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DETERMINANTS OF CHILDREN'S HEALTH FOR HUMAN CAPITAL ACCUMULATION: EMPIRICAL ANALYSIS

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ABSTRACT

In this paper we study the determinants of children health resources for human capital accumulation on a sample of children living in Cameroon. Data are from Demographic and Health Survey (DHS-III). We find that using ordinary least squares (OLS): employment status of the mother is significant compared with growth indices of children. Age explains the nutritional status of long and short term children growth. Vaccination is significant related to the nutritional status of children with a positive impact on the long term. The level of maternal education positively influences the growth index in short term. Community infrastructures such as water, electricity and toilets are significant and positive in relation to the growth indices of children in the long term. Recommendations for economic policy suggest: (i) the improvement in health conditions using public and private investments in health infrastructures, (ii) the continuation of the vaccination program, and (iii) the advancement in medical and scientific knowledge in order to promote health capital of children for human capital accumulation.

Keywords: Human capital, Health capital, Health infrastructure, Child development.

JEL Classification: I130, O150, C2.

Contribution/ Originality

This study documents the determinants of children health resources for human capital accumulation. Findings indicate that economic variables, socio-demographic variables and public/private infrastructure variables are key determinants of children health.

1. INTRODUCTION

Health and childhood are two themes that the association burns economic ideas and policy maker speeches in the world where the problematic of human capital accumulation is renewed. The

origin of human capital goes back to the emergence of classical economics in 1776, and thereafter developed a scientific theory. After the manifestation of that concept as a theory, Schultz (1961) and Becker (1964) recognized the human capital as one of important factors for a national economic growth in the modern economy. Although, young children's optimal growth and development requires adequate nutrition, beginning in utero, with adequately nourished mothers. During the first months of life, breastfeeding plays a critical role in providing children with necessary nutrients but, the quality of relationships also matters right from the start.

Children are social actors shaped by their environmentthat, in turn, plays a role in shaping it (Irwin and Johnson, 2005). The family is considered here as any group of people who dwell, eat and participate in other daily, home-based activities together. Family is the primary environmental that influences on children's development. Any chronic domestic problem, especially of the mother or primary caregiver, such as intimate-partner violenceor chronic illness, can have a deleterious effect on child development. Family members provide most stimuli for children, and families largely control children's contact with the wider environment.

Economic, socio-demographic, social capital, physical and service characteristics of residential communities influence early child development. Socioeconomic inequalities among residential communities are associated with inequalities in children's development, but there are important caveats. Children from low socioeconomic status families living in economically-mixed neighborhoods often do better in their development than low socioeconomic status children living in poor neighborhoods. The relational community is the group that gives children and families their identity and, often, how outsiders identify them. It is a primary source of social inclusion or exclusion, sense of self-worth, self-esteem and gender socialization. Relational communities transmit information regarding child-rearing practices and norms of child development (Hertzman, 2010). Interrelated aspects of regions that are significant for child development include physical, for example, the degree of urbanization (rural/urban zones) and the physical lay-out of cities, social, political and economic factors.

Investment in early childhood is a powerful economic strategy, with returns over the life course many times the size of the original expenditure. The early development of childhood promotes the quality of human capital accumulation. That is individuals' competencies and skills for participating in society and the workforce. Women's autonomy itself is determined largely by women's education, which is much more accessible. In turn, women's autonomy demonstrably influences opportunities for successful child health development. National policy in investing in public and private health infrastructures and economic factors are significant for child health development. The priority given to children in social policy can overcome national poverty in child developmental outcomes such as life expectancy. The global environment influences child development through its effects on economic and social conditions within nations. Non-governmental international bodies and civil society have a role in holding countries accountable for adopting policies that positively benefit children's well-being. Within many countries civil society

groups take direct action or stimulate government and community action on the social determinants of child health development.

