Poverty and the Anthropometric Status of Children: A Comparative Analysis of Rural and Urban Households in Togo

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Abstract

Using data from the Demographic and Health Survey (EDST-II), the study first constructed a composite index that characterized non-monetary assets. It then identified the determinants of child malnutrition by correlating both the non-monetary wealth and the socio-demographic characteristics of households. Among the characteristics specific to the child, age and sex are the main explanatory factors of child health status. Parental education has a positive impact on the improvement of the child's nutritional status, in particular in rural areas. Moreover, the household's wealth level has a positive impact on child health and nutritional status in both rural and urban areas.

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1. Introduction

Although the health sector has always been one of the priorities of Togo's social policies, more than three decades after its independence the country had no specific mechanism for formulating general and systematic health policies. It was not until November 1997 that a national health policy was adopted (Koffi-Tessio et al., 2000), introducing and consolidating existing health initiatives into a national framework with stated goals and targets. The goal of the health policy is to ensure that the population's health status enables all citizens to lead a socially and economically productive life. As part of the health policy framework, various programmes focus on mothers and their children. For example, the Extended Immunization Programme (PEV), which had started in 1980, progressively expanded to the entire country and since 1987 has been reinforced by massive vaccination campaigns**.** Sustained and intensified efforts have been deployed to vaccinate target diseases such as tuberculosis, measles, tetanus, polio, whooping cough and diphtheria.

Particular attention has equally been paid to vaccination against meningitis, yellow fever and hepatitis B in areas of seasonal epidemics. For its part, the health and nutrition programme comprises four sections: the fight against contagious and parasitical diseases; the fight against micronutrient deficiencies; the promotion of breastfeeding, weaning feeding and monitoring of child nutritional status; and the protection of the disadvantaged. Finally, the Maternal and Child Health Programme that started in the 1980s is an overall programme to support development; it aims at providing the basic health care needed by the population in general, and by the mother and the child in particular. Among other things, the programme aims to promote the health and welfare of the mother and the child, as well as family planning practices.

Despite the implementation of various programmes for more than three decades, Togo is still characterized by the persistence of enormous health problems and the need for better health care. The health situation is indeed marked by high infant and child mortality rates that can be attributed to contagious and parasitical diseases. The neonatal mortality rate is 42.4%, while the infant mortality rate is close to 80%. Children in rural areas are particularly vulnerable: out of 1,000 live births, 85 rural children die before they are one year old as opposed to 65% in the urban area. According to the demographic and health survey carried out in 1998, the proportion of children under five years of age who are underweight had risen from 18% in 1988 to 25% in 1998. The proportion of children suffering from malnutrition is 25%, while that of those with stunted physical development is 22%. Such low achievements in the health sector can be attributed to the socioeconomic context of generalized poverty: a population that is getting increasingly poor coupled with insufficient numbers of health facilities throughout the country.

Of these, poverty is arguably the fundamental cause of the acuteness of health problems in Togo. According to a survey carried out in Togo in 1999, more than 60% of the populations were poor, against only 32.3% in 1989 (PNUD [UNDP], 2000). At the national level, the reviewed poverty threshold was CFA francs 48,465 in 1994, compared with CFAF 35,000 in 1989. It should be noted that the poverty threshold varies considerably from one region to another and from one area of residence to another. The results of the 2006 Household Survey indicate that poverty has essentially remained a rural phenomenon, with an incidence of 60.8% against that of 24.2% urban areas (Ministry of Economy and Development, 2007).

Poverty is clearly manifest in households. For example, only 18% of the rural population and 50% of the urban population have an adequate system for the disposal of human waste. Thus, although there is a strong variation according to regions,, 80% of houses in Togo have no latrines; for the city of Lomé, the rate is 40%. Only 30% of houses have electricity, while 60% of urban households of more than five members live in houses with only one or two rooms (Ministry of Planning**,** 1999).

In the face of the continuing degradation of the health situation and the endemic nature of poverty in Togo in general, and the increasing gap between the poverty levels of urban households and those of rural ones in particular, it is appropriate to study the possible relationships between the poverty phenomenon and the child health and nutritional status in the country. A study of infant poverty can be further justified from two perspectives: from the economic point of view, children constitute a long-term essential investment in human capital for the society and from the social ethics point of view, they must be protected by the community, as they are not responsible for their socioeconomic situation, but benefit or suffer from the situation of the parents.

The aim of this study is thus to model and estimate the determinants of child malnutrition in Togo according to their area of residence. Specifically, the study measures and analyses the nutritional status of children, and assesses the impact of the household non-monetary wealth index and other household socio-demographic factors on child nutritional status depending on whether the household lives in the rural or urban area. Two hypotheses are tested: the first (H1) is: the higher the wealth index of the urban and rural household is, the higher the child's nutritional status will be. The second hypothesis (H2) is: mother's education in the rural area has a higher positive impact on the child's nutritional status than in the urban area.

The remainder of the paper is structured as follows: the next section offers a brief review of the literature. This is followed by a description of the methodology used. The fourth section presents and analyses the results, and the last section discusses conclusions and policy recommendations.

2. Literature review

According to the literature, the individual heath status of a country's population can be approximated by child growth. From the point of view of public health, this implies that it is preferable to focus on the determinants of the health of children rather than that of adults because by adulthood, these determinants reflect both the investment in human capital made during childhood and the difference in stature and strength that children inherit from their parents. In this connection, Waterlow et al. (1977) assert that genetic inheritance plays a preponderant role in determining the height and weight of an individual only after seven years of age. Before the age of seven, factors that are external to the individual (other than genetic inheritance) are said to account for more than 90% of the height and weight differences among children and thus have immediate consequences for their survival.

The concept of health status

There are many types of evaluation of an individual's health status. Generally, the professional or objective perception of health and illness is opposed to the layman's or subjective perception.

Subjective indicators

Subjective indicators have to do with the responses given by people surveyed about the symptoms of an illness (Butler et al., 1987; Kandrack et al., 1991; Cebu Study Team, 1992; Muller, 1998), about their epidemiological past (Acton, 1975), and about their overall assessment of their health status (Idler and Benyamini, 1997). These indicators also bear on reports on the ability of the respondents to accomplish normal or usual tasks. They are associated with the differences in perception and conceptualization of health and illness held by the people surveyed.

Aiachat and Curtis (1990) acknowledge the usefulness of subjective measures from the point of view of the experience with an illness and of the appreciation of a probable deterioration of the health capital. They also consider such measures essential to the understanding of the psychological, social or economic consequences of an illness for the individual. Nevertheless, the reliability of these indicators is more open to criticism than that of morbidity indicators because of the questionable nature of morbidity and of the multidimensional nature of health. It has been commonly observed that the education

of household heads, people's culture, their medical and health education, and the social norm in matters of the status of an illness are the cause of the systematic bias observed about the reported measure of health and morbidity. The applied literature also shows that these errors can be linked to the local availability or perceived accessibility of medical services, to the use of the health care system (Strauss and Thomas, 1998), to the individual's income (Schultz and Tansel, 1997; Strauss and Thomas, 1998), and to the type of profession the individual has.

Objective indicators

These are indicators calculated on the basis of a clinical or professional assessment of the physical and psychological characteristics of an individual (Butler et al., 1987; Feachem et al., 1992), including anthropometric measures (Behrman and Deolalikar, 1988; Strauss and Thomas, 1995; Lee et al., 1997). Despite the undeniable scientific import of professional measures, these are less frequent in household surveys because collecting data for them is very expensive. Moreover, for them to be considered as true measures of health status, they must be compared with a reference group the definition of which could be a source of bias and controversy (Barcat, 1998).

According to Charasse (1999), three anthropometric indicators are usually constructed. They are: height as a function of age; weight as a function of age; and weight as a function of height. Short-term measures (weight as a function of height) are dissociated from long-term ones (height as a function of age). Weight as a function of height is directly influenced by the diet one is getting or by illness, and the child's short-time survival depends on it. Height as a function of age is related to accumulated growth; retardation is attributable to chronic malnutrition or morbidity. For its part, weight as a function of age is a cumulative effect of the other two indicators. It is referred to as the body mass index (BMI), which is the ratio of weight (in kilograms) to the squared value (in metres) of height. For adults the extreme values of this indicator are indicators of either ill health or precocious morbidity depending on the value. Thus, a value of less than 18.5 is a sign of chronic energy deficiency while one more than 30 is a sign of obesity (Fogel, 1994).

Determinants of health status

Various studies carried out in developing countries have highlighted a number of factors considered as determinants of children's nutritional status. Among others, one can mention the following: Asenso-Okyere et al. (1997) for the case of Ghana; Charasse (1999), Maluccio et al. (2001), and Maitra and Ray (2004) for the case of South Africa; and Hoddinott and Kinsey (2001) for the case of Zimbabwe. Lachaud (2001) studied the situation in Burkina Faso, and Strauss (1990), Sahn (1994) and Thomas et al. (1996) assessed Côte d'Ivoire. Also in Africa, Glewwe (1999) looked at Morocco; Nakabo-Ssewanyana (2003) at Uganda; and Yamano et al. (2005) and Sahn and Alderman (1997) at Mozambique. Elsewhere, Vietnam was studied by Glewwe et al. (2002); Indonesia by Barcat (1998), Bangladesh by Bishai (1996), and Sri Lanka by Gunasekara (1999).

The factors that are generally pointed out have to do with the characteristics of the community, the household and the individual. Among the specifics are the following:

- ***Age of the child:*** As children get older, they are more likely to become ill because their diet now lacks breastfeeding (Asenso-Okyere et al., 1997). It has been demonstrated that after the sixth month, infants gradually go through the weaning period and therefore become more vulnerable to infections because their immune system has not yet fully developed (Charasse, 1999). This age effect has also been observed in Uganda (Nakabo-Ssewanyana, 2003).

