Inequalities in infant malnutrition between rural and urban areas in Cameroon: a Blinder-Oaxaca decomposition

Nguenda Anya Saturnin Bertrand[⊗⊗⊗]

Abstract

Child malnutrition is an obstacle to human capital and a deprivation of capabilities. In Cameroon, malnutrition is a public health problem and rural areas suffer more from child malnutrition than the urban areas. The objective of this study is to identify the factors that explain inequality in the distribution of child malnutrition between urban and rural areas in Cameroon. The methodology used is based on the Oaxaca-Blinder decomposition. The data used is from the Demographic and Health Survey organized in 2011 by the National Institute of Statistics. Differences in endowments of children and mothers explain 75% of the weight difference of children under 5 years between urban and rural areas. We specifically find that a paid job for the mother reduces by approximately 2.56 % the differences in the weights of children of less than 5 years between urban and rural areas. Also, the education of the mother reduces the difference in weight between the rural and urban children by 2.44% for primary education, 5.48% for secondary education and 3.54% for higher education. Lastly, the difference in weight between the children of rural and urban areas increases when the households are poor. The reduction inequalities of child malnutrition between urban and rural areas in Cameroon thus passes through the improvement of the education of the mother, the strengthening of the economic capacities of women in rural areas and the improvement of the living conditions of rural households.

Key words: infant malnutrition, inequality, Blinder-Oaxaca decomposition
JEL: H1, H14, H52, H53, H75.

[⊗⊗⊗] Researcher-Lecturer,Faculty of Economics and Applied Management, University of Douala, Cameroon,Email: nguenduz_144@yahoo.fr

1. Introduction

Nutrition, as well as education and healthcare contribute to the reinforcement and maintenance of health-capital (Grossman, 1972). In fact, health-capital is a component of human capital defined according to Schultz (1961) as a set of cognitive, physical, nutritional and biological aptitudes which reinforce human capacities. Child malnutrition can: negatively affect the physical and cognitive growth of the child; decrease the working capacity of the child in adult life, which leads to a loss in productivity; increase the risk of morbidity and mortality of the child; and, finally deteriorate the school performances of the child (Delpeuch et al., 2000; Jinabhai et al., 2003; Hong, 2007).

Health being the first condition of human life and a significant dimension of the function of human capabilities, child malnutrition shows, according to SEN (2002) a deprivation of capabilities which are essential dimensions of individual wellbeing. Malnutrition can be regarded as a multidimensional phenomenon and, apart from the aspect of the availability of food, there are other factors that can affect the nutritional status of children of less than 5 years (Tharakan and Suchindran, 1999). This situation of malnutrition in spite of the availability of food is illustrated by Sen (1981) in his analysis of famine where he shows how the absence of capabilities of access makes people unable to get food, so that the famine increases whereas the granaries are filled with food. More recently, Amugsi et al. (2013) show that socio-economic and demographic factors seem to be more relevant than hereditary characteristics in the explanation of the differences in child growth.

Empirical literature on the factors which explain variations in child malnutrition between rural and urban environments is still backward in developing countries in general, and in sub-Saharan Africa in particular. The first studies on differences in malnutrition between rural and urban areas explain this variation using differences in the characteristics of urban and rural areas. Ruel et al., (1999) show that compared to rural areas, urban areas have a unique set of characteristics which negatively affect the nutrition of children. This characteristic is the greater dependence on monetary income, a greater exposure to a contaminated environment, an increased participation of women in income generating activities outside the household, a reduced size of the family which can affect the availability of the services of child keeping. However, the urban environment also offers an easier access to a balanced meal, an improved housing, health services and a greater availability of employment. Moreover, services such as electricity, water and hygiene are on average more easily accessible than in rural areas (Garrett and Ruel, 1999; Smith et al., 2005).

However, equality in characteristics between rural and urban areas does not necessarily mean that the differences in malnutrition disappear (Mussa, 2014). For this reason, a second group of studies considers that in addition to the characteristics specific to the urban and rural areas, the characteristics of the mothers and the children play a role in explaining differences in malnutrition between urban and rural areas. This second group of studies is fast expanding. Srinivasan et al., (2013) explain differences in malnutrition between urban and rural areas in Bangladesh and Nepal using differences in maternal education, the wealth index, and access to drinking water and hygiene. Sharaf and Rashad (2016) find that the inequalities in child malnutrition between urban and rural areas are explained by differences in the standards of

