Identification and rural-urban decomposition of vulnerability to poverty in Togo

By

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Abstract

This paper estimates household vulnerability to poverty and assesses its rural-urban disparity using the 2018-2019 Togolese Harmonized Households Living Standards Survey. We consider vulnerability as expected poverty and appeal to the three-step feasible generalized least squares (FGLS) method and the Oaxaca-Blinder decomposition approach to estimate household vulnerability to poverty and assess its rural-urban disparity, respectively. We find that about 41% of Togolese are poor, while up to 62% are vulnerable to poverty. We also find that household size, being a female head, being unemployed, and facing a natural covariate shock are among factors that increase the risk of households falling into poverty. More interestingly, we find a significant rural-urban disparity in vulnerability to poverty among households of about 0.289 log points - with 63% of the gap explained by household endowments and 37% attributable to returns to endowments. These findings are consistent with poverty alleviation interventions that target vulnerable segments of the population.

Keywords: Poverty, Vulnerability to poverty, Rural-urban disparity, FGLS, Oaxaca-Blinder, Togo

1 Introduction

Sustainable Development Goal 1 (SDG 1) focuses on "Ending poverty in all its forms everywhere" with the specific goal of increasing the resilience of the poor and those in vulnerable situations as well as reducing their exposure and vulnerability to climate-related extreme events and other economic, social, and environmental shocks and disasters, by 2030 (United Nations, 2015). This global effort is materialized towards attaining substantial progress in reducing poverty and vulnerability. Poverty is described as living below the minimal level necessary by society, which is normally determined by one's need for food and other necessities to subsistence below minimum, socially acceptable living standards, which are typically established based on nutritional requirements and other basic goods.

Vulnerability typically refers to stress and contingencies, as well as difficulty coping with them. Another definition of vulnerability includes "a human condition or process resulting from physical, social, economic, and environmental factors, that determine the likelihood and scale of damage from the impact of a given hazard" (Kamanou & Morduch, 2002). Because poverty makes people more susceptible to various shocks, including diseases, natural disasters like earthquakes, and volcanic eruptions, their susceptibility to these shocks makes them even more vulnerable to further shocks. In other words, poverty and vulnerability are interconnected in a way that makes each cause the other (Philip & Rayhan, 2004).

In 2016, the monetary poverty rate in Togo was reported at 53.5%. Togo had a rural poverty rate of 68.7% compared to the urban poverty rate of 35.9% (INSEED-Togo, 2015), meaning that over two-thirds of rural households are below the poverty line. Poverty in Togo appears to be a rural phenomenon. The rural-urban difference in poverty or vulnerability to poverty is an important topic for developing countries such as Togo, where more than half of the population (57%) still lives in rural areas (INSEED-Togo, 2022), lacking infrastructure in health, education, electricity, transportation, drinking water, and sanitation. Residing in rural or urban areas, Togolese households frequently experience a variety of shocks such as climate, job loss, health risks, pests, commodity price shocks, political unrest, conflict, and other risk factors. These shocks impact the well-being of the individuals and households as well as their level of poverty.

In terms of climate shock, flood damage in West Africa, particularly in Togo, has increased significantly over the last two decades. Poor communities are more vulnerable, particularly in

rural areas with limited access to services and infrastructure (Komi et al., 2016). The most important climatic threats confronting Togo are flooding, drought, poor rain distribution, late l, violent winds, and coastal erosion. The most recent severe flooding happened in 2007 and 2008, with heavy rains causing extreme flooding in the northern Savannah, southern Maritime, and Central regions in 2008. The 2008 floods destroyed 11,688 hectares of cultivated land, resulting in significant income loss for farmers and a spike in food shortages throughout the region (UNITED NATIONS & OCHA, 2008).

Furthermore, 300 kilometers of road and eleven major bridges were destroyed, including the main bridge that connects the capital Lomé to the rest of the country, raising transportation costs. Food security deteriorated as flood-related prices escalated, and inflation rates increased from 1% in 2007 to 9.1% in 2008 (World Bank, GFDRR, & ISDR, 2011). In addition to obvious environmental implications such as soil degradation and biodiversity loss, the socioeconomic consequences of these events can be observed (World Bank, GFDRR, & Climate Change Team, 2011). Moreover, the COVID-19 health shock is another recent shock that households have experienced. According to the World Bank, the COVID-19 pandemic caused a drop in production and sales in a variety of sectors in Togo, particularly those where working remotely is not possible, such as manufacturing, retail trade, construction, and tourism. Approximately 62% of jobs are at risk, with 49% in the service sector and 13% in the industrial sector (World Bank, 2020).

These shocks have an effect on the well-being of the household/individual and their level of poverty. Despite the fact that statistics on ex-post poverty are widely available in Togo, studies on the level of ex-ante poverty are still lacking. Ex-post poverty studies have focused on the dynamic of non-monetary poverty in Togo, which decreased by 21% between 2006 and 2015 (Djahini-Afawoubo & Couchoro, 2020). Another study on multidimensional poverty, in which a composite index of non-monetary poverty index has been carried out in recent years in Togo (Noglo, 2017). Moreover, some authors focus on the decomposition of poverty over a short period (Ametoglo & Guo, 2016; Couchoro & Dout, 2019). Despite the growing body of poverty analysis work in Togo and the usefulness of knowledge related to the risk of households or individuals falling into poverty, to the best of our knowledge, studies engaging household vulnerability to poverty are yet to be materialized in Togo. In other words, Existing study on household and individual vulnerability to poverty in Togo is at best inexistent. Thus, there is a

lack of a current vulnerability profile for Togo. In this study, we attempt to fill this gap by identifying and studying urban-rural disparities in vulnerability to poverty.

The key objective of this paper is, therefore, to identify and study the urban-rural differences in vulnerability to poverty in Togo. More precisely, we calculate the household vulnerability index and analyze the rural-urban disparities in vulnerability to poverty. To achieve these objectives, this study provides an empirical analysis of household vulnerability to poverty in Togo based on the "Expected Poverty" approach (Chaudhuri et al., 2002) and analyses the rural-urban disparities with the Oaxaca Blinder decomposition. The findings show that the vulnerable population in Togo is found to be larger than the number of currently poor people and, a significant disparity in vulnerability to poverty between rural and urban households.

The assessment of vulnerability to poverty is necessary in Togo for the following reasons. It's crucial to focus on who is likely to be poor, how likely they are to be poor, and how poor they are likely to be rather than just focus on who is now poor. When considering policy actions that can only be made in the future to increase well-being, a static approach to well-being is of limited benefit. The distinction between ex-ante poverty prevention measures and ex-post poverty alleviation initiatives is made by analyzing vulnerability to poverty. For instance, using a public health analogy, just an attempt to stop a disease epidemic involves both treating those who have the condition and taking preventive measures directed at those who are at risk, plans for reducing poverty must include both alleviation and prevention measures. Hence, this analysis can help with both the development of suitable social protection policies and the spatial targeting of programs to reduce poverty. Policies and interventions must target not only those who are already poor but also those who are at risk of becoming poor and those who are already in poverty.

The remainder of this paper is organized as follows. The next section provides a brief review of existing studies on household vulnerability to poverty. In Section 3 we focus on the methodology and data followed by section 4 where the empirical results and a discussion analysis are presented. Finally, section 5 concludes the paper.