The extent of impairment of health conditions is an argument that could justify the interest of the study of the health dimension in developing countries and the definition of health policies and the implementation of operational programs arising. Microeconomic analysis of health can be divided in two ways, namely the production of health (Schiff and Valdes, 1990; Strauss and Thomas, 1995) and the demand side. This paper holds the production function of health because of the available data. This function expresses the relationship between the state of health of a child and some exogenous variables such as the individual characteristics of the child, those of the household and the community. Stunting of a child, revealed by these indicators can be, according to Charasse (1999), due, among other things, the age of the child and the parents (Strauss, 1990; Thomas *et al.*, 1991; Bishai, 1996; Barcat, 1998), the parental health (Barrerra, 1990; Strauss, 1990), and the availability of community health resources (Thomas *et al.*, 1991; Thomas and Strauss, 1992).

The objective of this article is to identify and to address the main determinants of the health capital of children for human capital accumulation. Data are from Demographic and Health Survey (DHS-III). We use ordinary least squares (OLS) to attend the objective. The rest of the paper is organized as follows: Section 2 outlines the basic literature related to the paper. Section 3 describes the main variables, the econometric model and the data sources. Section 4 presents and comments the empirical results and finally section 5 concludes.

2. REVIEW OF THE LITERATURE

The concept of human capital can be variously categorized by each perspective of academic fields. The first viewpoint is based on the individual aspects. Schultz (1961) recognized the human capital as something akin to property against the concept of labor force in the classical perspective, and conceptualized the productive capacity of human beings in now vastly larger than all other forms of wealth taken together. Most of researchers have accepted that his thought viewing the capacity of human being is knowledge and skills embedded in an individual (Beach, 2009). Similar to his thought, a few researchers show that the human capital can be closely linked to knowledge, skills, education, and abilities (Garavan *et al.*, 2001; Youndt *et al.*, 2004). Rastogi (2002) conceptualizes the human capital as knowledge, competency, attitude and behavior embedded in an individual.

There is the second viewpoint on human capital itself and the accumulation process of it. This perspective stresses on knowledge and skills obtained throughout educational activities such as compulsory education, postsecondary education, and vocational education (De La Fuente and Ciccone, 2002). Despite the extension of that concept, this perspective neglects that human being would acquire knowledge and skills throughout his/her own experience. The third is closely linked to the production-oriented perspective of human capital. Romer (1990) refers to the human capital as a fundamental source of economic productivity. Rosen (1999) considers the human capital as an

investment that people make in themselves to increase their productivity. More recently, Frank and Bernanke (2007) considerer that human capital is an amalgam of factors such as education, experience, training, intelligence, energy, work habits, trustworthiness, and initiative that affect the value of a worker's marginal product. Considering the production-oriented perspective, the human capital is the stock of skills and knowledge embodied in the ability to perform labor so as to produce economic value (Sheffrin, 2003). Furthermore, some researchers accept that human capital is the knowledge, skills, competencies and attributes in individuals that facilitate the creation of personal, social and economic well-being with the social perspective (Rodriguez and Loomis, 2007) and for the human capital accumulation.

Consequently, human capital simultaneously includes both of the instrumental concept to produce certain values and the endogenous meaning to self-generate it. In order to dependently or independently create these values, there is no doubt that learning through education and training can be an important in terms of defining the concept of human capital. Considering that experience can be included as a category of knowledge, the human capital is a synonym of knowledge embedded in individuals. Despite this, accumulating human capital also integrates self generation of health and investment in child's health, for example in vaccinating younger children. This is why in the paper we have try to determining the contribution of child's health resource for human capital accumulation. Health is considered as a prerequisite for the welfare of the individual. Models of life cycle showed how health can determine the income, wealth and future consumption (Lilliard and Weiss, 1997; Smith, 1999).