living of households in urban and rural for Egypt, Jordan and Yemen. O'Donnell et al., (2008) study the differences in weight between poor and malnourished children and the non-poor in Vietnam in1998. Wagstaff et al., (2003) decompose the inequalities observed in the health of children in Vietnam between 1993 and 1998. Thomas et al., (1991) explore the transmission channels of the beneficial effects of the education of the mother on the nutritional state of the child in Brazil. They find that the education of the mother has a significant impact on the size of the children in rural and urban areas of North-eastern Brazil. Glewwe (1999) finds that only the health knowledge of the mother is important in improving the health of the child. Among the recent studies which address the questionfrom this angle in sub-Saharan Africa, we can cite Mussa (2014) and Novignon et al. (2015). The first explores the determinants of differences in child malnutrition in children of less than 5 years between urban and rural areas in Malawi. The second study focuses on the decomposition of inequalities in child malnutrition urban and rural areas on the one hand, and between the poor and non-poor in Ghana on the other.

In Cameroon, it is established that after malaria which is the main cause of mortality and morbidity in children of less than 5 years, child malnutrition remains a significant cause of morbidity and infant mortality. Malnutrition mainly affects the vulnerable groups which are children of less than 5 years (0-59 months). The risk of child mortality is evaluated at 62 deaths per 1000 live births. As concerns the components of child mortality, they stand at 31 ‰ for neo-natal mortality and at 31 ‰ for post neo-natal mortality. Globally, the risk of infant and child mortality, i.e. the risk of death before 5 years of age, is 122 ‰. In other words, approximately a child on eight dies before reaching the age of 5 years (EDSC-MICS, 2011). If child malnutrition remains a major public health problem, it should be noted that differences between the rural and urban areas are getting larger, to the detriment of rural areas. According to the results of the last Demographic Health Survey carried out in 2011, the prevalence of delayed growth is about two times higher in rural areas (41 %) than in urban areas (22 %). Moreover, the children living in rural areas (8 %) are more frequent victims of acute malnutrition than those of urban areas (3 %). Lastly, in rural areas, a child on 5, that is to say approximately 20 % are underweight, as against 7 % in urban areas. In spite of the interest given by the Cameroonian government and professionals of public health to the problem of child malnutrition, there is no study that has focused on the decomposition of the inequality of child malnutrition between urban and rural areas in Cameroon.

The objective of this study is to identify the factors which determine variations in child malnutrition between urban and rural areas in Cameroon. This study thus contributes to the empirical literature on the determinants of differences in child malnutrition between rural and urban areas. The significance of this study is based at least on two points. Firstly, in its health sector strategy (SSS), the Cameroonian government set as objective to reduce by 2/3 infant mortality before 2015, making the identification of the factors which worsen child malnutrition in urban and rural areas important to at least partly decrease differences in infant mortality which stands at (93 ‰) in urban areas as against (153 ‰) in rural areas (EDSC-MICS, 2011). Secondly, the reduction of the malnutrition of the children of less than 5 years is a major concern of the Cameroonian government. The target of the millennium development objectives for the weight-for-age index is 8% for 2015. The government, through its Growth and Employment Strategy Document (DSCE) has as target 10 % in 2020. To achieve this goal, the Cameroonian

government, with regards to the rural areas plans to increase the share of public expenditure in rural areas from 5,6% in 2009 to 9% in 2020. Based on this, the percentage of children of less than five years that are underweight will be reduced more rapidly to reach 10,2% in 2020 (DSCE, 2009). An understanding of the determinants of child malnutrition in rural and urban areas remains a precondition to the success of this strategy.

The rest of this study is organized as follows. Section 2 presents the trend of child malnutrition in Cameroon. Section 3 presents the methodology. Section 4 the results and discussion. Section 5 concludes the study.

2. The trend of child malnutrition in Cameroon

A common approach to the study of child malnutrition consists in evaluating the nutritional status of the child on the basis of anthropometric indicators. This refers to the physical measures of the human body such as size or weight in relation to age or sex. The anthropometric indicators usually used for babies and children are: the weight-for-height; height-for-age; and weight-for-age indices.

The height-for-age index is an indicator of delayed growth. A too small child for his age is a manifestation of this delayed growth. Children with a height-for-age less than two standard deviations below the median height-for-age of the population considered (-2 standard deviations) are considered as small for their age and victims of *chronic malnutrition,* those with a height-for-age less than three standard deviations below the median height-for-age of the population considered (-3 standard deviations) are considered as victims of *severe chronic malnutrition.* A third of the children of less than 5 years (33 %) suffer from chronic malnutrition (moderate or severe): 14 % in the severe form (the height-for-age index is at less than 3 standard deviations from the median height-for-age of the population considered) and 19 % of the moderate form. These proportions are much higher compared to those expected in a population in good health and well nourished: 2,3 % for chronic malnutrition (moderate or severe) and 0,1 % for the severe form (EDSC-MICS, 2011).