2 Theoretical and empirical review on vulnerability to poverty

2.1 Theoretical review

Several studies have attempted to conceptualize vulnerability to poverty. Fujii (2016) classifies vulnerability definitions into three groups based on a literature assessment of the concepts and measurement of vulnerability to poverty: the welfare approach, the expected poverty method, and the axiomatic approach. *The welfarist approach*: this approach, developed by Ligon and Schechter (2003) and Elbers and Gunning (2003), measures vulnerability based on explicit welfare foundations. Ligon and Schechter (2003) analytical framework is fixed. Elbers and Gunning (2003), on the other hand, define vulnerability in the framework of a Ramsey model with income and asset shocks. Their vulnerability measure is similar to Ligon and Schechter's (2003) measure, but the error term is taken as the individual's welfare, which is the sum of the present-discounted instantaneous utility over an infinite time horizon.

Expected poverty approach: Another way to assess poverty vulnerability is to consider vulnerability as expected poverty. In this approach, vulnerability measures the likelihood of an individual falling into poverty over a given time horizon. As a result, in the expected poverty approach, the time horizon is inherently relevant. The most influential idea of using expected poverty measures to analyze vulnerability is based on Jalan and Ravallion's (2000) work, which examines the marginal impact of a random variable influencing individual welfare on societal poverty. (Chaudhuri et al., 2002) define vulnerability as the ex-ante risk that a household, if currently non-poor, will fall below the poverty line or, if currently poor, will remain poor.

Axiomatic Approach: This method derives a vulnerability measure from a set of axioms that list the properties of an ideal vulnerability measure. Calvo & Dercon (2005, 2007, 2013) make seminal contributions to deriving vulnerability measures from axioms. They considered vulnerability as the magnitude of poverty's threat and the consequent feeling of insecurity.

Apart from the classification made by Fujii, other authors have attempt to define vulnerability in different ways. Zhang & Wan, (2008) define vulnerability by comparing predicted vulnerability and actual poverty. Furthermore, **Kamanou and Morduch (2004)** develop a general empirical framework that combines Monte Carlo and bootstrap statistical techniques, a nonparametric technique for calculating the standard error. Furthermore, Gallardo (2018) finds that two key elements stand out in identifying vulnerable individuals: an expected level of well-

being below the poverty line and a relevant risk of falling into poverty due to a downside deviation from a reference level of well-being.

2.2 Empirical Review

The economic literature has extensively covered the unidimensional view of accessing vulnerability to poverty. Starting with the link between poverty and vulnerability, Philip & Rayhan, (2004) investigate how poverty and vulnerability can be related, and they discover that vulnerability is another universal aspect of poverty that makes it particularly painful and difficult to escape. Using Household Income and Expenditure Survey data from 2005, Azam & Imai (2011) estimate the ex-ante poverty and vulnerability of households in Bangladesh. Their findings show that the vulnerable population in Bangladesh is significantly larger than the number of poor people. According to their findings, those without education or from agricultural households are more vulnerable, and the geographical diversity of vulnerability is significant. Mba et al. (2021) investigate risk exposure in urban and rural areas, as well as its impact on household vulnerability to poverty in Nigeria. Their findings show that exposure to risks such as job loss, business failure, harvest failure, livestock death, dwelling demolition, increases and decreases in input and output prices, and other similar risks significantly drive households into poverty, but these risks differ across rural and urban households, both in characteristics and regions.

Moreover Chaudhuri et al. (2002) use cross-section data from Indonesia to assess household vulnerability to poverty; their findings show that the fraction of the population that faces a non-negligible risk of poverty is significantly greater than the fraction that is observed to be poor. Instead of examining the relationship between poverty and vulnerability, other scholars have attempted to specifically determine a population's vulnerability to poverty. Jadotte, (2010) uses a short panel structure of nested data at different levels to determine poverty vulnerability in Haiti (hierarchical modeling approach). The findings show that vulnerability is primarily a rural phenomenon in Haiti and that education has a negative correlation with vulnerability. In the same direction (Jha, Dang, & Tashrifov, 2010) use household level panel data from 2004 and 2005 to examine the profile of poverty and vulnerability in Tajikistan. They discover that one-half of non-poor households are vulnerable to poverty. Some authors emphasized factors that contribute to poverty and make people vulnerable to poverty, focusing on the impact of shocks to examine the possible drivers of poverty and vulnerability to poverty.

By analyzing the brief literature above, some conclusions can be highlighted: (i) No studies, to the best of our knowledge, have tried to investigate the issues of vulnerability to unidimensional

poverty in Togo. (ii) Some studies have tried to explore the issues of poverty in Togo (Djahini-Afawoubo & Couchoro, 2020; Noglo, 2017; *Couchoro* & Dout, 2019) but the analysis was on ex post poverty. (iii) Although some studies do examine the vulnerability to poverty in developing countries, no studies to the best of our knowledge have investigated how Togolese household behave with regard to vulnerability to poverty. Thus, this paper will allow us to fill these gaps in the literature by examining Urban- Rural vulnerability to poverty in Togo.

3 Empirical strategy

3.1 Methods

Two different methods will be used for our methodology. The first method is based on the calculation of vulnerability to monetary poverty measure developed specifically for cross-section data by Chaudhuri (2003) , Chaudhuri et al. (2002). Secondly, the Oaxaca-Blinder decomposition of Oaxaca (1973) and Blinder (1973) will be use to explain the urban-rural disparities in household vulnerability to poverty.

3.1.1 Vulnerability to poverty as expected poverty method

Considering Chaudhuri (2003), for a given household *h* the vulnerability is defined as the probability of its consumption being below poverty line at time *t+1*: $V_{ht} = \Pr(\ln c_{h,t+1} < \ln \underline{c})$ where V_{ht} is vulnerability of household *h* at time *t*, $c_{h,t+1}$ denote the consumption of household *h* at time *t*+1 and $\underline{c}$ stands for the poverty line of household consumption.

Assuming that for household *h* the data generation process for consumption is captured by the following equation: $\ln c_h = X_h \beta + \varepsilon_h$ (1)

where c_h stands for per capita consumption expenditure for household *h*, X_h represents a vector of observable household characteristics (containing both idiosyncratic and community elements), β is a vector of parameters, and ε_h is a mean-zero disturbance term that captures household's idiosyncratic factors (shocks) contributing to differential level of per capita consumption for households that share the same characteristics.

Consumption expenditures, c_h is assumed to be log-normally distributed and as such the disturbance term, ε_h will be distributed normally. The vulnerability to poverty of household, h with characteristics X_h can now be calculated using the coefficient estimates of the equation (1) in the following manner:

$$\hat{V}_h = \hat{\Pr}(\ln c_h < \ln \underline{c} \mid X_h) = \Phi\left(\frac{\ln \underline{c} - X_h \hat{\beta}}{\hat{\sigma}}\right) \qquad (2)$$

where $\hat{V}_h$ denotes vulnerability to poverty, that is the probability that the per capita consumption level (c_h) will be lower than the poverty line ($\underline{c}$) conditional on household characteristics X_h. Meanwhile, Φ(.) denotes the cumulative density of the standard normal distribution and $\hat{\sigma}$ is the standard error of the equation (1).