Theoretical and empirical works related on the leading role of health on economic growth are fairly recent. It is reasonable to assume that the economic activity of every individual is substantially influenced by his physical condition. Thus, healthy workers are more efficient. It establishes a positive relationship between an individual's health and productivity (Strauss, 1986; Sahn and Alderman, 1988; Deolalikar, 2004). A positive correlation between education and productivity (Rosenzweig, 1995) and health and productivity (Thomas and Strauss, 1997) have been established. Assuming that the improvement of health reinforces learning and increasing educational performance, then the gains resulting from the investment in health would certainly been multiplied. Kamerman *et al.* (2003) reviews the child welfare policies across countries and identify five domains that make a difference: income transfers (cash and tax benefits); employment policies; parental leave and other policies to support maternal employment; early childhood education and care services; and prevention and other interventions related to teen pregnancy (Siddiqi and Hertzman, 2001). Heymann (2006) has investigated on children and families in resource-poor countries and has demonstrated the importance of access to quality child care for families worldwide. Due to increased female participation in the global workforce millions of children worldwide are home alone, in informal child care (often by other children), or are brought to work where they are exposed to unsafe working conditions. The global environment is also characterized by international treaties that affirm the rights of children and women, which are meant to enhance the well-being of children.

The literature related on the determinants of health has been the subject of numerous researches. Among the identified factors, economic, socio-demographic and community infrastructures are cited as potential predictors of children health status. Indeed, household income and standard of living are measured by per capita expenditure given the difficulty of accurately measuring current income households (Thomas *et al.*, 1991). A positive relationship is expected between growth indices and factor household income. Lachaud (2001) indicates that there is a direct correlation between the increase in per capita expenditure and the reduction of chronic malnutrition. The perverse effect may occur if one considers the professional activity that generates income. Indeed, over the parent spends too much time on professional activities, unless the child receives special attention in health care program. Charasse (1999) shows, by estimating a model of demand for health, "all things being equal", income and more education play a key role in determining the growth score. According to Lavy *et al.* (1996), the income, the availability and the quality of health services increase the likelihood of child survival.

The availability of socio-community infrastructure such as water, electricity and health services affect children health development. Many studies have highlighted the positive impact of the investment on infrastructures related to the health of children. Strauss (1990) found that the existence of the pipeline system has had a positive impact on the health of children. Barrerra (1990) highlights the garbage on the size of the children while Thomas *et al.* (1991) show that garbage collection and a proportion of homes with electricity involved in the explanation of better health of children in the urban and the rural milieu. Socio-demographic factors such as the age of the child, the level of parental education, the parental age and the state of health of parents influence the children health development. There is a vast evidence of the association between the place where children live and their health (Marmot *et al.*, 2008). The place where children are born may have considerable influence on their growth, development and survival. It is clear that life chances may be very different whether a child is born in a developed country or in a developing one. But even within countries, these differences in life chances persist between social groups.

The more a child than the young, it is more susceptible to disease because of its power without breastfeeding (Asenso-Okyere *et al.*, 1997). Indeed, it is shown that after the sixth month, the child in addition to breastfeeding, weaning comes in and thus becomes susceptible to infections as their immune device is not yet developed (Charasse, 1999). Regarding the influence of education of the person responsible for the household on children's growth, Schultz (1984) distinguishes five channels. First, education has a direct impact on the acquisition of knowledge about health and hygiene. Second, education increases the general skills of reading and therefore to better understands the instructions caregivers. Thirdly, education increases the probability of getting a job, to increase the total income for improving child health. Fourth, education increases the opportunity cost of working time and reduces the time for which the care of children. Finally, parental education can affect the preferences of parents, particularly in the choice of the number of children to have. Thomas *et al.* (1991) reports that a child whose mother has a primary education is 1.6% times larger than the one whose mother is illiterate.