- ***Parents' educational level:*** Regarding the influence of heads of households on children's growth, Schultz (1984), quoted in Barcat (1998), distinguishes five dimensions. First, parents' education has a direct impact on their ability to impart knowledge about health and hygiene to their children. Second, education enhances general reading skills and enables parents to better understand the medical staff's instructions. Third, education increases the chances of getting a job and, as a result, of increasing the total income available to improve child health. Fourth, education may systematically affect parents' preferences, notably in the choice of the number of children to have. Finally, and on the other hand, education increases the opportunity cost of time away from work and thus reduces the time devoted to child care. Thomas et al. (1991) report that a child whose mother has a primary education level is 1.6% taller than one whose mother is illiterate. The study by Nakabo-Ssewanyana (2003) has shown that in Uganda the mother's level education has a strong impact on the long term nutritional status of girls, while the father's level of education affects the nutritional status of boys. However, Thomas and Strauss (1992) show that the level of education of the two parents is complementary because the positive effect of the father's level of education on the child's height increases when the mother's education increases as well.

- ***Parents' age:*** This has a positive effect on the child's height and on the child's chances of having normal growth. The parents' age is used as an approximate variable for the accumulation of experience in health care matters (Barcat, 1998). The parents' age can have a negative effect, however, if it is considered as an indicator of adult senility or tiredness (Bishai, 1996).

- ***Parents' health:*** Traditionally, the literature uses the parents' height and BMI as explanatory factors in favour of the child's growth (Barrerra, 1990; Strauss, 1990). The parents' height is indeed perceived as a result of medical knowledge and of nutritional and hygiene habits acquired during their childhood. For the case of Ghana, Asenso-Okyere et al. (1997) indicate that the father's BMI and the mother's BMI are significant explanatory factors for the child's short-term health and nutritional status.

- ***Household income or living standards as measured by per capita expenditure given the difficulty in measuring, with precision, current household income (Thomas et al., 1991):*** A positive relationship is expected between growth indexes

and the household income factor. Lachaud (2001) found that in Burkina Faso a direct correlation exists between the increase in per capita expenditure and the reduction of chronic malnutrition. However, the opposite obtains in relation to underweight and emaciation. Indeed, a pernicious effect may occur when the occupational activity that generates this income is taken into account: the more time the father or the mother devotes to occupational activities, the less the child benefits from their particular attention in terms of health care. Assessing a health demand model, Charasse (1999) shows that in South Africa, all things being equal, income, more than education, plays an essential role in determining the scores on the growth variable. Nakabo-Ssewanyana (2003) also notes that an increase in income for the urban poor in Uganda had a positive effect on the reduction of food insecurity and child malnutrition.

- ***Availability of social amenities such as water, electricity and community health facilities:*** Many studies have brought to light the positive impact of community infrastructure on child health. That is the case of the modern pipe-borne water system, which is reported by Strauss (1990) as having a positive impact on child health in Côte d'Ivoire. Similarly, Barrerra (1990) highlights the importance of refuse collection on the height of the child, while Thomas et al. (1991) find that refuse collection and more buildings with electricity contribute to better child health in the north-east of rural Brazil.

3. Methodology

The methodology of the study comprises two parts. The first part concerns the construction of the non-monetary wealth index, while the second deals with modelling, in particular of the conceptual and empirical frameworks of the relationship between this wealth index and child nutritional status. The construction of the non-monetary wealth index is justified because there has been little rigour in collecting information on income during Togo's national surveys. However, data are available on households' property and standards of living. These data are used in the construction of a wealth index that is considered as a proxy for the long-term household income.

The data were collected during the Demographic and Health Survey (EDST-II) carried out by the Department of Statistics in the Ministry of Planning and Economic Development from February to May 1998. This was a national survey of 8,070 households in urban (33%) and rural (67%) areas. During this survey, the 7,517 households interviewed out of those surveyed included 8,569 women aged 15–49 years and 3,819 men aged 15–59. Information was also obtained on 3,693 children aged 0–35 months. The survey has provided detailed information on, among other things, fertility, maternal and child health, child and mother nutritional status, and household economic and socio-demographic variables.

Construction of the non-monetary wealth index

Here we use a technique that makes it possible to aggregate the different dimensions of the non-monetary wealth index. By taking the non-monetary wealth approach, the study regards wellbeing as a series of achievements rather than the accumulation of wealth. This multidimensional approach to poverty rests on the construction of a composite poverty index[1] based on the data collected about property owned by households. The approach has been used in recent studies on poverty, especially when data on expenditure or income were not available, as is the case with the data from the Demographic and Health Surveys (Sahn and Stifel, 2000, 2003a/b; Booysen et al., 2004; Vodounou and Ahovey, 2004).

The principal methodological approaches to aggregation used in the literature are the entropy approach and the inertia approach; the former derives from the field of dynamic mechanics and the latter from static mechanics. Mainly based on the techniques of multidimensional analysis, also referred to as factor analysis,[2] the inertia approach draws on the main factor analysis techniques: the principal component analysis (PCA*)*, the generalized canonical analysis (GCA) and the multiple correspondence analysis

(MCA). Thus, the inertia approach rests on a methodology that makes it possible to construct a composite indicator with the least amount of arbitrariness in the definition of functional form. It also enables one to make an optimal choice of the relevant dimensions of poverty while avoiding redundant information.

The factor analysis technique to be used in this study is the multiple correspondence analysis (MCA*)* since the initial wealth indicators collected from households are in a qualitative form and can be codified in a binary form. In this rationale, the main areas taken into account are access to water and electricity, ownership of durable goods, housing, etc. Refer to Table 1 for the variables used in this study to describe the non-monetary dimensions of poverty.

Table 1: Description of variables related to the non-monetary dimensions of poverty

Dimension	Source
Elements of comfort, equipment and other property	
Refrigerator	EDS-Togo 98
Communications and transport	
Radio	
Television	
Car	
Motorcycle	
Bicycle	EDS-Togo 98
Energy	
Electricity	EDS-Togo 98
Housing and sanitation	
Type of floor (modern, traditional)	
Type of walls (modern, traditional)	
Type of ceiling (modern, traditional)	
Type of toilet (modern, traditional, without facilities)	EDS-Togo 98
Clean water	
Source of water (potable, protected, unprotected)	EDS-Togo 98

Using the MCA, the functional form of the composite indicator is simply the average weights of categories, which are themselves the average of standardized scores. If *m* designates household and *Cm* the value for composite indicator, the functional form of the indicator as defined by Asselin (2002) and used by Ki et al.(2005) and Booysen et al.(2004) is:

$$c_m = \frac{\sum_{k=1}^{K} \sum_{jk=1}^{Jk} w_{jk}^{k} I_{jk}^{k}}{K}$$

where

K = the number of category indicators;

Jk = the number of categories of indicator *k*;

W = weight (score of the first standardized axis) of category *Jk*; and
I = binary variable *0/1*, which takes the value *1* when the unit has category *Jk*.

Modelling the relationship between nutrition and health status

Many household behaviour models have been developed in the course of studies on investment in human capital. The theoretical basis for these models rests on a utility function that depends on the health and nutritional status of every household member as well as on goods acquired from the household's production (Schultz, 1984). These models indicate that decisions about health production and consumption are made simultaneously and with one being dependent on the other. In such a case, the implicit price of health is determined within the family entity, and further the health of an individual is the result of individual and family decisions in a given environment (Charasse, 1999).

The microeconomic analysis of an individual's health can be done from two standpoints: that of health production (Schiff and Valdes, 1990a/b; Strauss and Thomas, 1995) and that of health care demand. The starting assumption is that households try to achieve maximum wellbeing under the constraints of traditional techniques of production, time and budget. Activities of health production depend on inputs that are either controlled by families (endogenous) or predetermined (exogenous). As for the functions of supply of and demand for health, these depend on the resolution of the household wellbeing maximization programme. Thus, the reduced form of the functions of health demand or health production for a child depends solely on exogenous variables. Apart from the distinctive characteristics of the child, the household and the community, the demand-for-health approach is based on the hourly cost of adult labour, the price of health inputs, the set of prices of the other products intended for consumption and the price of nutriments on the market. Owing to a lack of data on these prices, the present study uses the health production approach. This function expresses the relationship between a child's health status and some exogenous variables such as the individual characteristics of the child, the household and the community.

The modelling of the child's nutritional status is based on the assumption of the maximization of a long-term household utility function (Schultz, 1984; Behrman and Deolalikar, 1988; Strauss and Thomas, 1995). This utility function[3] includes, as arguments, child nutritional status *(N)*, food consumption *(F)* and non-food consumption *(C)* of every individual, leisure *(L)*, and the health status of each household member *(H)*. Utility is also conditioned by observed characteristics, such as:

- Individual characteristics *(IC)*;
- Household characteristics *(HC)*;
- Community and environmental factors *(CC)*;
- Leisure time *(T)*; and
- Unobserved characteristics *(e)*;

all of which give the formula:

$$U_i = U(N, F, C, L, H, T, IC, HC, CC, \varepsilon) \quad (1)$$

The health production function is given by the following Equation 2:

$$H = H(NI, C, HS, IC, HC, CC, \mu) \quad (2)$$

This equation reveals that the health outcome is a function of nutritional consumption *(NI)* and consumption *(C)*. This equation is also conditioned by: household size *(HS)*; household characteristics *(HC)*; individual characteristics *(IC)*; community characteristics which improve health *(CC)*.

Moreover, guided by the underlying economic determinants of the nutritional status, we assume that nutrition depends on consumption and education, as well as on the characteristics of the individual and those of the community. This is expressed in the following equation:

$$Ni = N(Ci, E, IC, HC) \quad (3)$$

To the previous equations, we add the equation of household wages as well as time constraints. The wage equation is given by the expression:

$$W = w(H, N, E, IC, Ci, ew) \quad (4)$$

This equation shows that household wage is determined by health standards *(H)*, nutritional status *(N)*, education *(E)*, individual characteristics *(IC)*, household characteristics *(HC)*, unobserved characteristics *(Ci)* and the random fluctuation of wages *(ew)*.