Households future consumption is further assumed to be dependent upon uncertainty about some idiosyncratic and community characteristics. To have consistent estimates of parameters, it is necessary to allow heteroskedasticity, that is, variances of the disturbance term to vary. This can take the following functional form:

$$\sigma^2_{e,h} = Z_h\theta = \sum_i \sum_{j \geq i} X^i_h X^j_h \theta_{ij} + \eta_h \qquad (3)$$

A three-step Feasible Generalized Least Squares (FGLS) procedure can be used to estimate the parameter θ. Equation (1) is first estimated using an ordinary least squares (OLS) procedure. Then, the estimated residuals from the equation (1) are used to estimate the following equation, again by OLS

$$\hat{e}^2_{ols,h} = Z_h\theta + \eta_h = \sum_i \sum_{j \geq i} X^i_h X^j_h \theta_{ij} + \eta_h \qquad (4)$$

The estimate from above is then used to transform the equation (4) into the following:

$$\frac{\hat{e}^2_{ols,h}}{Z_h \hat{\theta}_{ols}} = \left(\frac{Z_h}{Z_h \hat{\theta}_{ols}}\right)\theta + \frac{\eta_h}{Z_h \hat{\theta}_{ols}} \qquad (5)$$

This transformed equation is estimated using OLS to obtain an asymptotically efficient FGLS estimate, $\hat{\theta}_{FGLS}$. $Z_h \hat{\theta}_{FGLS}$ is a consistent estimate of $\sigma^2_{e,h}$, which is the variance of the idiosyncratic component of household consumption.

This is then used to transform the equation (1) into:

$$\frac{\ln c_h}{\sqrt{Z_h \hat{\theta}_{FGLS}}} = \left(\frac{X_h}{\sqrt{Z_h \hat{\theta}_{FGLS}}} \right) \beta + \frac{e_h}{\sqrt{Z_h \hat{\theta}_{FGLS}}} \qquad (6)$$

OLS estimation of the equation (6) yields a consistent and asymptotically efficient estimate of β. The standard error of the estimated coefficient, $\hat{\beta}_{FGLS}$, can be obtained by dividing the reported standard error by the standard error of the regression. Finally, the estimates of β and θ obtained through this FGLS method can be used to estimate the vulnerability to poverty of household *h* through the following generalization of the equation (2):

$$\hat{V}_h = \Phi\left(\frac{\ln \underline{c} - X_h \hat{\beta}}{\sqrt{\sum_i \sum_{j \geq i} X_h^i X_h^j \hat{\theta}_{ij}}} \right) \qquad (7)$$

Clearly, estimation of vulnerability to poverty depends on the following elements: the distributional assumption of normality of log consumption, the choice of poverty line $\underline{c}$, the expected level of log consumption and the expected variability of log consumption. The higher the level of expected consumption and expected consumption variability the lower the vulnerability is.

A merit of this vulnerability measure is that it can be estimated with cross section data and the dataset that will be used in the case of this study is a cross section data.

3.1.2 The Oaxaca-Blinder decomposition method

Initially, it was introduced by Oaxaca (1973) and Blinder (1973) to investigate gender wage gaps in the labor market. In the case of our study, we used Oaxaca-Blinder (OB) decomposition to explain what factors contributed to rural-urban disparities in vulnerability to poverty in Togo. The Oaxaca-Blinder decomposition method is widely used to explain how much of the difference in mean outcomes across two groups is due to group differences in the levels of explanatory variables and how much is due to differences in the magnitude of regression coefficients. The OB model is a counterfactual method with an assumption that "Rural households had the same characteristics as their Urban counterparts". In our study, we used the vulnerability to poverty value calculated previously, and based on the OB model, we divided

the vulnerability to poverty gap between rural and urban areas into two main components schematically as follows:

$$\bar{Y}_r - \bar{Y}_u = (\bar{X}'_r - \bar{X}'_u)\hat{\beta}_r + \bar{X}'_r(\hat{\beta}_r - \hat{\beta}_u) \quad (8)$$

where $\bar{Y}_u$ and $\bar{Y}_r$ were the average outcome variables (vulnerability to poverty) for urban and rural; X is the explanatory variable; $\hat{\beta}_r$ and $\hat{\beta}_u$ denote the coefficients of explanatory variables for urban and rural, respectively. Therefore, the rural-urban average vulnerability to poverty gap can be attributed to two parts: explained part (due to differences in the levels of explanatory variables) and unexplained part (due to differences in the coefficients).

3.2 Estimation Technique

In this study, vulnerability is understood as the probability of households to be poor in the near future. Therefore, the measurement of vulnerability requires estimating the mean and variance of consumption by using Amemiya's (1977) Feasible Generalized Least Square (FGLS) methodology in three stages.

For the OB decomposition, we use the detailed decomposition of Jann (2008), in which we can determine the relative contribution of each variable to each one of the explained and unexplained components. However, the majority of our independent variables are categorical; therefore, we face the identification problem; that is, for categorical variables as predictors, the decomposition estimates depend on the choice of the base or the omitted category. To deal with this problem, we adopt the solution proposed by Yun (2005) by computing normalized effects. It is equivalent to averaging the coefficient effects of a set of dummy variables while changing the reference groups.

3.3 Data

The Harmonized Survey on Households Living Standards 2018-2019 (EHCVM 2018/19) in Togo will be used to assess vulnerability to poverty. The Togo EHCVM 2018/19 is the first edition of a nationally representative household survey carried out within the West African Economic Monetary Union (WAEMU) Household. The National Institute of Statistics, Economical Studies, and Demography (INSEED) is implementing the Togo EHCVM 2018/19 with assistance from the World Bank and the WAEMU Commission. The EHCVM is a nationally representative survey of 6,100 households that are also geographically representative, with 2270 from urban areas and 3901 from rural areas. Education, health,

employment, finances (savings and credits), food security, housing, household assets, shocks and survival strategies, agriculture, and other topics were covered in the Togo EHCVM 2018/19.

variables

Dependent variable: the outcome variable is the log of the household annual per adult equivalent consumption expenditure in francs CFA. *Explanatory variables:* the explanatory variables related to household characteristics include sex, age, educational level, marital status, employment status, household size, household hygienic condition, and household using a certain number of assets. The details related to the different variables are shown in table 1.

Choice of vulnerability threshold

After calculating the probability of falling into poverty associated to each Togolese household included in the sample, the next task is to divide the Togolese population (sample) into two groups (those that are vulnerable and those that are not). This requires choosing a level of vulnerability as the threshold, such that a household is considered vulnerable only if its vulnerability level exceeds it. Although the ultimate decision is somewhat arbitrary, various logical choices are available (Chaudhuri, 2003). We use the vulnerability threshold of 0.5 ($V_n = 0.5$) and the time horizon of t+2 commonly used in most of the empirical studies related to vulnerability to poverty. Based on the formula for the probability of falling into poverty in a given year, $V^* = 1 - \sqrt[n]{1 - V_n}$. V^* here is equal to 0.29. This implies that if the probability of household is higher than or equivalent to 29%, the household is said to fall below the poverty line in a given year. Due to the fact that we are using only one cross-section data for our analysis, we choose a time horizon of t+1 and maintain the probability threshold at 29%. A household in this study is vulnerable to poverty if its probability is equal to or higher than 29%.