Thomas and Strauss (1992) show that there is complementarity of education of both parents for the positive effect of father's education on children's height increases when the mother's education increases. Thus, the level of maternal education reduces child mortality (Caldwell, 1979; Behrman and Wolfe, 1982; Olsen and Wolpin, 1983; Hobcraft *et al.*, 1984; Pitt, 1995; Benefo and Schultz, 1996). Parental age has a positive effect on the size of children and the probability of having a normal size. The age of parents is used as a proxy for the accumulation of experience in health care (Barcat, 1998) variable. However, age may have a negative effect if it is considered an indicator of senility or tired adults (Bishai, 1996). Concerning the state of health of parents traditionally, the literature mentions parental height and body mass index (BMI) as favorable for the growth of children explanatory factors (Barrerra, 1990; Strauss, 1990). The size of the parents is seen as the result of medical knowledge, nutrition and hygiene habits acquired during childhood. Asenso-Okyere *et al.* (1997) fall in the case of an African country and analyses the coefficients of BMI of the father and mother are positively significant in explaining the health and nutrition of short-term child.

3. METHODOLOGY: MODEL SPECIFICATION, VARIABLE SELECTIONS AND DATA SOURCES

3.1. Model Specification

The empirical analysis of this research is based on the modeling of a production function of health and nutrition of an individual. The methodology of this approach is developed by Schiff and Valdes (1990),Strauss and Thomas (1995) and used in the work of Egnonto *et al.* (2003). These studies have considered two growth indices to assess the health and nutrition of short and long-term individuals. Child health will be measured according to two anthropometric indicators: weight-for-height and height-for- age. Changes in these indices are assumed to be explained by economic, socio-demographic and health factors of the household and the community.

According to Horton (1988), Asenso-Okyere *et al.* (1997) and Egnonto *et al.* (2003), in the short term, health and child nutrition is reflected in the weight-for-height index (assessed by z-score). Indeed, the weight for height is a measure of thinness and is supposed to represent the current nutritional status. The health and long-term nutrition of a child is reflected in the height-for-age (z-score evaluated) index. A child who is small for his age is considered as suffering from stunted growth. Several variables can explain the variations in these indices. The model to estimate is as follows:

$$Y_i = \beta X_i + \varepsilon_i \quad (1)$$

Where, Y_i is the indicator of anthropometric status of the child *i*. With $i = 1$ and 2 respectively representing the health of short and long terms. The two dependent variables are considered representative of the health production function: it is the weight-for-height index (whz-score = Y_1) and height-for-age index (haz-score = Y_2). X_i is the vector of economic, socio-demographic, and

community characteristics. ε_i represents an error term that includes omitted variables at the individual and household level. β is the vector of coefficients to be estimated.

3.2. Variable Selections

The dependent variables are: weight-for-height index (Y_1) and height-for-age index (Y_2). The independent variables representing by the vector (X_i) are characterized by economic, socio-demographic, and community factors which constitute the main determinants of child's health resource for human capital accumulation. For the economic characteristics, in the absence of a variable related on the income or on the expenditure per capita, the status of the mother's activity is used. This variable can address the standard of living of the household. It is introduced as a variable with several modalities: 1 = not working, 2 = worker in the informal sector, 3 = other informal occupation. Worker in the agricultural sector is the reference category. This variable can have a positive or negative effect on growth indices by socio-professional category.

For the socio-demographics characteristics, the age of the child, the sex of the child, the physical condition of the child (diarrhea situation for example), the vaccination campaigns, the age of the mother, the state of health of the mother, the level of education of parents, and the place of residence are the key factors. The age of the child is introduced into 5 age groups. This is a dummy variable that takes the value 1 if the age is in the range defined and 0 otherwise. The age groups are defined as follows: age group 1 for ages between 0 and 11 months, age group 2 for ages between 12 and 23 months, age group 3 for ages between 24 and 35 months, age group 4 for ages between 36, and 47 months age 5 for ages between 48 and 59 months group. The age group 1 is the reference age group. It is expected adverse effects between the reference age group and four age groups greater than 11 months. The sex of the child is introduced as a binary variable that takes the value 1 when it is a boy and 0 otherwise. It has an ambiguous effect on the health and nutritional status of the child. The physical condition of the child (diarrhea) is a binary variable indicating whether the child had diarrhea in the two weeks preceding the survey. It takes the value 1 if the child has diarrhea and 0 otherwise. It is expected that the child who has diarrhea is lower than other children do not have growth indices.