Concerning the weight-for-height index, children with a weight-for-height more than two standard deviations below the median weight-for-height of the population considered are considered as suffering from *acute malnutrition,* those located at more than three standard deviations suffer from *severe acute malnutrition.* In Cameroon, 6 % of children of less than 5 years suffer from acute malnutrition: 2 % from the severe form and 4 % from the moderate form. The proportion of children suffering from emaciation is twice higher than that expected in a population in good health and well nourished, that is 2,3 % and nineteen times higher for the severe form, that is 0,1 % (EDS-MICS, 2011).

For the weight-for-age index, it arises that this index reflects the two preceding forms of malnutrition, both in the moderate and severe forms. It is thus a combined index which reflects an underweight in children since a low weight-for-age can be caused by thinness as well as delayed growth. It is the measure most often used by the health services to monitor the nutritional progress and growth of children. Children with a weight-for-age more than two standard deviations lower than the median weight-for-age of the population considered are

considered as suffering from an *underweight*, those located at more than three standard deviations suffer from *severe underweight.* Three children of less than 5 years out of twenty (15 %) suffer from an underweight and 5 % from severe underweight. Here again, the situation is alarming since these proportions are higher than those expected in a population in good health and well nourished: 2,3 % and 0,1 % for the severe form.

3. Methodology

Three main sections make-up the methodology: data, specification of the method evaluation and finally, a presentation of the variables of the study.

3.1 Data of the study

The data used in this study is from the Cameroon Demographic Health Survey (EDS) carried out in 2011 by the National Institute of Statistics of Cameroon (INS). The evaluation of the nutritional status is based on the principle according to which, in a well nourished population, the distribution of measures of children of a given age approaches a normal distribution. Moreover, it is generally agreed that the genetic growth potential of children is the in the majority of populations, independently of their origin. Three indices expressed in units of standard deviation (Z score) relative to the median of the population considered and using measures of weight and height in combination with age make it possible to determine the nutritional status of young children, namely the delay of growth (height-for-age), emaciation (weight-for-height) and underweight (weight-for-age). During the data collection, in a household on two of the sample, the children of less than 5 years present in these households were weighed and measured. Approximately 6 200 children were eligible to be weighed and measured, however the data presented here relates only to 95 % of them (that is 5 860). In fact, in 5 % of cases, either the children were not measured for various reasons (absence, disease, etc), or their age is missing or too vague to use to calculate the indices, or the recorded data is excluded because it is incredible (for example, a child having the weight or the height of an adult) (EDS-MICS, 2011).

3.2 Specification of the model

The method used to identify the factors that explain differences in malnutrition between rural and urban areas in Cameroon is that of Oaxaca-Blinder as developed by Wagstaff et al. (2003) and O'Donnell et al. (2008). This technique decomposes differences in malnutrition between urban and rural areas into two parts: one part explains the difference in the individual characteristics of the mothers and children (characteristics effects) and another part that is due to differences in the effects of these characteristics (coefficient effect).

Consider a variable y which is the nutritional status of children of less than 5 years to Cameroon, our variable of interest. We consider two groups of children: children of the urban and children of the rural areas. We further suppose that y is explained by a vector of determinants x, according to the following regression model:

$$y_i = \begin{cases} \beta^{urbain} x_i + \varepsilon_i^{urbain} & \text{if urban} \\ \beta^{rural} x_i + \varepsilon_i^{rural} & \text{if rural} \end{cases} \quad (1)$$

$\boldsymbol{\beta}$: A vector of parameters including constants. In the case of only one equation as represented in the figure above, the children of urban areas can be considered as having a better nutritional status than those of the rural areas. To each value of x, the nutritional status y is better. Moreover, the urban environment has a higher average value of x. The difference between the average nutritional status of children of less than five years between urban and rural areas is equal to:

$$y^{urban}\_y^{rural} = \beta^{urban}x^{urban}\_\beta^{rural}x^{rural} \quad \textbf{(2)}$$

x^{urban} and x^{rural} are vectors of the explanatory variables evaluated at their averages in the urban and rural areas respectively. For example, if we consider two explanatory variables x_1 et x_2, we can write the following relation:

$$y^{urban}\_y^{rural}\left(\beta_0^{urban}\_\beta_0^{rural}\right)+\left(\beta_1^{urban}x_1^{urban}\_\beta_1^{rural}x_1^{rural}\right)+\left(\beta_2^{urban}x_2^{urban}\_\beta_2^{rural}x_2^{rural}\right) \textbf{(3)}$$

$$= \mathbf{G_0+G_1+G_3} \quad \textbf{(4)}$$

Thus, the difference between the nutritional status of children of urban and rural areas can be explained by (i) differences in the constant terms (G_0), (ii) differences in x_1 and β_1 (G_1), and the differences in x_2 and β_2 (G_2).