Table 1: Variables

Dependent variable		
Name	Variable Type	Description
Log(Consumption)/ log(pcexp)	Continuous	**Log of consumption expenditure per adult equivalent** CFA Franc (BCEAO)
hhzise	Continuous	Household size
hgender	binomial	Head of household gender(1=male, 2=female)
Age group	Ordered	15-29, 30-44, 45-64 and 65+
Location	binomial	Household location (1=Urban, 2=Rural)

HH_education	multinomial	Head of household education level (1=none, 2=primary, 3=secondary 1, 4=secondary 2, 5=university)
HH_marital status	multinomial	Head of household marital status (1=single, 2=married/cohabited, 3=divorce/separate, 4=widow)
Electricity _usage	Dummy	Household using electricity (0=No, 1=Yes)
mobile phone usage	Dummy	Household using mobile phone (0=No, 1=Yes)
Clean_sanitation	Dummy	Household using clean sanitation (0=No, 1=Yes)
HH employment status	binomial	Head of household employment status (1=employ, 2=not employ)
House_owner	binomial	Household is the owner of the house (1=Yes, 2=No)

Source: authors elaboration

4 Results

4.1 Descriptive analysis

The descriptive statistics are given in tables 2 and 5. It appears that the average log of household consumption per adult is 12.7, and the heads of households are, on average, 44 years old. Specifically, the rural heads of household are on average older (46 years old) than the urban heads of households (43 years old). The average household size in rural areas (5) is higher than that in urban areas (4). Regarding the gender of the head of household, 73% are male and only 27% are female.

In general, the number of households living in rural areas is relatively higher (63%) than those living in urban areas (37%). The education level of the head of household reveals a huge rural-urban disparity; about 48% of the rural households have no education compared to the urban areas where only 19% of the heads of household are not educated. In terms of access to electricity, more than half the households (58%) in our sample do not have access to electricity, but this access is not equitable across locations; when 81% of the urban households have access to electricity, only 19% of the rural household are using electricity. Similarly, only a quarter (25%) of households have access to clean sanitation; this lack of access is more severe in rural areas (8%) but relatively less in Urban areas (54%).

Agriculture remains the major activity of the household in our sample; 49% of households are working in the agriculture sector. This rate is higher in rural areas (71%). Overall, there are some differences in household characteristics with respect to location, which justify our second objective, that is to study the rural-urban disparities in vulnerability to poverty.

Table 2 summary of descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Log of consumption expenditure per adult equivalent	6,171	12.70	0.70	10.38	15.71
hage	6,171	44.42	14.94	15	105
hsize	6,171	4.44	2.71	1	31
hhgender					
male	6,171	0.73	0.44	0	1
female	6,171	0.27	0.44	0	1
location					
Rural	6,171	0.63	0.48	0	1
Urban	6,171	0.37	0.48	0	1
hh age group					
15-29	6,171	0.17	0.37	0	1
30-44	6,171	0.38	0.48	0	1
45-64	6,171	0.35	0.48	0	1
65 et plus	6,171	0.11	0.31	0	1
hh_education					
None	6,171	0.37	0.48	0	1
Primary	6,171	0.25	0.43	0	1
Secondary 1	6,171	0.22	0.42	0	1
Secondary2	6,171	0.09	0.29	0	1
University	6,171	0.06	0.24	0	1
HH_marital status					
single	6,171	0.10	0.30	0	1
married/cohabited	6,171	0.69	0.46	0	1
divorce/separate	6,171	0.07	0.25	0	1
widow	6,171	0.14	0.35	0	1
electricity_usage					
No	6,171	0.58	0.49	0	1
Yes	6,171	0.42	0.49	0	1
mobile phone usage					
No	6,171	0.17	0.38	0	1
Yes	6,171	0.83	0.38	0	1
clean_sanitation					
No	6,171	0.75	0.43	0	1
Yes	6,171	0.25	0.43	0	1
HH employment status					
employ	6,171	0.87	0.33	0	1
not employ	6,171	0.13	0.33	0	1
House_owner					
yes	6,171	0.50	0.50	0	1
no	6,171	0.50	0.50	0	1
HH sector activity					
Agricultural activity	5,610	0.49	0.50	0	1
Non-agricultural activity	5,610	0.51	0.50	0	1

Source: authors calculation

4.2 Vulnerability to poverty estimate

Table 3 presents the results of the regression, whereby the log of per adult expenditure consumption and the variance are estimated by household idiosyncratic characteristics and other determinants. The poverty line of 750 Francs CFA (West Africa) per day will be used in our study. The results of the estimation show that household size has a negative and significant effect on consumption, which implies that the larger the household size, the lower the per capita consumption. The age of the head of household has a positive and significant effect on log per adult consumption.

The female head coefficient is negative and significantly related to per adult consumption, implying that female-head consumption is relatively low compared to the consumption of the male head. This can be explained by the fact that female headed households seem to be less educated and have fewer employment opportunities to earn decent income to protect their household's consumption. Considering the location of the household, we find that the urban household has a positive and significant effect on per adult consumption compared to the rural household. This can be explained by the fact that the rural heads have less diversify jobs opportunities as the majority of them (71.01%) are working in the agricultural sector, which is regularly perturbate by climate change hence, generates less income.

Compared to the base category 'head of household with no education level', the rest of the dummies on education (primary, secondary1, secondary2, university) are found to affect the consumption per adult positively and significantly. Moreover, the head of household's marital status plays a significant role in per adult consumption. Compared to the single household head, the married/cohabited, divorced/separated and widow household heads have lower per capita consumption as their coefficients are negative and significant. This is explained by the fact that the size of the households that are not single may be larger and negatively impact consumption. In addition, the variables: using electricity, use a mobile phone and have a clean sanitation have a positive and significant effect on per-adult expenditure. Finally, heads of households that are not employed and do not live in their own house have lower per capita consumption than those who are employed and live in their own house.

Table 3 Estimates of vulnerability as expected poverty

Variable	Log of consumption expenditure per adult equivalent	Variance
hhsize	-0.0992***	0.0020
	(0.0030)	(0.0025)
hage	0.0037***	0.0003
	(0.0006)	(0.0005)
hhgender		
female	-0.1013***	-0.0185
	(0.0204)	(0.0162)
Location		
urban	0.0494***	0.0162
	(0.0189)	(0.0152)
hh_education		
Primary	0.0202	-0.0087
	(0.0183)	(0.0147)
Secondary 1	0.0697***	0.0080
	(0.0207)	(0.0167)
Secondary2	0.1399***	-0.0097
	(0.0279)	(0.0225)
University	0.4672***	0.0931***
	(0.0380)	(0.0307)
HH_marital status		
married/cohabited	-0.2278***	-0.0708***
	(0.0283)	(0.0225)
divorce/separate	-0.1626***	-0.0188
	(0.0387)	(0.0311)
widow	-0.2830***	-0.0761***
	(0.0364)	(0.0291)
electricity_usage		
Yes	0.2641***	-0.0545***
	(0.0179)	(0.0143)
Mobile phone usage		
Yes	0.2662***	-0.0136
	(0.0201)	(0.0163)
clean_sanitation		
Yes	0.2344***	0.0638***
	(0.0194)	(0.0156)
HH employment status		
Not employed	-0.1105***	0.0293
	(0.0222)	(0.0178)
House_owner		
No	-0.0617***	-0.0174
	(0.0158)	(0.0127)
Constant	12.7920***	0.3430***
	(0.0405)	(0.0326)
Observations	6171	6171
R-squared	0.3955	0.0118
ajusted	.3939523	.0092353
Prob>F	0	2.77e-09