Vaccination is a binary variable indicating the status of child immunization. It is respectively equal to 1 and 0 if the child has been vaccinated or not since birth. A positive effect is expected for this variable on growth indices insofar vaccination allows a child to resist some germs and thus to preserve certain diseases. The age of the mother has a positive effect on the height of children and the probability of having a normal growth. According Barcat (1998), parental age can be used as an approximation of the accumulation of experience in health care variable. However, age may have a negative effect if it is considered as an indicator of senility or tired adults (Bishai, 1996) The state of health of the mother is captured by body mass index (BMI) of the mother. The literature mentions this variable as an explanatory factor favorable to the growth of children (Barrerra, 1990; Strauss, 1990). This variable is used as a genetic factor. A positive relationship is expected between this variable and growth indices.

The educational level of parents, according to Schultz (1984) and Barcat (1998), shows that the level of parental education has an impact on children's growth. Thomas *et al.* (1991) show that a child whose mother has a primary education is larger than the one whose mother is illiterate. In this paper, the educational level of the mother is the last class successfully used. A positive effect of this variable is expected on the health and nutritional status of children. The level of education of the father is the last class successfully used. A positive effect of this variable is expected on the health and nutritional status of children. Finally, the place of residence is a binary variable indicating the localization of the residence of the household. It takes the value 1 if the place of residence is urban and 0 if it is rural. Considering that there are more modern health services in urban than rural areas, it is expected a positive relationship between growth indices and the middle of urban residence.

For the community characteristics, potable water, electricity and appointed latrines are the factors affecting child health resources for human capital accumulation. These community infrastructures can be finance by public or private capitals. Drinking water is a binary variable representing the quality of the water used by the household. It is equal to 1 if there is potable water and 0 otherwise. It is expected that this variable a positive sign. Electricity is a binary variable representing the quality of food served to children. The variable electricity is a proxy variable which analyze whether or not electricity is available in the household. It is equal to 1 or 0 respectively, if electricity is available in the household or not. A positive effect is expected. Appointed latrine is a binary variable representing the state of health infrastructure in the household as a proxy with captures the existence of latrines or not in the house. It is equal to 1 or 0 respectively if there is latrine or not. A positive effect is expected on the health and nutritional status of children.

3.3. Data Sources

Despite the implementation of various health programs, Cameroon is still characterized by the persistence of huge health problems. This situation is characterized by high rates of infant and child mortality due to infectious and parasitic diseases such as malaria, diarrheal diseases, and acute respiratory infections. The infant mortality rate fell from 65 per 1000 in 1991 to 87 per 1,000 in 2006 (PNDS 2011-2015). Similarly, maternal mortality also remains high. 430 per 100 000 in 1991, it rose to 1000 per 100 000 live births in 2006. Regarding the nutritional status of children, 18% of children under 5 years, at the national level, has a underweight (PNDS 2011-2015), while 32% of under 5 suffer from chronic malnutrition moderate, and 13% in its severe form DHS (2004).

This underperformance of health can be explained in part by a socio-economic situation of poverty, with a high proportion of poor population (39.9%) and low support for patients and health infrastructure deficit of other. Thus, in regard to access to drinking water, 56.1% of the populations are deprived in 2007. 52.8% of households are without electricity. In addition, the majority of Cameroonian (64%) does not have adequate toilets (DHS, 2004). Only 48% of children received

all vaccines of the Expanded Program on Immunization. Against, 5% of children received no vaccine (DHS, 2004).