The time constraint is given by the following equation:

$$T = Th + Tw + Tl + Te \quad (5)$$

where:

Th = time allocated to health
Tw = time allocated to labour
Tl = time allocated to leisure
Te = time allocated to education

Consequently, the household maximizes its utility under the following various constraints: health production function; nutrition production function; wage equation; time constraint *(T);* and budgetary constraint given by the following equation:

$$PcC + PhH - wL + Y \quad (6)$$

where:

Pc = the price of the consumption of non-health-related goods;
Ph = the price of the consumption of health-related goods;
Y = the transfer income; and
wL = wage labour

The maximization of the problem under the various constraints generates a set of reduced demand functions. On the basis of the existing literature (Thomas and Strauss, 1992; Sahn, 1994; Strauss and Thomas, 1995), the reduced form of the reduced demand function can be written as:

$$Hi = h(IC, HC, CC, \mu) \quad (7)$$

In this equation, which represents the reduced form of the health input demand function *i*, *IC* represents the child's characteristics such as age, sex, etc. *HC* symbolizes household characteristics such as parents' level of education, household resources and the availability of toilets and waste water draining facilities. *CC* represents community characteristics such as accessibility to and quality of health services, while μ is the term of random error representing the unobservable characteristics of the individual, the family and the community that affect the child's nutritional outcome.

As can be noticed, the preceding equation is a reduced form of the health production function that solely depends on exogenous variables such as:

- The characteristics of the child, the parents and the community; and
- A variable that is assumed to be independent of the previous ones, namely the specific and unobservable characteristics of the individual or of the family members and which can influence health.

From all that precedes, the final equation can be expressed as follows:

Anthropometric index i = f (child's characteristics, mother's characteristics, environmental characteristics)

Anthropometric indexes are calculated in reference to characteristics of a child population whose growth is deemed normal. These indexes are given in the growth chart of the National Centre for Health Statistics that was adopted by the United Nations in 1993. From the data on age, sex, weight and height of the children surveyed, anthropometric measurements of the nutritional status of every child are taken. Generally, these are:

- ***The height-for-weight index:*** This index compares the weight of the child surveyed with the mean or median weight of children of the same height and the same sex and belonging to the reference population. Thus, a child whose weight is low relative to their height is considered a victim of weight loss. This index is supposed to represent the child's current nutritional status.

- ***The age-for-height index:*** This compares the height of the child surveyed with the mean or median height of children of the same age and sex and belonging to the reference population. Consequently, children who are small for their age are considered

as suffering from growth retardation. This index is viewed as a long-term measure of nutritional status.

- ***The weight-for-age index:*** This index compares the weight of the child surveyed with the mean or median weight of children of the same age and same sex and belonging to the reference population. It is a measure of past nutritional status.

For every child, the measurements for these different indexes can be expressed in three ways: as a percentage of the reference population's median, as a percentile of the reference population, or how many standard variations they are above or below the mean of the reference population. In this study we use the third method of calculation, as it gives indexes whose distribution is, according to the laws of statistics, normal (these are the *z*-scores).

The empirical framework

To estimate the impact of economic and socio-demographic factors on child nutritional status, the appropriate model to be used is one that establishes a relationship between each nutritional status index and the non-monetary wealth index, on the one hand, and household socio-demographic characteristics, on the other. The model used for a separate estimation of the rural area and the urban area is expressed as follows:

$$Y_i = \beta_o + \beta_{j1}{}' X_{i1} + \beta_{j2}{}' X_{i2} + \beta_{j3}{}' X_{i3} + \beta_{j4}{}' X_{i4} + \alpha D_i + \varepsilon i \qquad (8)$$

where:

- Y_i represents the child's anthropometric status indicator *i*
- X_{i1} is the vector of characteristics linked to the child
- X_{i2} is the vector of characteristics linked to the parents
- X_{i3} is the vector of characteristics linked to the household
- X_{i4} is the vector of characteristics linked to community facilities
- D_i indicates the household's non-monetary wealth index
- ε_i is the usual symmetrical error term

The estimated coefficients such as α and β are elements that will be used to test (to accept or to reject) hypotheses *H1* and *H2*.

Variables

Three dependent variables represent the child's anthropometric nutritional status: the *z* scores for the height-for-weight index (whz-scores), the *z* scores for the age-for-height index (haz-scores), and the *z* scores for the age-for-weight index (waz-scores). A set of independent variables is capable of accounting for the variations observed in child nutritional status.

A summary of the variables that will be used for the estimation of the model is given in Table 2.

Table 2: Summary of the variables in the model to be estimated

Description		Measure	Expected effect
Dependent variables	Growth retardation	Z scores for the age-for-height index	
	Underweight	Z scores for the age-for-weight index	
	Emaciation	Z scores for the height-for-weight index	
Explanatory variables	**Household's living standards**		
	- Composite poverty indicator	Composite poverty index constructed using the multiple correspondence analysis*	(+)
	Parents' characteristics		
	• Mother's schooling	Yes = 1; No = 0	(+)
	• Father's schooling	Yes = 1; No = 0	(+)
	• Mother's age:		
	From 15 to 19 years	Control group	
	From 20 to 24 years	Yes = 1; No = 0	(+)
	From 25 to 34 years	Yes = 1; No = 0	(+)
	From 35 to 49 years	Yes = 1; No = 0	(+)
	• Mother's height	Height	(+)
	• Household region of residence		
	Lomé	Control group	
	Région Maritime	Yes = 1; No = 0	(-)
	Région des Plateaux	Yes = 1; No = 0	(-)
	Région Centrale	Yes = 1; No = 0	(-)
	Région de Kara	Yes = 1; No = 0	(-)
	Région des Savanes	Yes = 1; No = 0	(-)
	• Ethnic group of household head		
	Mina/Ewé	Control group	
	Akposso	Yes = 1; No = 0	(..)
	Ana-Ifè	Yes = 1; No = 0	(..)
	Kabyè-Tem	Yes = 1; No = 0	(..)
	Paragourma	Yes = 1; No = 0	(..)
	Other ethnic groups	Yes = 1; No = 0	(..)
	Non-Togolese	Yes = 1; No = 0	(..)
	Child characteristics		
	• Child's age		
	From 0 to 6 months	Control group	
	From 7 to 12 months	Yes = 1; No = 0	(-)
	From 13 to 24 months	Yes = 1; No = 0	(-)
	From 25 to 35 months	Yes = 1; No = 0	(-)
	• Child's sex	Male = 1; female = 0	(..)
	Household characteristics		
	• Spouse in the house	Yes = 1; No = 0	(+)
	• Size of the household	Total number of dependents	(+)
	Health services offered		
	• Vaccinated children	Proportion of vaccinated children in the household	(+)
	• Women vaccinated against tetanus	Proportion of vaccinated women in the household	
	• Women who received prenatal care from a medical doctor	Proportion of women who received prenatal care from a medical doctor	
	• Women who received prenatal care from a medical auxiliary/midwife	Proportion of women who received prenatal care from a medical auxiliary or a midwife	

* The variables needed to construct this index are: housing status, water supply, mode of lighting, hygienic conditions.

Estimation techniques

As Nakabo-Ssewanyana (2003) observes, some studies (Sahn, 1990; Sahn and Alderman, 1997; Thomas et al., 1996; Haddad and Hoddinot, 1994) highlighted a possible problem of endogeneity for certain explanatory variables, especially the composite wealth index (CWI), when the model was being empirically estimated.[4] Some authors such as Strauss (1990) and Haddad and Hoddinot (1994) used the fixed effects method, while Sahn and Alderman (1997) used the instrumental variables method.

In this study we use both techniques; in other words, our model is estimated as both a fixed effects model and instrumental variables model. The use of the two techniques[5] is guided by the concern not only to test the robustness of the results but also to be able to integrate relevant variables, for example infrastructure and regions, which would not be taken care of by a fixed effects model. In the case of the fixed effects model, dummy variables that are indicative of fixed effects are to be added. Fixed effects refer to clusters. This estimation technique enables us to correct the bias resulting from a possible correlation between individual factors and community characteristics and, above all, to take into account the endogeneity of certain explanatory variables. Besides, there are households where one of the spouses does not live in the house. Therefore, including the spouse-in-the-house variable would exclude such households during the estimation. For this reason, either model has been estimated in two ways: the variables related to the spouse have been eliminated in one model but maintained in the other. Where these variables are kept, a binary variable equal to 1 if the spouse is absent and to 0 if the spouse is present has been added to the model.

4. Presentation and analysis of the results

Child characteristics crucial to the analysis are growth retardation, emaciation and underweight; we look at their prevalence and distribution. Determinants of these manifestations of malnutrition are identified through household wealth indexes, the child's own characteristics, such parent characteristics as education, age, etc., household characteristics, and aspects of community infrastructure like the availability of health care. The phases of the analysis and the interactions of these factors are described below.

Analysis of child anthropometric indicators

As Table 3 reveals, growth retardation, underweight and emaciation seem to be a phenomenon more of rural than urban areas. The proportions of children suffering from malnutrition in the rural area are 27.95%, 32.09% and 14.93%, respectively, against 6.13%, 18.13% and 10.63% in the urban area.

Regionally, the table shows that the proportion of children suffering from growth retardation, underweight and emaciation is lower in Lomé that in other regions. The most affected regions are the *Région des Savanes* (33.64%), with regard to malnutrition, and the *Région des Plateaux* (24.36%), with regard to growth retardation. The same applies to underweight and emaciation. These results seem to confirm the hypothesis according to which access to health facilities (water, electricity and community health units) has a positive impact on children's health. This is all the more true for the *Région des Savanes*, which happens to be the poorest region of Togo.

The distribution of malnourished children according to the mother's level of education reveals that children whose mothers are illiterate show more signs of a deteriorating nutritional status. Likewise, the higher the mother's level of education, the lower the proportion of children suffering from malnutrition. With regard to the variable "mother", it seems that the number of children suffering from chronic malnutrition, underweight and emaciation increases with the mother's age, with the highest proportion of children being found with the oldest mothers.

As for the child's age, it appears that children aged less than six months are least likely to be malnourished. Beyond six months, the proportion increases. Thus, as children grow older, they are more exposed to the effects of growth retardation, underweight and emaciation. Taking the child's sex into account, boys seem to suffer more from growth retardation and emaciation: 26.9% and 14.39%, respectively, of male children against 23.9% and 13.61% of female children. In the case of underweight, the impact is reversed,

although still relatively negligible, and female (29.34%) seem to be more affected than male (28.84%).