Source : Authors computation

Notes: * $p<0.1$; ** $p<0.05$; *** $p<0.01$, standards error in parenthesis

A summary statistic of vulnerability to poverty, the probability of becoming poor, is presented in table 4. On average, households in Togo had a 40% probability of falling into poverty. According to Chaudhuri et al. (2002), the mean of the vulnerability should be close to the estimated poverty in order to get the right vulnerability to poverty estimates. In the case of our analysis, the mean vulnerability is 40%, which is close to the estimated poverty rate of 41.21%. It's important to highlight that on average, rural households had a 51% probability of falling into poverty, while urban households had only a 22% probability of falling into poverty.

As stated in the methodology, the probability related to the vulnerability threshold that was used in our study is 0.29, which means that a household is considered vulnerable if its estimated probability exceeds or equals 0.29. The results show that the total vulnerability to poverty for our sample is much higher than the estimates of poverty as shown in figure 1, which justifies the importance of forward-looking poverty analysis. This indicates that the current poverty estimates might be underestimated. The share of vulnerable households is 62%; that is, 62% of households in Togo have a 29% or higher probability of falling below the poverty line in the next year, while the non-vulnerable account for 38%. Regarding poverty decomposition, 41.26% of households are poor, while 58.74% are non-poor.

By detailing poverty and vulnerability rates with respect to selected household characteristics, as shown in figure 2, it appears that among the households living in rural areas, 83% are vulnerable to poverty; in contrast, only 27% of the households in urban areas are vulnerable to poverty. The distribution of poverty vulnerability across the 6 regions of Togo presented in figure 3 reveals a great disparity among them. The most vulnerable region is the savannah, which has the highest proportion (85%) of the households are vulnerable. The second region that has a high number of vulnerable people is the plateau region (71%). The region with the lower proportion of vulnerable households is the capital, Lomé.

Table 4: Summary of estimated Vulnerability to poverty

Vulnerability to poverty	**Mean**	**Standard Deviation**	**Min**	**Max**	**Observations**
Overall	0.4003	0.2452	0.0086	0.9999	6,171
Rural	0.5064	0.2147	0.0140	0.9999	3,901
Urban	0.2179	0.1778	0.0086	0.9954	2,270

Source: authors calculation

Figure 1: Poverty and Vulnerability

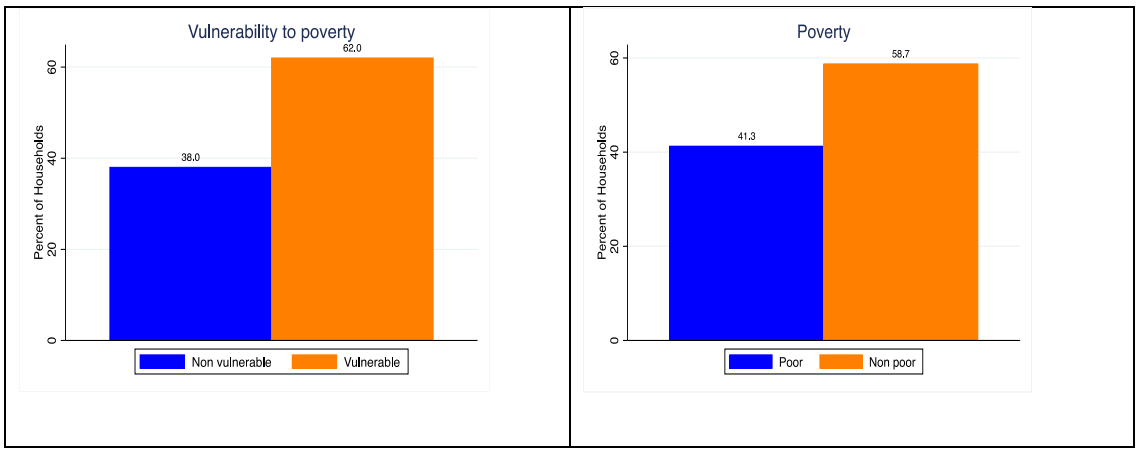


Figure 2: Vulnerability Status by location

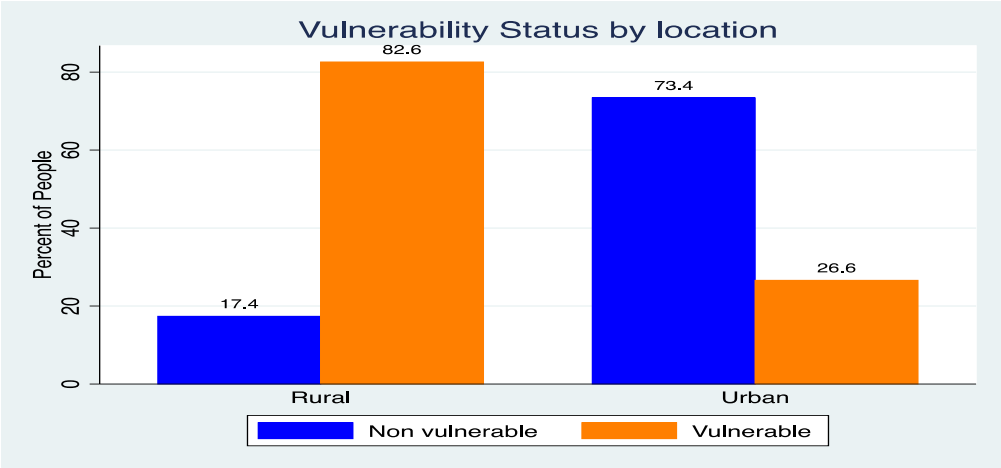
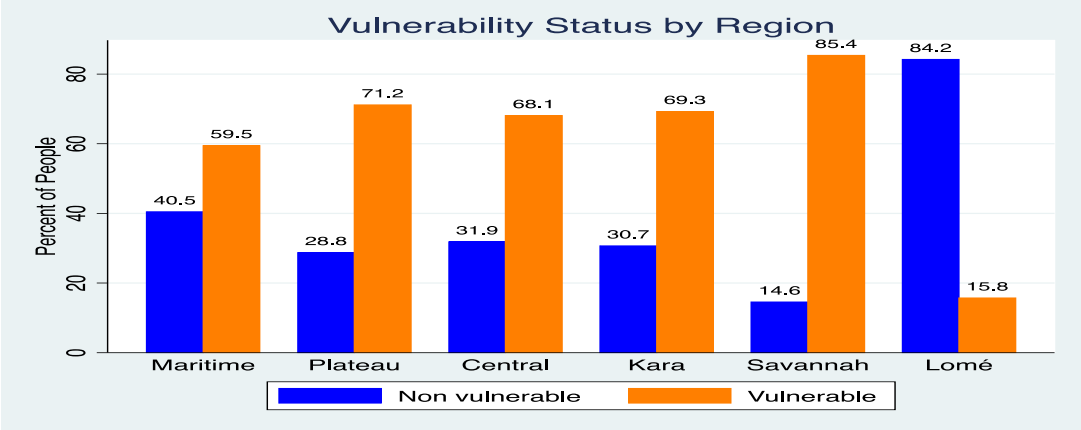


Figure 3: Vulnerability status by Region



4.3 Determinants of vulnerability to poverty

Table 5 presents the results of the determinants of vulnerability to poverty. The second column refers to the overall sample results, while columns 3 and 4 show, respectively, the regression results for households living in rural and urban areas. The overall as well as the rural and urban results show that the different characteristics of Households have a significant effect on their vulnerability level.