The Blinder-Oaxaca decomposition makes it possible to determine the proportion of the differences in child malnutrition between urban and rural areas explained by differences in the explanatory variables (X), and the proportion of variation due to differences in the parameters β. For this reason, the differences in the nutritional status of children of less than 5 years can be expressed in two ways:

$$y^{urban}\_y^{rural} = \Delta x\beta^{rural} + \Delta\beta x^{urban} \quad \textbf{(5)}$$

With: $\Delta x = x^{urban}\_x^{rural}$ and $\Delta\beta = \beta^{urban}\_\beta^{rural}$

The second way, which is equivalent to the first is as follows:

$$y^{urban}\_y^{rural} = \Delta x\beta^{urban} + \Delta\beta x^{rural} \quad \textbf{(6)}$$

In the first decomposition, the differences in the x variables are weighted by the coefficients of the rural area and differences in the coefficients are weighted by the x variables of the urban area. In the second relationship, differences in x variables are weighted by the coefficients of the urban areas and differences in the coefficients are weighted by x variables of the rural areas. The decompositions of equations (5) and (6) can be seen as specific cases of a more general decomposition:

$$y^{urbain}\_y^{rural} = \Delta x\beta^{rural} + \Delta\beta x^{rural} + \Delta x\Delta\beta \quad (7)$$

$$= \mathbf{E+C+CE}$$

The difference in the nutritional status is then explained by the difference in the endowments of children (E), difference in the coefficients (C) and a difference in interaction between the

endowmwnts and coefficients (EC). The decompositions (5) and (6) can also be written in the form:

$$y^{urban}\_y^{rural} = \Delta x\beta^{rural} + \Delta\beta x^{urban} \quad (7)$$

$$= \mathbf{E + (CE+C)}$$

$$y^{urban}\_y^{rural} = \Delta x\beta^{urban} + \Delta\beta x^{rural} \quad (8)$$

$$= \mathbf{(E+CE) + C}$$

The first equation places interaction (EC) in the unexplained component whereas the second decomposition puts it in the explained component. The decomposition is therefore finally reduced to two components: the explained component and the unexplained component.

3.3 Specification of the variables of the model

Among the measures of the nutritional status of children of less than 5 years, three anthropometric measures are usually used to evaluate delayed growth, underweight and emaciation going from the height-for-age, weight-for-age and weight-for-height indices respectively (UNICEF, 1998). This study focuses on the weight-for-age measure of the nutritional status. Weight-for-age is an indicator which reflects at the same time and without differentiating them, the two other forms of malnutrition: the delayed growth and emaciation. It is thus a combined index which reflects an underweight in children since a low weight-for-age can be caused by thinness as well as by delayed growth. It is the measure most often used by health services to monitor nutritional progress and the growth of children (Ricci and Becker, 1996; UNICEF, 1998). As recommended by the WHO, children whose weight-for-age indices are less than two standard deviations below the median of the population of reference have an underweight.

The empirical literature shows that an underweight in the child reflects the socio-economic environment of the household. Many variables in connection with the social and economic context of the household contribute to explain differences in the distribution of an underweight in the child. Thus, the level of education of the mother determines the nutritional status of the children. In fact, children whose mothers do not have any education are more exposed to underweight (Mussa, 2014; Novignon et al., 2015). Moreover, the occupation of the mother is an element which informs about the nutritional status of the child. The access of the mother to a paid job increases the chances of the child benefitting from a healthy and balanced diet (Mussa, 2014; O'Donnel et al., 2008).

The standard of living of the household, measured by the wealth index of the household is also one of the factors which explain differences in child malnutrition. Children from poor households tend to suffer more from underweight than those resulting from non poor households (Sharaf and Rashad, 2016). The age of the child also explains the prevalence of underweight. The risk of malnutrition thus seems to increase with the age of the child. Moreover, children with a birth interval lower than 48 months have more chances of suffering from underweight (O' Donnel et al., 2008; EDS-MICS, 20 11).