Table 3: Percentage of malnourished children

	Age for height (growth retardation)	Age for weight (underweight)	Height for weight (emaciation)
Area of residence			
Rural	27.95	32.09	14.93
Urban	16.13	18.13	10.63
Geographical region			
Lomé	12.84	14.19	11.15
Région Maritime (Coastal Region)	21.84	27.25	13.43
Région des Plateaux (Plateau Region)	24.36	27.19	12.63
Région Centrale (Central Region)	24.13	24.83	9.03
Région de Kara (Kara Region)	23.61	25.80	13.32
Région des Savanes (Savannah Region)	33.67	40.51	19.59
Mother's level of education			
Illiterate	29.25	33.90	15.73
Primary education	20.88	22.74	11.24
Secondary education	12.68	15.85	11.27
Tertiary education	0	0	0
Mother's age			
From 15 to years	22.87	30.49	18.83
From 20 to 24 years	25.66	27.93	12.90
From 25 to 34 years	24.76	28.62	13.15
From 35 to 49 years	27.26	30.79	15.63
Child's age			
From 0 to 6 months	4.20	3.69	5.73
From 7 to 12 months	15.80	31.47	20.14
From 13 to 24 months	37.54	40.09	20.09
From 25 to 36 months	34.32	33.81	14.43
Child's sex			
Male	26.90	28.84	14.39
Female	23.93	29.34	13.61
Overall	**25.40**	**29.09**	**14.01**

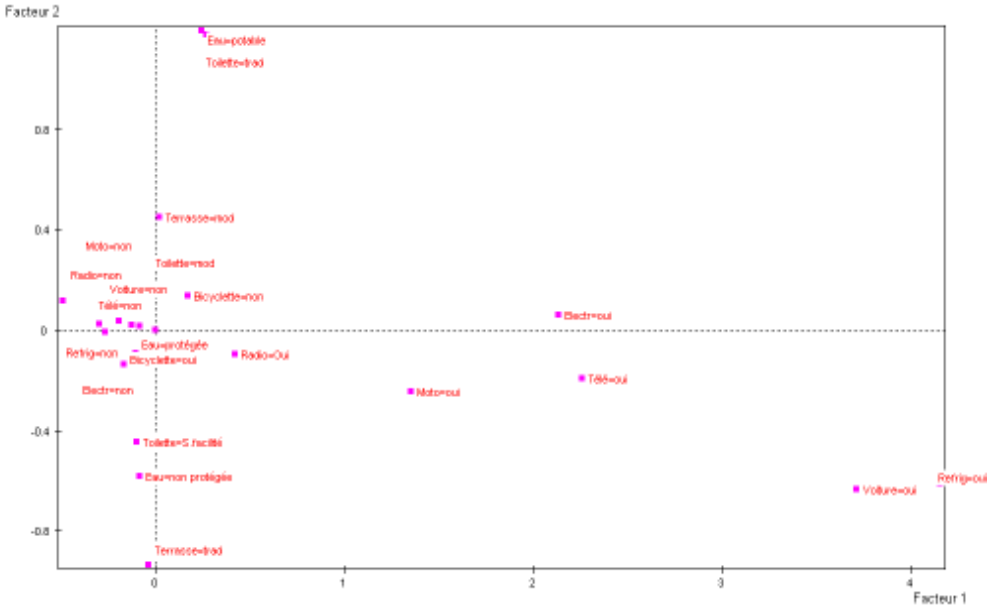
Source: EDST-98 and Author's calculations.

Measurement and analysis of wealth indexes

From a preliminary multiple correspondence analysis (MCA), it was possible to note that the first factor axis, which accounts for 23.91% of the total inertia of the scatter of variables, highlighted two categories of households: poor households and non-poor ones. As shown in Figure 1, the variables describing the poverty status are negatively correlated with the first axis and, on the other hand, that those synonymous with the wealth status are positively correlated with this axis. In other words, on the first factor plane, the poor are on the left and the rich on the right; it follows that wellbeing increases

from left to right. This first MCA on the dimensions of non-monetary poverty contributed to the final choice of non-monetary variables by using a criterion related to the ordinal consistency of the first axis. For a partial indicator, this property consists in seeing whether its ordinal structure of well-being has been borne out by the ordinal structure of the scores of its modalities on the first factor axis.

Figure 1: Factor plane for the first MCA



An analysis of the weight of non-monetary property obtained with the first MCA reveals the inconsistency of the bicycle as property,[6] thus it was eliminated from the second MCA. This final MCA led to an increase in the explanatory power of the first factor axis, i.e., 26.3%. It should also be noted that during this final MCA, the direction of the axes changed (Figure 2). However, this change has no particular significance because inertia analysis is independent of the direction of axes. It can be noticed that in the new factor plane the rich are on the left and the poor on the right. However, for the purposes of analysis, the first factor axis was re-oriented by positioning the poor on the left and the rich on the right. (See also Appendix B.)

Factor analysis

An analysis of the weights of different types of property (see Table 4) shows that ownership of durable goods, apart from the bicycle, regarded as a reflection of relatively high living standards, improves the household wealth index. And so does having access to clean water, electricity and modern toilets, as well as having a modern terrace, ceiling and walls. On the other hand, consumption of unprotected water and lack of toilet facilities are naturally among the things that would lower the level of the household's property index.

Figure 2: Factor plane for the second MCA

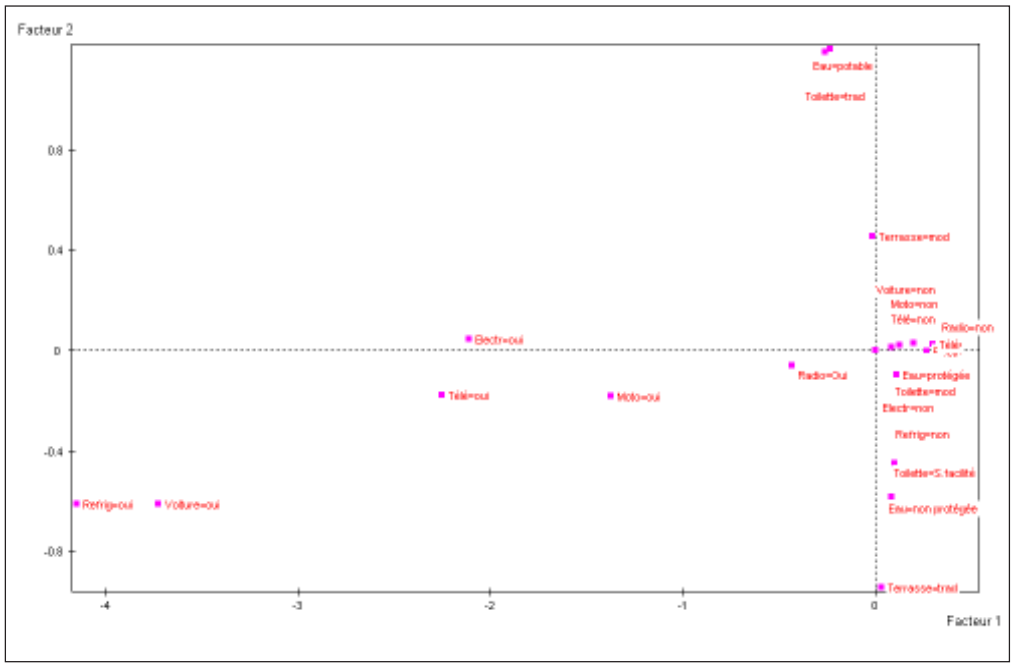


Table 4: Weights of different types of property from multiple correspondence analyses

Property	First MCA		Second MCA	
	Yes	No	Yes	No
Durable property				
Radio	0.82	-0.96	-0.80	0.95
TV	4.41	-0.59	-4.18	0.56
Refrigerator	8.11	-0.25	-7.70	0.24
Bicycle	-0.33	0.33		
Motorcycle	2.63	-0.39	-2.56	0.37
Car	7.23	-0.16	-6.90	0.15
Electricity	4.15	-0.53	-3.92	0.48
Household characteristics				
Potable water	0.47	-	-0.43	-
Protected water	-0.21	-	0.20	-
Non-protected water	-0.18	-	0.15	-
Modern toilet/ traditional toilet	0.53	-	-0.48	-
No toilet facility	-0.20	-	0.19	-
Modern terrace	0.04	-	-0.04	-
Traditional terrace	-0.08	-	0.06	-

Source: EDS-Togo 1998 and author's calculations.

The composite wealth indicator

From the property weights generated by the MCA, a composite indicator has been calculated for each household. Given the configuration of the variables from the second MCA (Figure 2), these represent a composite wealth indicator (CWI). Table 5 shows that households in urban areas have a higher composite wealth indicator than those in rural areas, which means a lower poverty status for the former. Two important observations can be made from the distribution of households according to geographical regions: (a) the level of wellbeing is lower in households in the *Région des Plateaux* and the *Région des Savanes*; and (b) households in Lomé, the capital city, enjoy the highest level of wellbeing.

Table 5: Some descriptive statistics of the composite wealth indicator

	Mean	Standard deviation	Minimum	Maximum
Area of residence				
Urban	0.46	0.83	-36	3
Rural	-0.15	0.28	-36	2.86
Geographic area				
Lomé	0.69	0.87	-36	3
Région Maritime	-0.07	0.48	-36	2.94
Région des Plateaux	-0.09	0.31	-36	2.92
Région Centrale	-0.004	0.50	-36	3
Région de Kara	-0.03	0.48	-36	3
Région des Savanes	-0.15	0.39	-36	2.93

Source: EDS-Togo 1998 and author's calculations.

Econometric analysis of the determinants of malnutrition

Econometric estimations used two estimation techniques, one related to the fixed effects model and the other to the use of instrumental variables. With these techniques we are able to correct the endogeneity problems of some explanatory variables. It is thus possible to correct the bias arising from a possible correlation between individual factors and community characteristics. Results are tabulated in Appendix C and described below.

The impact of child characteristics on child nutritional status

In both rural and urban areas, the health and nutritional status of children over six months of age was found to be significantly lower than that of children under six months. This state of affairs applies to the short-term nutritional status (whz-scores), the long-term statue (haz-scores), and the past nutritional status (waz-scores). This means that growth retardation worsens more quickly for children over six months of age than those under six months, reflecting the accumulation of deprivation that leads to chronic malnutrition. The explanation for this is that by around six months of age babies are being weaned and are particularly vulnerable to diarrhoeal diseases and inappropriate weaning practices.