The data used in this study are data collected after the Demographic and Health Survey (DHS-III) conducted by the National Institute of Statistics in collaboration with the Ministry of Public Health and technical assistance from ORC Macro, an American institution in charge of international cooperation program of the Demographic and Health Surveys. During this survey in February 2004, 10,462 households, 10,656 women aged 15-49 and 5,280 men aged 15-49 years were interviewed.

4. EMPIRICAL RESULTS: PRESENTATION AND DISCUSSIONS

Preliminary analysis has been conducted, such as descriptive statistics, test of detection of multicollinearity and normality problems (see Annexes). It is notice that there is not multicollinearity problem in this study. The results of the kewness/Kurtosis test in the tables in Annexes 7 and 9 show that residues are not normal. In fact the symmetric condition is verified but the flattening is not that of a normal distribution

The equation (1) with the two dependent variables representing growth indices of short and long term, respectively, were calculated for each category of an explanatory variable with multiple modalities. The estimation of these models by the method of ordinary least squares (OLS) yielded the results shown in the tables 1 and 2 below:

Table-1. Results of short-term model (dependent variable: weight-for-height)

Characteristics	Variables	Modalities	Coefficients	P value
Characteristics of the child	Age *Ref : 0-11 month*	12-23 month	-0,492***	0,000
		24-35 month	-0,210***	0,000
		36-47 month	-0,045	0,430
		48-59 month	-0,180***	0,002
	Sex : *Ref=Female*	Male	0,018	0,599
	Have had diarrhea		-0,216***	0,000
	Have receive at least 1 vaccine		-0,040	0,271
Characteristics of the mother	Age	Age	-0,055***	0,006
		Square of age	0,001***	0,006
	Level of instruction	Last class attend with success	0,052***	0,000
	Situation of mother activity *Ref : Worker in the agricultural sector*	Not working	-0,048	0,256
		Worker in the formal sector	-0,047	0,345
		Other informal profession	-0,195*	0,086
	State of health	Body mass index	0,065***	0,000
Characteristics of the father	Level of instruction of the father	Last class attend with success	0,008*	0,097
Characteristics of housing	Access to potable water		0,016	0,678
	Access to electricity		-0,004	0,934
	Access to appointed latrine		-0,026	0,577
Place of residence	Urban: *Ref : Rural*		-0,050	0,273
Constant			-0,699**	0,020
Statistics of the model				
Number of observations	3168			
R^2 adjusted	0.181			
*,** and *** indicate significance at the level of 10%, 5% , and 1%, respectively				

Source: authors' calculation

Table-2. Results of long-term model (dependent variable: height -for-age)

Characteristics	Variables	Modalities	Coefficients	P value
Characteristics of the child	Age *Ref : 0-11 month*	12-23 month	-1,214***	0,000
		24-35 month	-1,103***	0,000
		36-47 month	-1,128***	0,000
		48-59 month	-1,000***	0,000
	Sex *Ref=Female*	Male	-0,041	0,380
	Have had diarrhea		-0,097	0,139
	Have receive at least 1 vaccine		0,107**	0,030
Characteristics of the mother	Age	Age	-0,072***	0,007
		Square of age	0,001***	0,004
	Level of instruction	Last class attend with success	0,010	0,273
	Situation of mother activity *Ref : Worker in the agricultural sector*	Not working	0,086	0,132
		Worker in the formal sector	0,228***	0,001
		Other informal profession	0,465***	0,002
	State of health	Body mass index	0,021***	0,001
Characteristics of the father	Level of instruction of the father	Last class attend with success	0,032***	0,000
Characteristics of housing	Access to potable water		0,180***	0,001
	Access to electricity		0,121**	0,067
	Access to appointed latrine		0,199***	0,001
Place of residence	Urban: *Ref : Rural*		0,157**	0,011
Constant			-0,552	0,171
Statistics of the model				
Number of observations	3168			
R^2 adjusted	0.210			
*,** and *** indicate significance at the level of 10%, 5% , and 1%, respectively				