The effect of the ethnic membership of the household or religion on child malnutrition is considered in certain studies (Mussa, 2014), while that of the sex of the child or age of the mother is developed by others (Novignon et al., 2015). The explanatory variables used in this study can be subdivided into three groups drawing from the existing empirical literature. Firstly, we have factors specific to the children are likely to affect their anthropometric statute. The age of the child can affect the nutritional status of the child. Moreover, the square of the age makes it possible to take into account non-linearity. The sex of the child makes it possible to capture the effect of sex on malnutrition. Secondly, certain characteristic of the mother are equally included in this study: the age of the mother, as well as the square of the age of the mother; the education of the mother in years, which is likely to be an approximation of the knowledge of the mother as regards the feeding of the children; the occupation of the mother which informs about the access or not to a monetary income: ethnic group and the religion of the mother; the matrimonial status of the mother; and the interval between births. Thirdly, several features of the household are also taken into consideration: (i) the size of the household; the number of children of less than 5 years in the household, and the standard of living of the household in order to take into account the resources available for the families to potentially use in matters of health. The measurement of the standard of living of the household is done using the wealth index of the household by quintile available in the Demographic Health Surveys organized in Cameroon.

4. Results and interpretation

Table 1 presents the means and standard deviations of the variables used in the study. Tables 2 and 3 summarize the Oaxaca-Blinder decomposition of differences in child malnutrition between urban and rural areas.

Table 1: Means and standard deviations of the variables

	Urban area		Rural area		Country	
Variables	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Ethnic group						
Choa-Arab	0, 1122	0, 31564	0, 1114	0, 31464	0,11 41	0, 31502
Biumanda	0, 0702	0, 25557	0, 1902	0, 39249	0,08 05	0, 34759
Adamawa	0, 0825	0, 27514	0, 1639	0, 37024	0,117 2	0, 33657
Bantu	0, 0123	0, 11004	0, 0093	0, 09605	0, 0105	0, 10207
Grassfield	0, 1122	0, 31564	0, 1486	0, 35576	0, 1335	0, 34018
Bamileke	0, 3270	0, 46925	0, 0938	0, 29153	0, 1903	0, 39254
Coastal people	0, 0320	0, 17616	0, 0279	0, 16479	0, 0296	0, 16958
Beti	0, 1993	0, 39960	0, 1579	0, 36472	0, 1750	0, 38005
Kko	0, 0358	0, 18587	0, 0562	0, 23031	0, 0478	0, 21328
Other	0, 0165	0, 12739	0, 0409	0, 19807	0, 0308	0, 17279
Religion						
Catholic	0, 3930	0, 48843	0, 3123	0, 46346	0, 3443	0, 47514
Protestant	0, 3344	0, 47181	0, 3409	0, 47403	0, 3384	0, 47316
Moslem	0, 2274	0, 41914	0, 2384	0, 42614	0, 2341	0, 42341
Animist	0, 0101	0, 09977	0, 0428	0, 20239	0, 0298	0, 17012
Other	0, 0202	0, 14079	0, 0247	0, 15518	0, 0229	0, 14966
Sex of the child						
Male	0,43 96	0, 50001	0,498 7	0, 50000	0, 4903	0, 49995
Female	0.5221	0.46667	0.5013	0.28740	0.5102	0.4324
Age of the child (in months)	5,4015	5,76230	5,70217	5,2025	5,2848	5,72740
Occupation of the mother:						
Paid job	0, 6239	0, 48451	0, 7460	0, 43536	0, 6955	0, 46023
Not paid job	0, 3761	0, 48451	0, 2540	0, 43536	0, 3045	0, 46023
Age of the mother (in years)	20.21	10.24	16.6	2 8.45	21 531	13.45
Matrimonial status of the mother						
Married	0, 6744	0, 46872	0, 7420	0, 43759	0, 7140	0, 45192
Single	0, 0697	0, 25478	0, 0575	0, 23286	0, 0626	0, 24222
Concubine	0, 1556	0, 36252	0, 2055	0, 40414	0, 1762	0, 38104
Widow	0, 0118	0, 10793	0, 0136	0, 11597	0, 0129	0, 11271
Divorced	0, 0066	0, 08098	0, 0066	0, 08128	0, 0066	0, 08115
Level of education of the mother						
No education	0, 1675	0, 37345	0, 3832	0, 48619	0, 2978	0, 45731
Primary education	0, 3804	0, 48550	0, 4609	0, 49848	0, 4290	0, 49494
Secondary	0, 4063	0, 49115	0, 1513	0, 35832	0, 2522	0, 43430
higher	0, 0458	0, 20903	0, 0046	0, 06770	0, 0209	0, 14308
Wealth index of the household						
Very poor	0,0 012	0,0 234	0, 3554	0, 47871	0, 2084	0, 40619
Poor	0, 0335	0, 17987	0, 3637	0, 48114	0, 2271	0, 41900
average	0, 2375	0, 42566	0, 1981	0, 39866	0, 2144	0, 41046
Rich	0, 3893	0, 48770	0, 0582	0, 23412	0, 1951	0, 39634
Very rich	0, 3398	0, 47374	0, 0246	0, 15493	0, 1550	0, 36191
A number of children of less than 5 years in the household	2,17	1,232	2,52	1,398	2,37	1,343
Size of the household (a number of people in the household)	7,56	3,671	8,30	4,389	7,99	4,123
Interval between births (in months)	24.6	7.5	8.5	09.7	10.7	6.7

Source: Author from the EDS-MICS, 2011 data.