It further emerges from the estimated coefficients, when they are significant, that boys' nutritional status is worse than that of girls, particularly in the case of chronic malnutrition and that of past nutritional status. The estimated coefficients indicate that

the boys' chronic malnutrition index is in general between 0.11 and 0.19 less than that of girls; for the past nutritional status, the variation is 0.09. This result is valid for both rural and urban households. Moreover, it is similar to findings by Svedberg (1990) across ten sub-Saharan African countries, Sahn and Stifel (2002) for 14 sub-Saharan African countries, Sahn and Alderman (1997) for the case of Mozambique, and Koffi-Tessio et al.(2000) for the case of Togo.

These findings can be accounted for through physiological and sociological reasons. Physiologically, girls grow more precociously than boys. Sociologically, in the African context, and specifically in rural areas, the mothers, who have the responsibility of taking care of children, pay more attention to girls than to boys. This can be explained by the fact that during the process of socializing the girl-child, the mother, in her concern to teach her, from an early age, the role of a woman, will wittingly or unwittingly keep her daughter close to herself. Thus, during the mother's daily domestic chores, the daughter is always beside her while the boy is somewhere else busy playing. Because the girl is always with her mother, she gets more food from the mother than the boy does. Besides, considering the fact that the coefficients are statistically more significant in the rural than the urban area, one can deduce that the care given to girls could be explained by the specific nature of rural societies, where far fewer girls go to school, and where girls help their mothers in their domestic chores from early childhood. They are more likely to enjoy special care from their parents, notably their mother.

The impact of the household's characteristics on child health status

The relationship between a household's composite wealth indicator and the child growth index was found to be positive and highly significant independent of the area of residence. This means that the higher the level of the multidimensional wealth of the rural or urban household is, the better the child nutritional status becomes. In other words, the indicator of child health status in a household improves as the household's level of wealth increases. Indeed, variation in the increase (or reduction) of the composite wealth indicator leads to variation in the improvement (or deterioration) of child nutritional status. However, it should be noted that the increase is higher in the case of the long-term nutritional status and that of past status than in the case of the short-term status. This means that the household's non-monetary assets are an important determinant of child nutritional status. Compared with the effect in the rural area, the effect in the urban area is stronger for the three types of growth indexes. As the growth retardation index increases by 0.26, the CWI increases by 1 in the rural area against 0.30 in the urban area.

The results obtained regarding the variable "household size", measured as the total number of dependents, show that there is a negative impact of this variable on child nutritional status, but one that is relatively weak irrespective of the area of residence. Thus, the higher the number of dependents, the more the child nutritional status deteriorates. It should be noted, however, that the negative impact is higher in urban households than in rural ones. This finding can be explained by the fact that urban households have more needs and incur more expenses than those in the rural area, particularly in terms of consumption of different services such as electricity, clean water, telephone and transport.

The presence of the spouse in the family home has a significant effect on a child's nutritional status according to the area of residence only in the case of fixed-effects models.[7] Thus, the findings show that in either urban or rural areas, children who live with both parents have a long-term nutritional status (being underweight) lower than that of children who live with only one of the parents. For children in the urban area, the presence of both parents at home has a positive effect on the child's current nutritional status. A negative impact of the presence of both parents at home can be explained by the fact that this presence constitutes an additional burden to the household. On the other hand, the positive impact of the presence of both parents at home can be explained by the fact that either parent will contribute to providing care to the child.

The impact of parents' characteristics on child heath status

On the whole, the mother's schooling has been observed to have a significant and positive impact on child health status. In this respect, children whose mothers are educated present a higher nutritional status than whose mothers are illiterate, that is with lower growth retardation and emaciation indexes. This positive impact of mother's schooling has also been found in other studies, among which Asenso-Okyere et al. (1997) the case of Ghana and Koffi-Tessio et al.(2000) for the case of Togo. However, the impact of the mother's schooling on child health status varies according to the mother's area of residence: mother's schooling always has a positive and significant impact on child health in the rural area. On the other hand, the impact of mother's schooling on child nutritional status in the urban area was not significant for either present or past nutritional status. This finding may be interpreted as follows: In the rural area, the ignorance of illiterate women about health-related matters and their non-hygienic practices have a negative impact on the health and nutritional status of their children. However, literate mothers in rural households are more aware of hygiene issues in their daily practices. Thus, children whose mothers are literate enjoy good health whereas those whose mothers are illiterate suffer from poor health.

Although the spouse's level of education has a positive effect on child nutritional health, that impact was found to be statistically non-significant in the urban area. However, it was found to be significant and positive for the long-term and past nutritional status in the rural area.

The mother's age has a significant impact on child growth, although this impact varies according to whether the mother lives in the rural or urban area; it also varies with types of nutritional status indicators. Taking age groups into account, it appears that children of rural mothers aged 25–34 years present a higher long-term nutritional status than children of mothers aged less than 20 years. This impact has not been observed in the urban area. Similarly, compared with children whose mothers are less than 20 years old, the mother's positive impact on her child's past nutritional health is very significant in rural areas if she is aged 20 or more, while the impact is not significant in urban areas. On the other hand, in urban areas, the present nutritional status of children whose mothers are over 20 years old is significantly higher than that of children whose mothers are less than 20, while there is no difference for rural households.

The positive and significant impact of the mother's height on the long-term and past nutritional status of the child confirms the explanation that the genotype and phenotype

play an important role in determining a child's stature. A similar finding is reported in Sahn and Alderman (1997). The impact of the mother's height on the child's stature is weaker in the urban than the rural area.

Given the historical factors associated with eating habits or economic, sociological and geographical factors,[8] it is likely that belonging to a given ethnic group or living in another area of residence than the capital city is likely to have an impact on the nutritional status of children. It transpires from estimation results that the ethnicity variable seems to be a non-negligible factor in accounting for growth retardation in urban as well as rural areas. For example, compared with urban children from the Adja-ewé ethnic group, urban children from the Akposso and Kabye ethnic groups as well as "non-Togolese" children have higher scores on the long-term nutritional status variable. The estimated coefficients for regions reveal that the *Région des Savanes,* both urban and rural areas, is the only region for which the child nutritional status is significantly lower than that of children from the capital city. The same situation obtains in the *Région de Kara* when one considers its rural areas.

The impact of the availability of health facilities on child health status

Although taken into consideration only in the case of the use of the instrumental variables method, the variables representing health facilities were found to be non-negligible in relation to child health and nutritional status in rural areas, especially concerning growth retardation and emaciation. Indeed, in rural areas, when the proportion of vaccinated children increases by 1%, the growth retardation index increases by 1.20 while the emaciation index increases by 0.96. On the other hand, in urban areas, the effect of health facilities appears to be paradoxical compared with the expected outcome, since it was found to be either non-significant or negatively significant.

5. Conclusion and policy implications

With its emphasis particularly on household living standards in urban and rural areas, the study was able to identify the main determinants of child malnutrition in Togo. Econometric estimations produced results that are similar to those already reported in the literature.

First, in relation to child characteristics, the results show that the child's health status deteriorates beyond the age of six months, the age when the weaning process generally begins, as the mother progressively abandons breastfeeding and provides solid foods, which are more exposed to possible contamination than maternal milk. On the other hand, the sex of the child plays an important role in determining the child's nutritional status, with girls having a better nutritional status than boys.

Second, the study analysed the impact of household wellbeing or poverty status on child nutritional status by using the household's non-monetary assets index. The results indicate that the wellbeing of a household contributes to improved child nutritional status in both rural and urban areas. Household size was found to be another determinant of malnutrition, as it has a negative effect on child nutritional status, specifically in the urban area.

Third, taking into account parents' characteristics, the study found that the mother's schooling contributes to improving the child's nutritional status. However, even though the impact was found to be positive and significant on the three indicators of nutritional status in the rural area, in the urban area a positive and significant impact was observed only in relation to past malnutrition. An identical result was observed in relation to the impact of the father's schooling, an impact that was found to be positive but not significant in the urban area. Moreover, the child's nutritional status increases with the mother's age, especially in relation to cases of underweight and chronic malnutrition in the rural area and of underweight in the urban area. Furthermore, the positive and significant impact of the mother's height on the child's nutritional status confirms the explanation that genotype plays a key role in determining a child's stature.

Fourth, by using different variables as a proxy for the child health and nutritional environment, the study found that community amenities and infrastructure had an effect on child nutritional status. This was mainly positive in the urban area, but the rural area was found to be characterized by an insufficiency of health facilities and services.

The findings point to health and nutrition policy guidelines for improving children's nutritional status as well as fighting household poverty. These guidelines would include:

- Continuing to promote exclusive breastfeeding during the first six months of childhood.
- Strengthening the policy of basic education for all, particularly in rural areas.
- Providing rural populations with adequate health facilities.

- Implementing policies aimed at raising household income or reducing the cost of durable goods, both of which contribute to wellbeing and increase in the wealth index.
- Promoting health and nutrition education for women who have their babies in maternal and infant care centres.
- Strengthening family planning services in order to improve women's health and limit the household's size, in particular the number of children.

Notes

1. Chakravarty et al. (1997) and Bourguignon and Chakravarty (1999) present a literature review on this approach.

2. For more details, see Asselin (2002).

3. In reference to the literature review presented in Fambom (2004).

4. The test done made it possible to confirm the non-exogeneity of the CWI variable.

5. Note that each technique has its advantages and shortcomings, which are pointed out here.

6. The inconsistency of the bicycle as a property was noted by Ki et al. (2005) in a study on multidimensional poverty in Senegal.

7. All these coefficients are strongly non-significant when they are estimated using the instrumental variables method. Moreover, when the variable is removed from the model, the estimation produces coefficients whose sign and value do not change significantly.

