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Abstract

This study applied the probit model controlling for endogeneity, using the 2004/2011 Demographic and Health Survey in Cameroon to investigate the influence of child health on maternal labour force participation (MLFP) and to explore the heterogeneous effects of MLFP by sector of activity and marital status. The summary statistics revealed that participating mothers systematically differ from non-participating mothers on various characteristics. The results showed that overall, child health increases the probability of MLFP for married women and single mothers in both agriculture and non-agriculture sectors. These results mean that poor child health exerts emotional stress and imposes a physical demand for caring on family members. As the primary carer, the mother consequently reduces work commitment or even leaves the labour market to care for the ill child. Thus, investing in child health is very important as it enables the mother to use the extra-time at their disposal to participate additionally in labour market and job training opportunities.

Keywords: Maternal Labour Force Participation, Role, Children's health, ivprobit, Cameroon

1. Introduction

The subject of child health and its influence on maternal labour force participation (MLFP) after childbirth is of growing importance due to the significant increase in child health problems in the world over recent decades (Dunkelberg and Spiess, 2007; Ako et al, 2008). It reflects an increasing awareness of the well-being of children by parents and the community, evidenced by a broadened definition of child health to include: difficulties in gripping objects, long-term effects of brain damage, stroke or head injury and any other long-term condition that causes a restriction (such as arthritis, asthma, Alzheimer's disease, heart disease). In modern literature, child health is the condition of the body or state of well-being from zero to five years (0–59 months) strongly determined by four indicators: genetics, parent lifestyles, environment and socioeconomic status of guardians or parents. Generally, health has two distinct phases: positive health (well-being) and negative health (ill health). The positive phase consists of the qualitative aspects of health and human life in general, strongly associated with the concept of "fitness" while the negative phase is determined by the presence of disease, illness, deformity, unwanted states, injury, disability and handicap. The relationship between the two phases is not clear cut; if anything, they may not be systematically related at all (Tambi, 2017).

Labour force participation (LFP) is the percentage of the population that works or is willing to work, that is, those who are employed and those who are unemployed but actively seeking work. Women constitute half of any country's human endowment although they contribute less than men in LFP and in educational achievement and skills (Psacharopoulos and Tzannatos, 1989) hence the efforts to encourage more women to participate in labour force. In some African countries, MLFP has actually increased, though not proportional to the wage. For example, women in Cameroon constitute 39% of the labour force; their participation in wage employment in the modern sector has remained low, accessing less than 35% of wage employment (Fotso, 2017). However, this may be understated for statistical reasons given the prevalence of unrecorded economic activities that are largely performed by women in developing countries (Psacharopoulos and Tzannatos, 1989).

A significant change in human behaviour during the past century led to a massive incorporation of women into the labour force (Tambi, 2017). There is, therefore, an extensive theoretical and empirical literature that attempts to explain female labour supply and its evolution. In particular, the relationship between fertility and female

labour supply is of longstanding interest in the social sciences. Much of the research effort has been devoted to disentangling the causal mechanisms linking childbearing and female labour supply. Still in the past few decades, the labour force participation of mothers with young children has increased dramatically. However, in Cameroon this participation is relatively low in comparison to other countries. This could be due to individual factors such as poor health (Tambi, 2017), leading to higher physical and mental health risks at childbirth and increased stress in everyday life due to childcare, and increased demands regarding child care due to poor health of the child. On average, the caregiving burden for children with health problems is higher, and their mothers can thus be expected to show a higher preference for staying at home to care for the sick child. Apart from this direct effect, we may also expect to find indirect effects due to the lower availability and higher costs of day care for unhealthy children (Baum, 2004) also resulting in additional time costs (Dunkelberg and Spiess, 2007). All these may have a negative impact on mother's labour force participation.

Concretizing these issues, birth defects and child disabilities have been a major focus of research in various academic fields due to the wide array of their economic and psychological impacts at the individual, family and societal levels. Further, the economic effects of child health have increasingly attracted researchers' attention over the past two decades (Powers, 2003). A child who has health problems often exerts emotional stress on the family and imposes a physical demand for caring on family members. A family member, usually the mother as the primary caretaker, consequently reduces work commitment or even leaves the labour force to care for the child. To provide a safety net to the affected families and children, the government has to offer financial support. Therefore it is important to quantify the link between child health and maternal work behaviour to facilitate financial support. A crucial aspect in the context of child health indicators and their effect on MLFP is the fact that in the long run, such a connection can lead to persistent low socio-economic status from one generation to the next.

Brandon and Hogan (2001) found that the existence of health problems in children has a negative effect on the woman's ability to get off welfare. Baum (2004) intimated that mother's employment may enhance child health outcomes by increasing family income via work earnings. Increased family income potentially benefits health by facilitating the purchase of health inputs such as prenatal/medical care. Consistent with this analysis is the study by Corman et al (2004) conducted in the United States, showing the reverse effect of labour on health. According to Corman et al (2004), lowering household income due to decreased maternal labour market participation could also lead to decreased investments in the family members' health and hence poor health outcome. According to the Government of Cameroon (2011), about 22% of women respondents living close to the poverty line said their reasons for not going to hospital when their children were ill or when they were pregnant were financial. This means that most of the women were not actually working and so were unable to pay the hospital bills, which worsened their chances of participating in the job market should the child be born with complications or disability due to home delivery.

