000	0.008
Ownership of bicycle	40.56%	46.41%	44.84%	31.43%	0.204	0.276	0.000
Ownership of motorbike	1.13%	6.11%	13.39%	13.43%	0.000	0.000	0.943
Ownership of vehicle	0.14%	0.30%	1.72%	15.43%	0.000	0.000	0.000
Ownership of mobile phone	41.27%	60.92%	77.15%	92.29%	0.000	0.000	0.000
<b>Suffer a shock withing periods</b>							
Health shock	4.10%	4.49%	5.35%	2.91%	0.370	0.554	0.118
Death shock	2.90%	3.07%	3.13%	0.55%	0.773	0.799	0.003
Dwelling shock	2.05%	2.74%	4.11%	3.40%	0.067	0.260	0.645
Agriculture shock	2.73%	3.24%	2.06%	1.94%	0.504	0.280	0.920
Economic shock	3.19%	1.00%	1.85%	1.46%	0.198	0.279	0.703
Climate shock	40.09 %	31.17%	23.97%	10.19%	0.000	0.016	0.000
Other shocks	1.14%	2.74%	2.26%	4.37%	0.183	0.651	0.183
Change in working members	-0.44	-0.45	-0.21	0.36	0.042	0.036	0.000
Change in number of residents	-1.43	-2.06	-2.43	-3.10	0.000	0.078	0.019

Source: Author's calculations based on panel survey data from The Ugandan Bureau of Statistics (2014) and (2016).  
 $H_0$  is true if the difference of the means are equal to 0. The p-value is obtained from using a Welch Two Sample t-test.

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I hereby confirm that the work presented has been performed and interpreted solely by myself except for where I explicitly identified the contrary. I assure that this work has not been presented in any other form for the fulfillment of any other degree or qualification. Ideas taken from other works in letter and in spirit are identified in every single case.

Signature: \_\_\_\_\_

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Bonn, 30/10/2018