8. Togo is subdivided into five economic regions each with its own specificities.

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Appendix A: The first MCA

Table A1: First MCA

Number	Specific value	Percent	Percent cumulative
1	0,2630	23,91	23,91
2	0,1585	14,41	38,33
3	0,1185	10,77	49,10
4	0,1047	9,52	58,62
5	0,0949	8,63	67,24
6	0,0770	7,00	74,25
7	0,0741	6,74	80,98
8	0,0640	5,82	86,80
9	0,0613	5,57	92,37
10	0,0453	4,12	96,49

Table A2: Coordinates of active modalities for first MCA

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
ELECTRICITY							
Electr=yes	1,111	8,00189	-2,13	-0,06	0,28	-0,27	-0,46
Electr=no	8,889	0,12497	0,27	0,01	-0,04	0,03	0,06
RADIO							
Radio=yes	5,421	0,84484	-0,42	0,10	-0,55	0,07	-0,10
Radio=no	4,580	1,18360	0,49	-0,12	0,65	-0,09	0,12
TELE							
Tel=yes	1,162	7,60286	-2,26	0,19	-0,12	-0,16	-0,44
Tel=no	8,838	0,13153	0,30	-0,03	0,02	0,02	0,06
REFRI							
Refrig=yes	0,297	32,70260	-4,16	0,61	1,60	0,74	1,60
Refrig=no	9,703	0,03057	0,13	-0,02	-0,05	-0,02	-0,05
BICYCLE							
Bicycle =yes	5,047	0,98144	0,17	0,13	-0,64	0,41	0,47
Bicycle=no	4,953	1,01887	-0,17	-0,14	0,65	-0,42	-0,48
MOTO							
Moto=yes	1,265	6,90718	-1,35	0,24	-1,09	-0,13	-0,80
Moto=no	8,735	0,14477	0,20	-0,04	0,16	0,02	0,12

continued next page

Table A2 Continued

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
CAR							
Car=yes	0,222	44,01430	-3,71	0,64	2,01	1,62	3,46
Car=no	9,778	0,02272	0,08	-0,01	-0,05	-0,04	-0,08
WATER							
Water=potable	2,770	2,61067	-0,24	-1,19	-0,17	-0,30	0,25
Water= protected	1,846	4,41672	0,11	0,09	0,46	1,71	-0,96
Water=non-protected	5,384	0,85722	0,09	0,58	-0,07	-0,43	0,20
TOILET							
Toilet=trad	2,744	2,64466	-0,27	-1,18	-0,20	-0,24	0,17
Toilet=without	7,256	0,37811	0,10	0,45	0,08	0,09	-0,06
TERRACE							
Terrace=mod	6,761	0,47906	-0,02	-0,45	-0,01	0,21	-0,02
Terrace=trad	3,239	2,08735	0,04	0,94	0,01	-0,43	0,03

Table A3: Different specific value of second MCA

Number	Specific value	Percent	Percent cumulative
1	0,2903	26,13	26,13
2	0,1754	15,79	41,92
3	0,1232	11,09	53,00
4	0,1110	9,99	63,00
5	0,0856	7,71	70,70
6	0,0827	7,44	78,14
7	0,0809	7,28	85,42
8	0,0684	6,16	91,58
9	0,0507	4,56	96,14
10	0,0429	3,86	100,00

Table A4: The second MCA: Multiple correspondence analysis elimination of active modalities

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
ELECTRICITY							
Electr=yes	1,234	8,00189	2,11	-0,05	0,02	-0,02	0,64
Electr=no	9,877	0,12497	-0,26	0,01	0,00	0,00	-0,08
RADIO							
Radio=yes	6,023	0,84484	0,43	0,06	-0,42	0,29	0,24
Radio=no	5,088	1,18360	-0,51	-0,07	0,50	-0,35	-0,29
TELE							
Tel=yes	1,292	7,60286	2,25	0,18	-0,24	0,18	0,03
Tel=no	9,820	0,13153	-0,30	-0,02	0,03	-0,02	0,00

continued next page

Table A4 Continued

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
REFRIG							
Refrig=yes	0,330	32,70260	4,15	0,61	2,11	-1,12	-0,05
Refrig=no	10,782	0,03057	-0,13	-0,02	-0,06	0,03	0,00
MOTO							
Moto=yes	1,405	6,90718	1,38	0,18	-1,11	0,76	-0,94
Moto=no	9,706	0,14477	-0,20	-0,03	0,16	-0,11	0,14
CAR							
Car=yes	0,247	44,01430	3,72	0,61	3,27	-1,79	-0,61
Car=no	10,864	0,02272	-0,08	-0,01	-0,07	0,04	0,01
WATER							
Water=potable	3,077	2,61067	0,23	-1,20	-0,20	-0,36	-0,31
Water= protected	2,051	4,41672	-0,11	0,10	1,12	1,67	-0,43
Water=non protected	5,983	0,85722	-0,08	0,58	-0,28	-0,39	0,31
TOILET							
Toilet=trad	3,049	2,64466	0,26	-1,19	-0,22	-0,24	-0,45
Toilet=without	8,063	0,37811	-0,10	0,45	0,08	0,09	0,17
TERRACE							
Terrace=mod	7,512	0,47906	0,02	-0,45	0,12	0,14	0,39
Terrace=trad	3,599	2,08735	-0,03	0,95	-0,25	-0,30	-0,82

Table A5: Contributions of active modalities of the second MCA

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
ELECTRICITY							
Electr=yes	1,234	8,00189	18,94	0,01	0,00	0,00	5,81
Electr=no	9,877	0,12497	2,37	0,00	0,00	0,00	0,73
RADIO							
Radio=yes	6,023	0,84484	3,91	0,13	8,70	4,70	4,21
Radio=no	5,088	1,18360	4,63	0,15	10,30	5,57	4,98
TELE							
Tel=yes	1,292	7,60286	22,62	0,23	0,61	0,36	0,02
Tel=no	9,820	0,13153	2,98	0,03	0,08	0,05	0,00
REFRIG							
Refrig=yes	0,330	32,70260	19,58	0,71	11,89	3,70	0,01
Refrig=no	10,782	0,03057	0,60	0,02	0,36	0,11	0,00
MOTO							
Moto=yes	1,405	6,90718	9,17	0,27	14,01	7,36	14,55
Moto=no	9,706	0,14477	1,33	0,04	2,03	1,06	2,11
CAR							
Car=yes	0,247	44,01430	11,79	0,53	21,42	7,13	1,08
Car=no	10,864	0,02272	0,27	0,01	0,49	0,16	0,02

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Table A5 Continued

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
WATER							
Water=potable	3,077	2,61067	0,58	25,19	0,99	3,59	3,41
Water= protected	2,051	4,41672	0,08	0,11	20,83	51,61	4,45
Water=non protected	5,983	0,85722	0,14	11,59	3,84	8,11	6,55
TOILET							
Toilette=trad	3,049	2,64466	0,72	24,50	1,18	1,60	7,23
Toilette= without	8,063	0,37811	0,27	9,26	0,45	0,60	2,73
TERRACE							
Terrace=mod	7,512	0,47906	0,01	8,81	0,91	1,38	13,64
Terrace=trad	3,599	2,08735	0,01	18,40	1,90	2,89	28,46

Table A6: Cordinates, contribution and square cosine of active modalities of second MCA

Modalities	Relative weight	Distance	Axe 1	Axe 2	Axe 3	Axe 4	Axe 5
ELECTRICY							
Electr=yes	1,234	8,00189	0,56	0,00	0,00	0,00	0,05
Electr=no	9,877	0,12497	0,56	0,00	0,00	0,00	0,05
RADIO							
Radio=yes	6,023	0,84484	0,22	0,00	0,21	0,10	0,07
Radio=no	5,088	1,18360	0,22	0,00	0,21	0,10	0,07
TELE							
Tel=yes	1,292	7,60286	0,67	0,00	0,01	0,00	0,00
Tel=no	9,820	0,13153	0,67	0,00	0,01	0,00	0,00
REFRIG							
Refrig=yes	0,330	32,70260	0,53	0,01	0,14	0,04	0,00
Refrig=no	10,782	0,03057	0,53	0,01	0,14	0,04	0,00
MOTO							
Moto=yes	1,405	6,90718	0,27	0,00	0,18	0,08	0,13
Moto=no	9,706	0,14477	0,27	0,00	0,18	0,08	0,13
CAR							
car=yes	0,247	44,01430	0,32	0,01	0,24	0,07	0,01
car=no	10,864	0,02272	0,32	0,01	0,24	0,07	0,01
WATER							
Water=potable	3,077	2,61067	0,02	0,55	0,02	0,05	0,04
Water=protected	2,051	4,41672	0,00	0,00	0,28	0,63	0,04
Water=non protected	5,983	0,85722	0,01	0,40	0,09	0,18	0,11
TOILET							
Toilet=trad	3,049	2,64466	0,03	0,53	0,02	0,02	0,08
Toilet=without	8,063	0,37811	0,03	0,53	0,02	0,02	0,08
TERRACE							
Terrace=mod	7,512	0,47906	0,00	0,43	0,03	0,04	0,32
Terrace=trad	3,599	2,08735	0,00	0,43	0,03	0,04	0,32

Appendix B: Results of econometric estimations

Table B1: The case of fixed-assets models used for the rural area when the child lives with both parents

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-5.05	-9.29***	0.20	0.43	-2.64	-5.54***
Child's characteristics						
7–12 months	-0.69	-9.37***	-0.90	-14.33***	-1.39	-21.44***
13–24 months	-1.42	-18.41***	-0.95	-14.16***	-1.69	-24.69***
25–35 months	-1.59	-25.74***	-0.60	-11.55***	-1.59	-29.14***
Sex (1= boy)	-0.17	-0.47	0.03	0.88	-0.09	-2.28**
Parents' characteristics						
Mother's age						
20–24 years	0.09	0.84	0.08	0.91	0.20	2.09**
25–34 years	0.19	1.83*	0.05	0.63	0.26	2.93**
35–49 years	0.17	1.54	0.03	0.41	0.21	2.23**
Educated mother (1= Yes)	0.12	2.28**	0.17	3.56***	0.16	3.42***
Mother's height	0.003	9.13***	-0.00	-1.01	0.001	5.16***
Educated father (1= Yes)	0.09	1.72	0.07	1.61	0.09	2.14**
Household's characteristics						
Composite wealth index	0.26	3.02***	0.15	2.07**	0.29	3.98***
Household size	-0.003	-0,73	-0.01	-2.18**	-0.01	-2.58***
Both parents at home	-0.08	-1.50	0.01	0.25	-0.09	-1.87
Ethnic group						
Akposso	0.005	0.03	0.05	0.47	0.09	0.68
Ana-Ifè	0.03	0.24	0.01	0.13	0.06	0.57
Kabyè-Tem	0.01	0.33	-0.05	-1.12	-0.01	-0.34
Paragourma	0.02	0.34	-0.03	-0.55	0.01	0.32
Other ethnic groups	0.15	0.88	-0.11	-0.83	0.02	0.21
Non-Togolese	0.16	1.54	-0.00	-0.01	0.11	1.15
Wald test						
Child characteristics	Chi^2 (1)=447.46		Chi^2 (1)=242.63		Chi^2 (1)= 861.76	
Parent characteristics	Chi^2 (1)=4.49		Chi^2 (1)=2.43		Chi^2 (1) = 11.81	
Household characteristics	Chi^2 (1)=2.94		Chi^2 (1)=3.03		Chi^2 (1)=4.49	
Number of observations	2,918		2,918		2,918	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Table B2: The case of fixed-assets models used for the urban area when the child lives with both parents