The average value of malnutrition in urban areas is 0.646 and 0.724 in rural medium. The difference in child malnutrition between urban and rural areas is therefore approximately 0.08. This difference is decomposed into the explained component and the unexplained component. The explained component (E) measures the contribution of the differences in the characteristics of the children and mothers to the differences in child malnutrition between urban and rural areas. The contribution of the explained component is 75%. This means that differences in the

endowments of children and mothers explain 75% of variations of delayed growth of children of less than 5 years between urban and rural areas. The unexplained component (CE+E) is only 25% of the difference in child malnutrition. Factors other than the endowment of children and mothers thus explain 25% of differences in child delayed growth between urban and rural areas. This result is similar to that of Mussa (2014) who finds that inequality in the distribution of child underweight is explained more by the characteristics of the mothers and the children. The differences in the endowments of the households expose the rural children to underweight relative to those in urban areas. In fact, rural households on average are less educated and have a lower access to a satisfactory hygiene, drinking water and healthcare than urban households.

Table 2: Oaxaca-Blinder decomposition of differences in child malnutrition between urban and rural areas in Cameroon

Malnutrition: Z-score weight for age lower than -2						
	Coefficients	**standard deviation.**	**Z**	**P>|z|**	**[95% confidence interval]**	
Average in urban area (U)	0. 6465504	0.0070938	90.37	0.000	0.6271388	0.6549459
Average in rural area (R)	0 7244183	0.0055103	139.06	0 000	0.7093318	0.7309321
Difference (Ru)	0 0778679	0 0089825	8.80	0.000	0.0614842	0.0966949
Decomposition difference:						
Explained (E)	0.0585819	0 0130345	4.49	0.000	0.0330347	0.0841292
Unexplained ()	0.0205076	0 0100416	2.04	0.041	0.0008265	0.0401888
% Explained (E/r-u): 75%						
% Unexplained (Ne/r-u): 25%						

Source: Author using EDS-MICS, 2011 data

Table 3 presents the contribution of each determinant to the explanation of the differences in underweight between rural and urban areas. The children whose mothers originate from the ethnic groups in the northern regions (Choa-arab, Biumanda and Adamawa) suffer more from underweight than those whose mothers are from the South. Akoto and Hill (1998) find similar results. They find that the ethnic membership of the mother can affect the food equilibrium of the child. However, the precarious living conditions in these northern regions of Cameroon, particularly the high level of poverty of the woman and low level of education of girls, explains this result better the ethnic group. In fact, a child on three from the Far-North (32%), a child on four of the North (24 %) and a child on 5 of the Adamawa (21 %) suffer from underweight. In the other regions, this proportion is lower than 16% (EDS-MICS, 2011).

The religion of the mother also explains differences in weight between children of urban and rural areas. In fact, the children of Moslem or animist mothers are exposed to underweight. The low economic capacity of the Moslem woman and her low recourse to Western medicine could justify this result (Akoto, 1993).The access of the mother to a paid job reduces approximately by 2.56 % the underweight inequality between children of less than 5 years of in urban and rural areas. This result is similar to that of Srinivasan et al. (2013). However, the positive effect of the access of the mother to a paid job on the nutritional status of the child is not unanimous in the empirical literature. In fact, an active mother can also have a negative effect on the nutritional status of the child. Early weaning, giving the child at a tender age to a member of the family or a person who does not master the rules of hygiene also exposes him to diarrhoea and malnutrition (Akoto and Hill, 1988).

The education of the mother reduces differences in underweight between rural and urban children by 2.44% for primary education, 5.48% for secondary education and 3.54% for higher education. Mussa (2014) and Novignon et al. (2015) find the same result. The acquisition of education leads to a better knowledge of the rules of hygiene and principles guiding the feeding of children. Inequality in the distribution of underweight between children of rural and urban areas also increases when the households are poor. Mussa (2014), Sharaf and Rashad (2016), Novignon et al. (2015), all find a similar result. At least two reasons can explain this result. Firstly, poor households often have a low access to food which is a necessary condition for food safety. Secondly, poor households in a context of direct payment of the healthcare by patients can have insufficient financial resources for child care.

The square of the age of the mother reduces the inequality in malnutrition between urban and rural areas. This result shows that relatively old mothers have more experience in the feeding of the child. This result is in line with that of Sharaf and Rashad (2016). In rural areas, girls are more exposed to early marriage which leads to early pregnancies. Their immaturity on the biological and physiological levels affects the health of their children.