We find that the larger the household size, the higher its probability of falling into poverty in the near future. The households in which the head is female are more likely to have a high vulnerability to poverty rate compared to the male household's head. Households with older members (30-44, 45-64 and 65+) are less vulnerable to poverty compared to households with younger members which implies that the youth will have a high rate of vulnerability to poverty. Moreover, being educated irrespective of the education level, reduces significantly the probability of being vulnerable to poverty, contrary to those who are not educated. Furthermore, the head of household who has access to electricity, uses a mobile phone, and uses clean sanitation has a low probability of falling into poverty in the near future compared to those who do not have access. Finally, being unemployed and not leaving your own house increases the probability of being poor in the near future compared to those who are employed or leaving their own house. With reference to those who are single, the married/cohabited, divorced/separate and widow experience a higher rate of vulnerability to poverty.

The most important takeaways from the OLS regression models are by that controlling for the different households' characteristics, the urban rural disparity in vulnerability to poverty seemed to be much greater than the gap in the descriptive analysis. The different coefficients of the two group are significantly different. The determinants of vulnerability included in the models have a strong association with vulnerability. These patterns provide strong justification to use the Oaxaca-Blinder decomposition technique to better understand which factors help explain the urban-rural vulnerability to poverty disparity.

Table 5 Estimates of the determinants of vulnerability to poverty Rural vs Urban

Vulnerability to poverty	(1) Whole Sample	(2) Rural	(3) Urban
hhsize	0.0563***	0.0572***	0.0534***
	(0.0003)	(0.0003)	(0.0005)
hhgender			
female	0.0479***	0.0606***	0.0347***
	(0.0019)	(0.0023)	(0.0027)
hh age group			
30-44	-0.0159***	-0.0186***	-0.0093***
	(0.0021)	(0.0023)	(0.0032)
45-64	-0.0509***	-0.0567***	-0.0341***
	(0.0023)	(0.0024)	(0.0036)
65+	-0.0915***	-0.1027***	-0.0580***
	(0.0030)	(0.0031)	(0.0052)
hh_education			
primary	-0.0172***	-0.0105***	-0.0207***
	(0.0018)	(0.0018)	(0.0032)
secondary 1	-0.0488***	-0.0426***	-0.0479***
	(0.0020)	(0.0021)	(0.0032)
secondary 2	-0.0890***	-0.0894***	-0.0828***
	(0.0027)	(0.0033)	(0.0038)
university	-0.1296***	-0.1906***	-0.1201***
	(0.0032)	(0.0055)	(0.0040)
HH_marital status			
married/cohabited	0.0577***	0.1185***	0.0125***
	(0.0026)	(0.0034)	(0.0034)
divorce/separate	0.0316***	0.0713***	0.0139***
	(0.0035)	(0.0044)	(0.0048)
widow	0.0903***	0.1475***	0.0488***
	(0.0034)	(0.0041)	(0.0047)
electricity_usage			
Yes	-0.1887***	-0.1837***	-0.1557***
	(0.0016)	(0.0019)	(0.0026)
mobile phone usage			
Yes	-0.1659***	-0.1666***	-0.1506***
	(0.0019)	(0.0018)	(0.0045)
clean_sanition			
Yes	-0.1088***	-0.1230***	-0.0915***
	(0.0017)	(0.0027)	(0.0021)
HH employment status			
not employ	0.0574***	0.0640***	0.0469***
	(0.0021)	(0.0023)	(0.0031)
House_owner			
No	0.0287***	0.0393***	0.0265***
	(0.0015)	(0.0016)	(0.0025)
shock_idiosyncratic_demographic			
Yes	0.0004	-0.0012	0.0030
	(0.0013)	(0.0014)	(0.0021)
Shock covariate_natural			
Yes	0.0034**	-0.0001	-0.0042
	(0.0017)	(0.0016)	(0.0036)
shock_covariate economic			
Yes	0.0001	-0.0018	0.0029
	(0.0018)	(0.0018)	(0.0034)
Constant	0.3683***	0.3125***	0.3474***
	(0.0033)	(0.0039)	(0.0063)
Observations	6171	3901	2270
R-squared	0.9580	0.9598	0.9318
ajusted	.9578607	.9595853	.9311754

Prob>F	0	0	0

* $p<0.1$; ** $p<0.05$; *** $p<0.01$, standards error in parenthesis

Source: Authors computation

4.4 Oaxaca Blinder decomposition results

The results of the Oaxaca Blinder analysis are given in Table 7 and shown graphically in Figure 4. It summarizes the findings of the Oaxaca-Blinder detailed decomposition analysis of the vulnerability to poverty disparity by comparing households residing in rural areas to households residing in urban areas. The coefficients of the variables represented the absolute contribution of each variable to the total vulnerability difference, or gap. Subsequently, these coefficients represent the absolute contribution to the explained gap under the explained detail and also the absolute contribution to the unexplained gap under the unexplained details. To facilitate the interpretation, the percentage contribution to the total gap and the explained gap are calculated.

Overall, the rural-urban disparity in vulnerability to poverty accounts for 0.2885 units. Of this aforementioned difference, the decomposition analysis shows that the explained gap accounts for (0.1828) 63.4% of the total vulnerability gap. which means that around 63.4% of rural urban disparity in vulnerability to poverty can be explained by differences in household characteristics between the two areas. In other words, if the rural households were similar to their urban counterparts, in terms of the characteristics that are considered in our analysis, the rural-urban disparity in vulnerability to poverty would decrease from 0.2885 to 0.1056. The unexplained part, which might be due to discrimination, represented (0.1056) 36.6% of the total vulnerability gap. More than half of the vulnerability disparity is due to differences in household's characteristics between the two areas.

Our findings show that the most contributing variables to the total rural-urban disparity in vulnerability to poverty are household size (20.76%), the head of household education level (13.73%), use of a mobile phone (12.34%), usage of clean sanitation (20.49%), and marital status (2.98). Those variables are also the main contributors to the explained part of the total gap. Variables such as the age of the head of household, age square, the gender of the head of household, the head of household's employment status, and households living in their own house have a significant and negative contribution to the total gap of rural and urban vulnerability to poverty disparity.