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-1.36	-1.59	-0.94	-1.21	-1.46	-1.81
Child's characteristics						
7–12 months	-0.68	-6.42***	-0.94	-10.08***	-1.40	-14.34***
13–24 months	-0.88	-7.22***	-0.79	-7.32***	-1.27	-10.91***
25–35 months	-1.15	-12.68***	-0.57	-6.76***	-1.30	-14.90***
Sex (1= boy)	-0.11	-2.06**	0.01	0.30	-0.03	-0.57
Parents' characteristics						
Mother's age						
20–24 years	-0.15	-1.00	0.50	3.36***	0.22	1.41
25–34 years	-0.18	-1.23	0.39	2.79***	0.08	0.55
35–49 years	0.14	0.89	0.34	2.22**	0.26	1.60
Educated mother (1= Yes)	0.22	2.85**	0.00	0.07	0.01	0.26
Mother's height	0.00	1.78	0.00	0.72	0.00	1.98
Educated father (1= Yes)	0.01	0.16	0.01	0.16	0.04	0.50
Household's characteristics						
Wealth composite index	0.30	7.97***	0.15	3.95***	0.30	7.23***
Household's size	-0.03	-5.76***	-0.02	-4.58***	-0.04	-6.81***
Both parents at home	-0.16	-1.89	0.15	1.90	-0.03	-0.45
Ethnic group						
Akposso	0.22	1.70	0.02	0.22	0.08	0.57
Ana-Ifè	0.15	0.72	-0.20	-0.90	0.25	1.34
Kabyè-Tem	0.21	2.61*	-0.01	-0.23	0.01	0.15
Paragourma	0.22	1.93	0.13	1.26	0.09	0.93
Other ethnic groups	0.08	0.49	0.04	0.28	-0.07	-0.44
Non-Togolese	0.40	2.88	-0.10	-0.78	0.16	1.22
Wald test						
Child characteristics	Chi^2 (1) =108.85		Chi^2 (1) = 82.04		Chi^2 (1) = 234.57	
Parent characteristics	Chi^2 (1) =0.01		Chi^2 (1) = 8.07		Chi^2 (1) = 1.84	
Household characteristics	Chi^2 (1)=1.29		Chi^2 (1) = 8.81		Chi^2 (1) = 5.74	
Number of observations	799		799		799	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Table B3: The case of fixed-effects models used for the rural area when the child lives with only one parent

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-5.01	-9.29***	0.26	0.56	-2.64	-5.58***
Child's characteristics						
7–12 months	-0.69	-18.30***	-0.90	-14.30	-1.39	-21.38***
13–24 months	-1.41	-18.30***	-0.95	-14.11	-1.68	-24.58***
25–35 months	-1.59	-25.66***	-0.60	-11.52	-1.58	-29.00***
Sex (1= boy)	-0.17	-3.68***	0.03	0.88	-0.09	-2.28**
Parents' characteristics						
Mother's age						
20–24 years	0.07	0.68	0.07	0.83	0.18	1.91
25–34 years	0.16	1.61	0.04	0.50	0.24	2.68**
35–49 years	0.13	1.23	0.02	0.22	0.17	1.87
Educated mother (1= Yes)	0.15	2.96***	0.19	4.31***	0.19	4.20***
Mother's height	0.003	9.11	-0.00	-1.01	0.00	5.20***
Household's characteristics						
Composite wealth index	0.28	3.23***	0.16	2.22**	0.31	4.31***
Household's size	-0.005	-1.06	-0.01	-2.42**	-0.01	-2.97**
Ethnic group						
Akposso	-0.01	-0.08	0.04	0.40	0.07	0.59
Ana-Ifè	0.03	0.26	0.01	0.15	0.07	0.63
Kabyè-Tem	0.01	0.17	-0.06	-1.18	-0.02	-0.51
Paragourma	0.02	0.30	-0.03	-0.61	0.01	0.30
Other ethnic groups	0.14	0.85	-0.10	-0.79	0.02	0.15
Non-Togolese	0.15	1.45	-0.00	-0.06	0.09	1.01
Wald test						
Child's characteristics	Chi^2 (1)=444.98		Chi^2 (1)=241.42		Chi^2 (1)= 855.33	
Parents' characteristics	Chi^2 (1)=2.97		Chi^2 (1)=1.63		Chi^2 (1) = 8.85	
Household's characteristics	Chi^2 (1)=1.20		Chi^2 (1)=4.41		Chi^2 (1)=17.39	
Number of observations	2,918		2,918		2,918	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Table B4: The case of fixed-effects models used for the urban area when the child lives with only one parent

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-1.53	-1.85	-0.72	-0.94	-1.45	-1.86
Child's characteristics						
7–12 months	-0.68	-6.48***	-0.93	-9.79***	-1.40	-14.46***
13–24 months	-0.88	-7.23***	-0.80	-7.23***	-1.27	-10.97***
25–35 months	-1.16	-12.88***	-0.57	-6.61***	-1.30	-14.99***
Sex (1= boy)	-0.12	-2.47**	0.01	0.31	-0.03	-0.49
Parents' characteristics						
Mother's age						
20–24 years	-0.13	-0.86	0.52	3.47***	0.22	1.40
25–34 years	-0.17	-1.20	0.40	2.79**	0.08	0.55
35–49 years	0.15	0.92	0.34	2.24**	0.25	1.57
Educated mother (1= Yes)	0.20	2.78**	0.02	0.38	0.02	0.38
Mother's height	0.00	1.87	0.00	0.60	0.00	2.00**
Household's characteristics						
Composite wealth index	0.31	8.53***	0.14	3.76***	0.30	7.42***
Household's size	-0.03	-5.78***	-0.02	-4.69***	-0.04	-6.91***
Ethnic group						
Akposso	0.23	1.80	0.01	0.14	0.08	0.58
Ana-Ifè	0.11	0.53	-0.20	-0.91	0.25	1.35
Kabyè-Tem	0.24	2.92***	-0.02	-0.34	0.01	0.17
Paragourma	0.22	1.94	0.12	1.15	0.09	0.89
Other ethnic groups	0.09	0.52	0.03	0.22	-0.07	-0.45
Non-Togolese	0.44	3.17***	-0.13	-1.02	0.16	1.27
Wald test						
Child's characteristics	Chi^2 (1) =111.81		Chi^2 (1) = 78.1		Chi^2 (1) = 237.16	
Parents' characteristics	Chi^2 (1) =0.01		9Chi^2 (1) = 8.7		Chi^2 (1) = 1.63	
Household's characteristics	Chi^2 (1)=58.67		6Chi^2 (1) = 9.41		Chi^2 (1) = 42.89	
Number of observations	799		799		799	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%

Table B5: The case of non-fixed-effects models used for the rural area when the child lives with both parents

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-4.67	-6.26	-0.38	-0.58	-3.24	-5.15***
Child's characteristics						
7–12 months	-0.86	-10.04***	-0.89	-11.62***	-1.47	-20.44***
13–24 months	-1.51	-16.65***	-0.93	-11.44***	-1.71	-22.35***
25–35 months	-1.75	-24.61***	-0.69	-10.88***	-1.67	-27.79***
Sex (1= boy)	-0.18	-3.50***	0.02	0.55	-0.07	-1.62
Parents' characteristics						
Mother's age						
20–24 years	0.08	0.62	0.21	1.89	0.23	2.12**
25–34 years	0.19	1.65	0.16	1.50	0.23	2.36**
35–49 years	0.13	1.07	0.09	0.87	0.14	1.30
Educated mother (1= Yes)	0.09	1.36	0.11	1.93	0.13	2.43**
Mother's height	0.00	7.59***	0.00	0.00	0.001	5.67**
Educated father (1= Yes)	0.02	0.32	0.007	0.13	0.01	0.26
Household's characteristics						
Composite wealth index	0.26	2.64***	0.06	0.74	0.21	2.53**
Household's size	-0.00	-0.22	-0.002	-0.56	-0.001	-0.23
Both parents at home	-0.10	-1.60	-0.03	-0.60	-0.08	-1.52
Health facilities						
% vaccinated children in the household	1.23	2.60***	0.19	0.47	0.96	2.41**
% women vaccinated against tetanus	-0.87	-1.54	0.10	0.20	-0.47	-0.99
Prenatal care from medical doctor	2.10	1.71	-0.03	-0.32	0.76	0.74
Prenatal care from a medical auxiliary/midwife	0.33	1.33	-0.32	-1.45	-0.04	-0.22
Ethnic group						
Akposso	0.08	0.49	0.15	1.01	0.16	1.15
Ana-Ifè	0.04	0.27	0.03	0.24	0.01	0.07
Kabyè-Tem	0.14	1.91	-0.05	-0.80	0.05	0.88
Paragourma	0.16	2.11	-0.05	-0.79	0.05	0.88
Other ethnic groups	0.18	0.96	-0.00	-0.00	0.07	0.48
Non-Togolese	0.21	1.77	-0.05	-0.54	0.07	0.76
Regions						
Maritime	-	-	-	-	-	-
Plateaux	-0.02	-0.29	0.04	0.54	0.03	0.40
Centrale	-0.16	-1.54	0.10	1.10	0.00	0.01
Kara	-0.01	-0.17	-0.22	-2.15**	-0.16	-1.70
Savanes	-0.29	-2.75***	-0.21	-2.22**	-0.31	-3.54***
Wald test						
Child's characteristics	F(1.2890) = 412.98		F(1.2890) = 171.26		F(1.2890)= 758.26	
Parents' characteristics	F(1.2890) = 2.09		F(1.2890) = 3.34		F(1.2890) = 6.06	
Household's characteristics	F(1.2890) = 1.81		F(1.2890) = 0.07		F(1.2890) = 1.67	
Infrastructure	F(1.2890) = 6.24		F(1.2890) = 0.07		F(1.2890) = 1.83	
Health facilities	2918		2918		2918	
R^2	0.22		0.08		0.26	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Table B6: The case of non-fixed-effects models used for the urban area when the child lives with both parents