The square of the age of the child determines the differences in weight between children in urban and rural areas. The risk of malnutrition increases with the age of the child. Srinivasan et al. (2013) find this same result. In fact, before the first six months of his life, the child is protected from any food deficiency if it is exclusively nourished with breast milk. After the sixth month, the organism of the child requires a rich and varied food that the mother's milk cannot offer. The

sex of the child, on the other hand does not significantly explain the difference in underweight between children of urban and rural areas. This result shows that girls and the boys receive the same treatment at the medical and nutritional level. This result is different from that of Novignon et al. (2015) and Amugsi et al. (2013). These authors find that the male sex decreases the inequality of child malnutrition significantly. In addition, the matrimonial status of the mother does not have any significant effect on the difference in underweight between children of urban and rural areas. We however find that the life of the mother in union (married or cohabitation) decreases underweight inequality, even if the coefficient remains insignificant. A large size of the household and a large number of children of less than 5 years in the household are factors which also positively explain underweight differences between children of urban and rural areas. This result is similar to that of Srinivasan et al. (2013). The length of the interval between births reduces the inequality in the distribution of underweight between children of urban and rural areas. O'Donnel et al. (2008), find a similar result. In fact, the shorter the interval between births is, the more precarious the nutritional status of the child is. The spacing of the births can be an effective method in reducing the high prevalence of malnutrition.

Table 3: Detailed decomposition of the difference in child malnutrition between urban and rural areas.

Variables	explained component (V)				unexplained component (w)			
	Coefficients	**standard deviation**	**Z**	**P>|z**	**Coefficients**	**standard deviation**	**Z**	**P>|z**
Ethnos group of the mother	.							
Choa-Arab	0.023263	0.008529	2.73	0.006	0.0017760	0.0005307	3.35	0.001
Biumanda	0.017448	0.031545	5.53	0.000	0.002669	0.0005821	4.59	0.000
Adamawa	0.012271	0.002207	5.56	0.000	0.0022978	0.0005769	3.98	0.000
Bantu	-0.036766	0.001291	-2.85	0.004	0.0023171	0.0007636	3.03	0.002
Grassfield	-0.038747	0.009396	-4.12	0.000	0.0011255	0.0012265	4.84	0.000
Bamileke	-0.028781	0.006370	-4.52	0.000	0.0059401	0.0002477	4.18	0.000
Coastal people	-0.004492	0.00206	-0.22	0.828	0.0047662	0.0011212	4.25	0.000
Beti	-0.026029	0.001380	-1.89	0.059	0.0007351	0.0002692	4.05	0.000
Kko	-0.010446	0.009914	-1.05	0.292	0.000499 0	0.0001848	3.63	0.000
Others	-	-	-	-	-	-	-	-
Religion of the mother								
Catholic	0.06908	0.0021204	1.41	0.159	0.0050089	0.0020859	2.40	0.016
Protestant	0.01059	0.007514	0.79	0.432	0.0002161	0.001918	2.73	0.006
Moslem	0.06914	0.00088	3.24	0.001	0.0007418	0.0010454	0.71	0.478
Animists	0.04474	0.009963	4.49	0.000	0.0004874	0.0015059	3.24	0.001
Others	-	-	-	-	-	-	-	-
Sex of the child								
Male	-0.0972	0.001169	-0.83	0 402	-0.0000894	0.0007416	-0.18	0.853
Female	-	-	-	-	-	-	-	-
Age of the child (in months)	0.01033	0.001423	0.73	0.468	8.30e-06	0.0001709	0.78	0.436
Age of the child squared	-0.035402	0.007038	-4.12	0.000	-0.000108	0.0001767	2.21	0.023
Occupation of the mother:								
Paid job	-0.0256167	0.007269	-1.73	0.084	-0.000107	0.0007269	-1.47	0.141
Not paid job	-	-	-	-	-	-	-	-
Age of the mother	0.002734	0.004561	0.96	0.505	0.0000461	0.0003105	0.71	0.478
Age of the mother squared	-0.081071	0.001319	-2.17	0.040	-0.0000392	-0.0003269	-1.85	0.064
Matrimonial status of the mother								
Married	-0.06207	0.006758	-0.41	0.585	-0.0000157	0.0001473	0.56	0.573
Single	0.001498	0.001563	0.96	0.351	0.0001891	0.0001008	0.78	0.436
Concubine	-0.002122	0.003386	0.63	0.531	-0.0000153	0.0001128	0.95	0.394
Widow	0.00289	0.001327	0.22	0.826	0.0000271	0.0001014	0.63	0.531
Divorced	-	-	-	-	-	-	-	-
Level of education of the mother								
No education	-	-	-	-	-	-	-	-
Primary education	-0.0244741	0.0087025	-2.81	0.000	-0.000186	0.0005080	-3.66	0.000
Secondary	-0.0548943	0.0158329	-3.47	0.001.	-0.0001075	0.0003320	-3.24	0.001
Higher	-0.0354986	0.0080696	-4.40	0.005	-0.0008294	0.0006383	-1.85	0.060
Wealth index of the household					-	-		
Very poor	0.018635	0.0055835	3.74	0.000	0.017348	0.0108233	-3.95	0.000
Poor	0.0107533	0.0057369	2.76	0.000	0.0117474	0.0015824	-3.35	0.001
Average	-0.0082946	0.00325	-1.92	0.054	0.0002651	0.0001041	-1.61	0.108
Rich	- 0.020884	0.0041827	-4.29	0.000	-0.0021592	0.0001795	-2.21	0.027
Very rich	-	-	-		-	-	-	-
number of children of less than 5 years in the household	0.067092	0.0030863	0.42	0.684	0.0001544	0.0073265	0.56	0.573
number of children of less than 5 years in the household squared	0.001915	.0018485	3.63	0.000	-0.0001758	0.00195263	-0.07	0.948
household size	0.036076	.0034705	0.95	0.344	0.0002408	0.00074181	0.71	0.854
household size squared	0 008327	0.0078254	2.15	0.035	-0.0002928	0.0002201	-1.33	0.478
Interval between births (in months)	-0.005748	0.0074175	-1.56	**0** 115	-0.0003607	0.0001678	-0.79	0.184
Interval between births (in months) squared	-0.017954	0.0031145	-1.96	0.505	-0.00031662	0.00059877	-1.92	0.432
Constant	-	-	-	-	-0.0015310	0.0098093	-1.56	0.119
Total	0.0529807	0.0108344	4.89	0.000	0.0208872	0.0082269	3.03	0.002