Source: authors' calculation

These two tables help us to identify that three main characteristics (economic, socio-demographic and community infrastructures) determine child health resource for human capital accumulation in Cameroon. The empirical analysis shows the effects of economic, socio-demographic and community infrastructures on the weight-height indices and on the height-age indices for human capital accumulation. Employment status of the mother is significant compared with growth indices of children. Thus, the formal and informal sectors are significant and have a positive impact on the indices of long-term growth of children. Children whose mothers worked in the formal sector and the non-agricultural informal sector have the indices of long-term growth more significant than those whose mothers worked in the agricultural sector. In opposition, in the short term, the informal sector has a negative effect on growth indices. Children whose mothers engaged in agriculture have the best health development.

With regard to socio-demographic determinants like age, all the coefficients are negative and significant. This shows that age explains the nutritional status of long and short term children in Cameroon, but with a greater negative impact in the long run than in the short term. Children older than 12 months are lower than those of less than one year. That after the first 11 months, children go through a period of weakness in which stunting can accumulate. With respect to sex, the results are not significant, indicating that there is no difference between boys and girls. Their growth patterns are similar with respect to the variable short term or long term, even if a negative long-term impact is observed. The coefficients of the physical condition of children that is to say having

diarrhea has no effect on the nutritional status of long-term children, but negatively influences however nutritional status and short term health. In fact, children who had diarrhea in the two weeks preceding the survey have a better than children who suffered from this disease nutritional status. Vaccination is significant related to nutritional status of children with a positive effect on the long term. This means long-term vaccination improves the health of children by preventing several diseases by so accumulate human capital.

The estimation results show that the level of maternal education is significant in the short term and is not in the long term. Thus, the level of maternal education positively influences the growth index short term. As against, it has no effect on the index of long term growth of children. This result differs from those obtained by Asenso-Okyere *et al.* (1997) in Ghana and Egnonto *et al.* (2003) in Togo. The level of education of the father is significant and positive on growth indices of short and long term children. It has a very significant positive effect on the growth index of long-term versus short-term index. The mother's age is significant on the growth index of short and long-term children. Thus, children whose mothers over 31-35 years tend to have a health and nutritional best (short and long term) than those whose mothers are younger. This result contrasts with that obtained by Egnonto *et al.* (2003) in Togo.

The state of health of the mother as measured by the body mass index of the mother is positive and significant in relation to growth indexes of children. Thus, the coefficients indicate that the body mass index (BMI) of the mother has a positive effect on growth indices of children. Mothers who have a better body mass index have children with better health and nutrition in the short and long term, but with a greater effect in the short term. Place of residence of parents is significant in relation to the health and nutritional status of children. Place of residence does not affect the growth indices of short-term children. Otherwise, the urban environment has a positive effect on the indices of long-term growth of children.

Community infrastructures such as water, electricity and toilets fitted are significant and positive in relation to the growth indices of children in the long term. Thus, the availability of drinking water, electricity and toilets in homes has a positive impact on growth indices of children and improve their health capital in the long term. These results are similar to those obtained by Strauss (1990) for the case of Côte d'Ivoire, Barrerra (1990) and Thomas *et al.* (1991) North East rural Brazil.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This paper has analyzed the determinants of children health resources for human capital accumulation. We have found that economic variables, socio-demographic variables and public/private infrastructure variables are important determinants of children health in Cameroon. Employment status of the mother is significant compared with growth indices of children. Age explains the nutritional status of long and short term children. Vaccination is significant related to nutritional status of children with a positive effect on the long term. The level of maternal education positively influences the growth index short term. Community infrastructures such as

water, electricity and toilets are significant and positive in relation to the growth indices of children in the long term.

What actions to be used to improve determinants of children health resources for human capital accumulation? These actions can endorse the following key policy objectives: give to every child the best start in life, enable all children and young people to maximize their capabilities, create fair employment and good work for all children, ensure a healthy standard of living for all children, create and develop healthy and sustainable places and community infrastructures, and strength the role and impact of ill health prevention.