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-1.76	-1.14	0.70	0.49	-0.22	-0.17
Child's characteristics						
7–12 months	-0.60	-3.91***	-1.05	-7.21***	-1.42	-10.71***
13–24 months	-0.85	-4.87***	-0.88	-5.34***	-1.29	-8.65***
25–35 months	-1.18	-8.74***	-0.61	-4.79***	-1.30	-11.21***
Sex (1= boy)	-0.10	-1.02	-0.03	-0.39	-0.05	-0.61
Parents' characteristics						
Mother's age						
20–24 years	-0.26	-1.21	0.41	2.00**	0.19	1.05
25–34 years	-0.29	-1.43	0.22	1.16	0.03	0.17
35–49 years	-0.02	-0.11	0.24	1.09	0.21	1.09
Educated mother (1= Yes)	0.03	0.31	-0.03	-0.36	0.01	0.10
Mother's height	0.00	1.20	0.00	0.46	0.00	1.49
Educated father (1= Yes)	0.02	0.19	0.74	0.56	0.07	0.62
Household's characteristics						
Composite wealth index	0.32	4.90***	0.13	2.15**	0.29	5.13***
Household's size	-0.03	-3.38***	-0.02	-2.68***	-0.04	-4.91***
Both parents at home	-0.11	-0.93	0.14	1.22	0.02	0.20
Health facilities						
% vaccinated children in the household	-1.54	-1.34	0.62	0.58	-0.56	-0.58
% women vaccinated against tetanus	2.50	1.61	-2.07	-1.42	-0.55	-0.42
Prenatal care from a medical doctor	-0.03	-0.08	-0.38	-1.07	-0.29	-0.91
Prenatal care from a medical auxiliary/midwife	-0.67	-2.09**	-0.27	-0.91	-0.64	-2.35**
Ethnic group						
Akposso	0.20	1.02	-0.006	-0.03	0.15	0.16
Ana-Ifè	0.27	0.74	-0.12	-0.36	-0.00	-0.01
Kabyè-Tem	0.24	1.77	-0.06	-0.53	0.07	0.60
Paragourma	0.10	0.60	0.16	0.10	0.06	0.46
Other ethnic groups	0.27	0.11	-0.04	-0.18	-0.03	-0.14
Non-Togolese	0.36	1.73	0.06	0.32	0.25	1.38
Regions						
Maritime	-0.33	-1.59	-0.05	-0.28	-0.27	-1.50
Plateaux	-0.20	-0.93	-0.14	-0.69	-0.26	-1.43
Centrale	-0.24	-1.32	0.24	1.43	0.04	0.32
Kara	-0.05	-0.33	-0.01	-0.08	-0.06	-0.43
Savanes	-0.10	-0.62	-0.26	-1.68	-0.29	-2.05**
Wald test						
Child's characteristics	F(1.770) = 47.37		F(1.770) = 47.14		F(1.770) = 142.02	
Parents' characteristics	F(1.770) = 0.66		F(1.770) = 2.26		F(1.770) = 0.92	
Household's characteristics	F(1.770) = 1.32		F(1.770) = 3.26		F(1.770) = 4.42	
Health facilities	F(1.770) = 0.90		F(1.770) = 2.41		F(1.770) = 1.37	
Number of observations	799		799		799	
R^2	0.16		0.10		0.21	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Table B7: The case of non-fixed-effects models used for the rural area when the child lives with only one parent

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-4.75	-6.39***	-0.41	-0.62	-3.30	-5.27***
Child's characteristics						
7–12 months	-0.86	-10.04***	-0.89	-11.63***	-1.47	-20.44***
13–24 months	-1.51	-16.64***	-0.92	-11.44***	-1.71	-22.34***
25–35 months	-1.75	-24.58***	-0.69	-10.87***	-1.67	-27.77***
Sex (1= boy)	-0.19	-3.53***	0.02	0.54	-0.07	-1.65
Parents' characteristics						
Mother's age–						
20–24 years	0.07	0.59	0.21	1.88	0.22	2.09**
25–34 years	0.19	1.60	0.15	1.48	0.23	2.32**
35–49 years	0.12	1.01	0.09	0.85	0.13	1.25
Educated mother (1= Yes)	0.09	1.50	0.11	2.05**	0.13	2.60***
Household's size	0.00	7.63***	0.00	0.02	0.00	5.71***
Educated father (1= Yes)						
Household's characteristics						
Composite wealth index	0.27	2.72***	0.06	0.77	0.22	2.60***
Household's size	-0.00	-0.28	-0.00	-0.59	-0.00	-0.29
Health facilities						
% vaccinatedchildren in the household	1.22	2.59***	0.19	0.46	0.96	2.41**
% women vaccinated against tetanus	-0.86	-1.53	0.10	0.20	-0.46	-0.98
Prenatal care from a medical doctor	2.13	1.74	-0.33	-0.30	0.79	0.77
Prenatal care from a medical auxiliary/midwife	0.33	1.32	-0.32	-1.46	-0.04	-0.23
Ethnic group						
Akposso	0.07	0.45	0.15	0.99	0.16	1.12
Ana-Ifè	0.04	0.25	0.03	0.23	0.00	0.06
Kabyè-Tem	0.13	1.88	-0.05	-0.82	0.05	0.85
Paragourma	0.16	2.14**	-0.05	-0.77	0.06	0.91
Other ethnic groups	0.17	0.91	-0.00	-0.02	0.07	0.43
Non-Togolese	0.21	1.73	-0.06	-0.55	0.07	0.72
Regions						
Maritime	-	-	-	-	-	-
Plateaux	-0.03	-0.33	0.04	0.53	0.03	0.38
Centrale	-0.16	-1.60	0.10	1.10	-0.00	-0.02
Kara	-0.02	-0.22	-0.22	-2.20**	-0.16	-1.76
Savanes	-0.30	-2.89***	-0.21	-2.31**	-0.32	-3.69***
Wald test						
Child's characteristics	F(1.2892) = 412.66		F(1.2892) = 171.36		F(1.2892)= 758.18	
Parents' characteristics	F(1.2892) = 1.90		F(1.2892) = 3.34		F(1.2892) = 5.90	
Household's characteristics	F(1.2892) = 7.50		F(1.2892) = 0.55		F(1.2892) = 6.83	
Health facilities	F(1.2892) = 6.28		F(1.2892) = 0.07		F(1.2892) = 1.85	
Number of observations	2918		2918		2918	
R^2	0.21		0.08		0.26	

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

Table B8: The case of non-fixed-effects models used for the urban area when the child lives with only one parent

Dependent variables	Age-for-height index		Height-for-weight index		Age-for-weight index	
Explanatory variables	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**	**Coefficient**	**z-stat**
Constant	-1.89	-1.23	0.93	0.65	-0.15	-0.12
Child's characteristics						
7–12 months	-0.61	-3.97***	-1.04	-7.17***	-1.42	-10.75***
13–24 months	-0.85	-4.89***	-0.88	-5.33***	-1.30	-8.67***
25–35 months	-1.19	-8.76***	-0.61	-4.80***	-1.30	-11.23***
Sex (1= boy)	-0.10	-1.05	-0.02	-0.30	-0.04	-0.55
Parents' characteristics						
Mother's age						
20–24 years	-0.26	-1.22	0.41	2.00**	0.19	1.04
25–34 years	-0.30	-1.44	0.22	1.14	0.02	0.14
35–49 years	-0.03	-0.13	0.22	1.03	0.20	1.02
Educated mother (1= yes)	0.03	0.33	-0.01	-0.15	0.02	0.30
Mother's height	0.00	1.23	0.00	0.42	0.00	1.49
Educated father (1= yes)						
Household's characteristics						
Composite wealth index	0.33	5.10***	0.12	2.06**	0.29	5.21***
Household's size	-0.03	-3.40***	-0.02	-2.70***	-0.04	-4.94***
Health facilities						
% vaccinated children in the household	-1.54	-1.34	0.65	0.60	-0.54	-0.55
% women vaccinated against tetanus	2.53	1.63	-2.12	-1.45	-0.56	-0.43
Prenatal care from a mdecial doctor	-0.03	-0.09	-0.38	-1.08	-0.56	-0.43
Prenatal care from a medical auxiliary/midwife	-0.66	-2.06**	-0.27	-0.92	-0.56	-0.43
Ethnic group						
Akposso	0.19	1.01	-0.00	-0.03	0.15	0.93
Ana-Ifè	0.25	0.70	-0.11	-0.33	-0.00	-0.02
Kabyè-Tem	0.25	1.81	-0.07	-0.57	0.07	0.60
Paragourma	0.09	0.58	0.02	0.18	0.07	0.51
Other ethnic groups	0.01	0.07	-0.03	-0.15	-0.03	-0.15
Non-Togolese	0.37	1.78	0.05	0.25	0.24	1.37
Regions						
Maritime	-0.33	-1.58	-0.05	-0.26	-0.26	-1.48
Plateaux	-0.21	-0.96	-0.14	-0.68	-0.27	-1.44
Centrale	-0.23	-1.32	0.21	1.27	0.02	0.19
Kara	-0.04	-0.26	-0.03	-0.22	-0.07	-0.48
Savanes	-0.10	-0.61	-0.29	-1.87	-0.31	-2.20**
Wald test						
Child's characteristics	F(1.772) = 48.02		F(1.772) = 46.59		F(1.772) = 142.37	
Parents' characteristics	F(1.772) = 0.79		F(1.772) = 2.02		F(1.772) = 0.70	
Household's characteristics	F(1.772) = 22.1		F(1.772) = 2.86		F(1.772) = 21.05	
Health facilities	F(1.772) = 0.928		F(1.772) = 2.42		F(1.772) = 1.35	
Number of observations	799		799		799	
R^2 0.16	0.10		0.24			

*** = significant at 1%, ** = significant at 5% and * = significant at 10%.

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