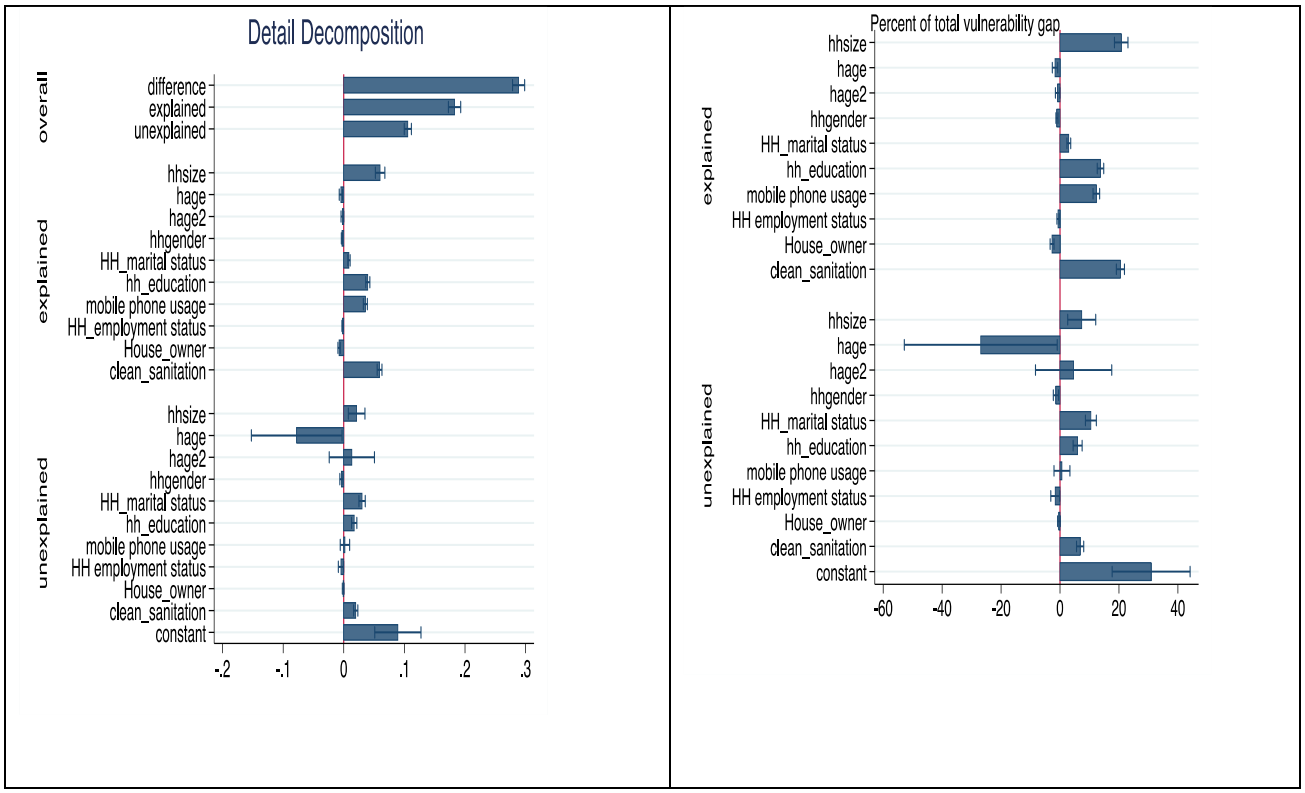
Household size. The size of the household is the greatest contributor to rural-urban vulnerability to poverty disparity. The decomposition result shows that if the rural households have on average the same household size (which would be a lower rate) as the urban households, their vulnerability to poverty will decrease by around 20.76%. This is because, on average, the household size in rural areas (4.83) is higher than the one in urban areas (3.77), and the vulnerability to poverty increases with the household's size. *Clean sanitation:* Having access to clean sanitation appears to be the second main contributor to the rural-urban vulnerability to poverty gap. The results show that if rural households have the same type of sanitation as urban households, their vulnerability rate will be reduced by 20.49%. This means that the rural sanitation condition is not as good as the urban one, and the vulnerability rate decreases with households' access to clean sanitation. *Education level:* If education level of household living in rural areas equates to those living in urban areas, the vulnerability rate of rural households will decrease by 13.73%. *Mobile phone:* if the rural households are using a mobile phone as much as the households living in urban areas, the rural household's vulnerability rate will decrease by 12.34%.

A negative contribution of *head of household age* indicates that if the rural households have the same age as urban households, the vulnerability to poverty rate of the rural households would be 1.70% greater than it is currently or the vulnerability to poverty rate of the rural households would increase by 0.5 percentage points. This is because, on average rural households are older than urban head of households and the risk or probability of falling into poverty decreases with age. Similarly, if the rural households (have the same *employment conditions* as the urban ones) are employed as the urban ones, the rural household's vulnerability to poverty would increase by 0.19 percentage points. This can be explained by the fact that rural households have fewer employment opportunities than urban ones, and the risk of being vulnerable to poverty increases with fewer employment opportunities or households being unemployed. Furthermore, if the head of the rural household had the same *housing status* (most of them are not the owner their house) as the urban household head, their probability of falling into poverty would be 2.7% greater than it is currently. We can justify this by the fact. that the majority of rural household heads live in their own house compared to those of urban household heads, and being the owner of a house decreases the probability of falling into poverty in the near future.

The analysis of the rural-urban disparity in vulnerability to poverty using Oaxaca-Blinder decomposition provides additional support for the OLS regression analysis findings, as well as

support for the claim that the disparity between rural and urban households is largely due to household characteristics differences.

Figure 4: Oaxaca Blinder detail decomposition of vulnerability to poverty Gap



4.5 Discussions

The vulnerability to poverty analysis show that 62% of the Togolese population was vulnerable to poverty and this is higher than share of the population that is currently poor (41%). This result confirmed the previous finding by Appiah-Kubi et al. (2010) and Novignon (2010) in the case of vulnerability analysis in Ghana. Interestingly, the rural household had a higher average vulnerability to poverty (0.51) compare to the urban households (0.22). This result confirms the findings of earlier research's that vulnerability is higher in rural areas than urban areas in Bangladesh (Azam & Imai, 2009) and in Nigeria (Mba et al., 2018) . Also, the Savannah (85.4%) and Lomé (15.8%) are the most and least vulnerable regions in Togo respectively.

Regarding the determinants of vulnerability to poverty, the household size affect positively and significantly vulnerability to poverty. This can be explained by the fact that, increasing the

number of household members while holding income constant leads to a decrease in the welfare of all the members due to competition for the existing scare resources. Several authors Christiaensen & Subbarao (2004) Mok et al. (2011), Muyanga et al. (2011), Noah et al. (2019) and Mba et al. (2018) (Abebe, 2016; Adhikari et al., 2020; Orbeta, 2005) find a similar result where the high household size increase vulnerability to poverty. Contrary to those authors, Megersa (2015) found that, large family size is a good source of labor for the household in the future that will undermine vulnerability to poverty.

Female head households are more vulnerable than male head household. One possible explanation of this result is that female head seem to be less educated, have precarious jobs hence an instable or low income which make them more vulnerable. Another explanation of this result is that the female head households may be the household in which the women are taking care of them self and others alone such as separated/divorced, widow and single mothers. Those categories of female heads are more vulnerable to any negative shocks and hence have high probability to fall into poverty. This result is in line with Pritchett et al. (2000) finding whose showed that female headed household in Indonesia are less well off (have higher vulnerability rate). However, this finding contrast with the one of Ding (2022) who find that, female heads of households show a lower probability of becoming vulnerable than do their male counterparts in both urban and rural households.