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ANNEXES

1. DESCRIPTIVE STATISTICS

Annex-1.

Sex of the child	Absolute frequency	Relative frequency
Female	1 597	50,4
Male	1 571	49,6
Together	3 168	100,0

Annex-2.

State of the child	Yes	No	Total
Have had diarrhea	15,7	84,3	100,0
Have receive at least 1 vaccine	41,9	58,1	100,0

Annex-3.

Variables	Mean	Median	Standard deviation	Coefficient of variation
Height-for-age of the child	-1,26	-1,30	1,61	-1,28
Weight-for height of the child	0,04	0,08	1,21	32,02
Age of the child (in month)	27,4	26,0	17,2	0,63
Age of the mother (in completed years)	27,7	27,0	6,9	0,25
BMI of the mother	23,4	22,7	3,9	0,17
Level of education of the mother (last classes successfully followed)	4,8	5,0	3,8	0,8
Level of education of the father (last classes successfully followed)	5,8	6,0	4,8	0,8

Annex-4.

Variables	Yes	No	Together
Urban zone	38,9	61,1	100,0
Access to electricity	36,6	63,4	100,0
Access to potable water	42,8	57,2	100,0
Access to appointed latrine	27,6	72,4	100,0

Annex-5.

Activity situation of the mother	Relative frequency
Workwoman	8,2
Agricultural dependant worker	42,5
Other work	5,7
Not working	43,6
Together	100,0

2. DETECTION OF MULTICOLLINEARITY AND NORMALITY PROBLEMS

First Estimation

Test of Multicollinearity

Annex-6.

Variables	Variance Inflation Factor (VIF)	1/VIF
Education of mother	2,26	0,442097
Education of father	1,98	0,505318
electricity	1,87	0,534197
urban	1,66	0,603465
age5	1,61	0,619199
age4	1,59	0,628503
age2	1,58	0,633324
age3	1,54	0,650366
worker	1,43	0,701164
appointed latrine	1,42	0,703531
passive worker	1,36	0,734661
BMI of mother	1,25	0,796962
potablewater	1,24	0,805213
otherwork	1,21	0,825494

Continue

agemother	1,14	0,880704
vaccinated	1,09	0,917343
diarrhea	1,04	0,957459
male	1	0,996179
Mean VIF	1,46	

Test of Normality of the Residue

Annex-7.

Variable	Observation	Pr(Skewness)	Pr(Kurtosis)	adjusted $chi^2(2)$	Prob>chi^2
residue	2,80E+03	0,6112	0, 0000	30,3	0, 0000

Second estimation

Test of Multicollinearity

Annex-8.

Variables	Variance Inflation Factor (VIF)	1/VIF
Education of mother	2,27	0,440298
Education of father	1,98	0,505404
electricity	1,87	0,534414
urban	1,67	0,597498
age5	1,65	0,605831
age4	1,64	0,608397
age2	1,6	0,625186
age3	1,59	0,627913
worker	1,42	0,706471
appointed latrine	1,41	0,708126
passive worker	1,37	0,732487
BMI of mother	1,26	0,795168
potablewater	1,24	0,804046
otherwork	1,2	0,831364
agemother	1,13	0,884306
vaccinated	1,1	0,908275
diarrhea	1,05	0,955486
male	1,01	0,994856
Mean VIF	1,47	

Test of Normality of Residues

Annex-9.

Variable	Observation	Pr(Skewness)	Pr(Kurtosis)	adjusted $chi^2(2)$	Prob>chi^2
residue	2,80E+03	0,9282	0, 0000	29,65	0, 0000

We note that there is not multicollinearity problem in this study. This, because in the tables in annex 6 and 8, Variance Inflation Factor (VIF) is not more than 10. The results of the kewness/Kurtosis test in the tables in Annex 7 and 9 show that residues are not normal. In fact the symmetric condition is verified but the flatteningis notthat of anormal distribution.