Source: Author using the EDS-MICS, 2011 data.

5. Conclusion

The objective of this study is to identify the determinants of differences in child malnutrition between urban and rural areas in Cameroon. We find that the endowments of mothers and children explain the inequalities in child malnutrition between urban and rural areas. Among the main policy implications, we can mention that the fight against child malnutrition mainly passes through the reinforcement of the education of the mother. In fact, education facilitates a better knowledge of the rules of hygiene and basic principles as regards child nutrition. Moreover, the education of the mother contributes to a better access to healthcare and drinking water. The education of the girl child should be reinforced in rural areas, particularly in the northern regions of the country where less importance is still being given to the schooling of the girl child. The immediate effect of this low schooling of girls is that child malnutrition and maternal mortality remain higher in these regions than in the rest of the country.

Another important lesson from this study is that the socio-economic status of the mother explains the differences in child malnutrition between urban and rural areas. Firstly, the access of the mother to a paid job reduces the inequality in the underweight of children between urban and rural areas. The reinforcement of the economic capacity of the mother thus contributes to an improvement of the nutritional status of the child. In rural areas particularly, the economic capacity of the woman remains limited. The Moslem woman in particular faces an increase in economic hardship. The improvement of the economic capacity of the woman can be done through the schooling of the girl and the development of income generating activities. Secondly, the poverty of the household is a determinant of inequalities in underweight between children of the urban and rural areas. The poverty of the households is more of a rural phenomenon in Cameroon. Healthcare, drinking water, decent housing, balanced diets are more rationed in rural than in urban areas. In this context, a balanced diet is a real challenge for the poor households. The execution of public investments in rural areas in order to facilitate the access of poor households to essential services such as child healthcare, drinking water and hygiene would go a long way in contributing to the improvement of the health of children. It is also important to emphasize on family planning since this study shows that a large size of the family as well as an increase in the number of children less than 5 years in a household also accounts for differences in underweight between children of urban and rural areas. The spacing of the births can thus reinforce the capacities of households to feed the children suitably.

A limit of this study resides in the fact that it reduces child malnutrition only to underweight. However, overweight in children is also a form of malnutrition. In fact, overweight or obesity constitutes a growing and serious problem for certain children in developing countries. In Cameroon, 6 % of children of less than 5 years are too fat for their height and are thus suffering from this form of malnutrition (EDS-MICS, 2011). Another limit of this study is that it considers the rural or urban areas as homogeneous. However, in the rural areas for example, the size of the population, its density, and the availability of health services or drinking water are elements that differ from a rural area to another. Thus, future research will aim, on the one hand, to study the determinants of obesity in children and on the other hand, the determinants of child malnutrition by integrating spatial heterogeneity.

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