The age of the household affects significantly and negatively its vulnerability to poverty. Generally, the negative sign of each age group coefficient implies that as the head of the household get older he became less vulnerable to poverty. The explanation for this is that, as the age of household head increase, his work experience also increases, hence, the income and consumption increase as well. They have more experiences as they become older, working as directors, consultants, for example. Similarly, Bogale et al. (2005) found that as the age of household's head increases, they tend to own more assets and experience changes in the structure of the family as children grow and leave the household or contribute in labor force to various farm activities.

Our analysis reveals that education is an important determinant of vulnerability to poverty, it reduces significantly vulnerability to poverty. The reduction increase as the level of education increase, the coefficients of the different education dummies are increasing in absolute value progressively from primary to university level. In summary, it is evident that households led by individuals who possess higher levels of education are less susceptible to experiencing poverty.

These findings are consistent with those of Ligon & Schechter, (2003) study, which demonstrated that households headed by individuals with higher levels of education exhibit lower levels of vulnerability. This phenomenon could potentially be ascribed to the premise that household heads with higher levels of education are anticipated to exhibit higher levels of expenditure on consumption.

Moreover, highly educated head of household have higher per capita consumption expenditure. Education also serve as an important investment and at the same time, insurance tool against shocks. Individuals with a higher level of education are more likely to be resilient to changing situations and to have a better coping technique or capability (Christiaensen & Subbarao, 2005; Glewwe & Hall, 1998). In addition, more educated head tend to keep their household size smaller because they better understand the implication of having a larger household.

5 Conclusion

The previous research's in Togo focus mainly on ex-post poverty analysis. This chapter consider this gap and aims to estimate household vulnerability to poverty and determine the its urban rural disparities. Interesting finding can be drawn from our empirical analysis. Concerning the vulnerability analysis, as it has been found in many similar studies in developing countries, vulnerable population in Togo is found to be larger than the number of currently poor. Rural households have greater vulnerability to poverty rate than urban households. In addition, the most important factors that increase the risk of households falling into poverty in the near future are household size, being a female head, been unemployed, facing a natural covariate shock. However, been educated, using a mobile phone, have access to electricity, using a clean sanitation and being owner of its house contribute to reduce household vulnerability to poverty.

The Oaxaca blinder decomposition has shown a significant disparity in vulnerability to poverty between rural and urban households. Approximatively, on one hand 63% of the disparity is explained by the household's characteristics and this 63% could be reduced if the rural households had the same characteristic as their urban peers(Jann, 2008). On the other hand, the difference in coefficients (the association effect) which are resulted from the difference in unobserved parts between rural-urban households accounted for 37 % of the total rural-urban vulnerability to poverty gap. The variables such as the size of household, education, using a mobile phone and using clean sanitation are the most contributor to the explained gap.

The findings of this study have a number of practical implications. Base on the vulnerability rate across the different region, there is, therefore, a definite need to develop targeted interventions aims at reducing household's poverty and vulnerability to poverty according to each region characteristics. As the proportion of currently poor and vulnerable are not the same, policies solely aimed at addressing the currently poverty are insufficient in achieving sustainable poverty reduction over an extended period. Hence the policy maker must include in the poverty reduction programs specific objective directed to the vulnerable proportion of the population.

The Oaxaca Blinder decomposition suggest that the explained vulnerability to poverty gap could be narrowed by balancing households' characteristics as much as possible, such as sensitization of the of rural household on planning familial usage, providing training and education opportunities to the households who are at a lower education and increase access to electricity especially in the rural area through implantation of electricity infrastructure. Moreover, improving education level for rural household's head through alphabetization program may help to reduce the disparity and reduce the probability of fall into poverty. Clearly, policies and programs aimed at human capital investment are very important government interventions especially in developing country like Togo.

Appendix 6 and 7

Table 6 descriptive statistic rural vs urban

Characteristics	Whole sample	Rural	Urban
Observations	N=6,171	N=3,901	N=2,270
hhgender			
male	73.47	76.37	68.50
female	26.53	23.63	31.50
location			
Rural	63.22		
Urban	36.78		
ghage			
15-29	16.76	15.02	19.74
30-44	37.56	36.76	38.94
45-64	35.07	36.17	33.17
65+	10.61	12.05	8.15
hh_educ			
none	37.25	47.76	19.21
primary	25.15	26.40	23.00
secondary 1	22.27	18.53	28.68
secondary 2	9.12	5.49	15.37
university	6.21	1.82	13.74
HH_mstatus			
single	10.29	5.77	18.06
married/cohabited	68.68	73.49	60.40
divorce/separate	6.81	6.08	8.06
widow	14.23	14.66	13.48
elec_use			
no	58.43	81.16	19.38
yes	41.57	18.84	80.62
telmob_use			
no	17.23	23.94	5.68
yes	82.77	76.06	94.32
clean_sanit			
no	74.98	91.87	45.95
yes	25.02	8.13	54.05
HHemploy			
employed	87.31	88.46	85.33
Not employed	12.69	11.54	14.67
House_owner			
no	49.73	36.14	73.08
yes	50.27	63.86	26.92
HHagric			
Agricultural activity	49.23	71.01	9.34
Non-agricultural activity	50.77	28.99	90.66
region			
Maritime	15.33	18.43	10.00
Plateau	17.84	21.92	10.84
Central	13.27	15.61	9.25
Kara	18.26	20.20	14.93
Savannah	18.54	23.84	9.43
Lomé	16.76		45.55

Table 7: Oaxaca Blinder Detail Decomposition

	(1) pr b/se
overall	
group_1: Rural (location=0)	0.5064***
	(0.0034)
group_2: Urban(location=1)	0.2179***
	(0.0037)
difference	0.2885***
	(0.0051)
explained	0.1828***
	(0.0052)
unexplained	0.1056***
	(0.0030)
Explained %	63.36%
Unexplained %	36.60%
explained	
hhsize	0.0599***
	(0.0040)
hage	-0.0049***
	(0.0013)
hage2	-0.0023**
	(0.0011)
hhgender	-0.0030***
	(0.0005)
HH_mstatus	0.0086***
	(0.0010)
hh_educ	0.0396***
	(0.0017)
telmob_use	0.0356***
	(0.0017)
HHemploy	-0.0019***
	(0.0006)
House_owner	-0.0078***
	(0.0010)
clean_sanit	0.0591***
	(0.0020)
unexplained	
hhsize	0.0212***
	(0.0070)
hage	-0.0776**
	(0.0382)
hage2	0.0133
	(0.0190)
hhgender	-0.0040***
	(0.0013)
HH_mstatus	0.0302***
	(0.0027)
hh_educ	0.0172***
	(0.0022)
telmob_use	0.0019
	(0.0040)
HHemploy	-0.0047**
	(0.0022)
House_owner	-0.0010
	(0.0007)
clean_sanit	0.0197***
	(0.0018)
Constant	0.0892***
	(0.0195)
Observations	6171.0000
R-squared	
ajusted	
Prob>F	

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