Today, more women than before are working in the formal workplace: about 60% of women are currently in the labour force, which is almost a 50% increase from 30 years ago (Baum, 2004). Much of this increase is due to mothers participating in the labour force and 61% of all mothers returning to work within three months of their child's birth. It is also because many of the women found that formal work is increasing their family income though increasingly competing with their household time; consequently many employed pregnant women return to work quickly after giving birth to keep their jobs. The proportion of women in the labour force has also increased due to current welfare reforms as emphasized in Baum (2004). Thus, we observed that most studies in this domain are more and more related to socioeconomic and demographic characteristics. Different authors have explored different relationships: Brandon and Hogan (2001) presented a strong relationship between women's work patterns and changes in their family status; Marmot et al (1991) demonstrated a positive relationship between health and economic prosperity; Fotso (2017) noted that child disability influences LFP negatively; and Bound et al (1996) found that health has positive and significant effects on LFP. This makes it imperative to verify the role of children's health on maternal labour force participation in Cameroon while comparing the results with those of other developing countries where child health is still a major issue.

Reiterating our research problem, better child health is critical for optimal growth and development as it improves the timing of school entry, the number of years spend in schooling and the actual achievements in school all commonly shown to lead to increased lifetime earnings (Rosenzweig and Schultz, 1983). From a focus group discussion Tambi (2017) observed that families use extra time accrued to them due to better health for their children to do extra work that fetches them money, improving their economic well-being and reducing poverty and psychological trauma on parents due to a child's ill-health. The benefits due to improved child health are, therefore, obvious and far-reaching. Unfortunately, health conditions, particularly for children, are worsening throughout sub-Saharan Africa despite the widespread promotion of maternal and child vaccinations in the region (Mwabu, 2009). Studies have shown the importance of child health in determining household income, schooling and parent earnings (Tambi, 2017). Ako et al (2008) have revealed that Cameroon government policy towards international organizations interested in child health is not flexible. Further, the importance of investing in child health has been much less appreciated or greatly underestimated by analysts, most decision makers and the partner international donor community (WHO, 2006). Properly equipped new-born centres are only in the larger cities like Yaoundé and Douala; the proportion of infants correctly immunized against diphtheria, tetanus and whooping cough in 2010 was 46%; and the proportion of infants reaching their first birthday that had been correctly treated against measles and tuberculosis was 54% (Government of Cameroon, 2011).

Despite the increasing prevalence of child health problems in the country and the imperative nature of the issue as demonstrated by the increased percentage of MLFP, it appears that only a few studies have attempted to examine the relationship between child health and mother labour supply. Fotso (2017) sought to evaluate the effect

of a child's disability on MLFP, capturing heterogeneity according to mother's level of education using the Cameroon 2011 demographic and health-national multiple indicators cluster survey (see Fotso, 2017). His study differs from ours in several ways: the data set is different; the method of analysis is different; child health is captured in a different way (Fotso (2017) used a constructed child health indicator—healthcare-cost-intensive disability and time-intensive disability—while our study used the child anthropometrics—WAZ, HAZ and HWZ); and our study used 11,732 observations while Fotso (2017) used a maximum of 4,409 observations. Tambi (2017) used focus groups to elaborate the link between child health, MLFP and household asset endowments in Cameroon. The issue with Tambi (2017) is that: (1) it used a small database; (2) it failed to handle the endogeneity problem; and, (3) it was restricted to a small section of the population. This makes it worthwhile measuring the causal effects of child health on female labour force participation in Cameroon.

Our study explores the influence of child health on MLFP using the probit model controlling for endogeneity (ivprobit). Further, we used the Cameroon demographic and health survey that had 11,732 observations (NIS, 2011). This study will, therefore, provide long-overdue information that is of timely policy relevance. Our study is, therefore, unique and has a variety of advantages over previous efforts at exploring the relationship between child health and maternal labour supply. This study is important in that improving child health around the world today is an important social objective which has obvious direct payoffs in terms of longer and better lives for millions and indirect payoffs through accelerating economic growth. In addition, the economic benefit that derives from improved child health comes in part from reduced child mortality and from reduced costs of healthcare for children. These economic benefits are dominated by productivity gains from improved child health which releases extra time for mothers to participate in the labour market, and from increased schooling and cognitive ability attributable to health in early childhood.

According to Rosenzweig and Schultz (1983), better child health improves the timing of school entry, the number of years completed, the learning that takes place per year of schooling and the actual achievements in school which are commonly shown to lead to increased lifetime earnings.

Out of Cameroon, the few existing studies we are aware of are based exclusively on data from United States (such as Salkever, 1982; Powers, 2003; Frijters et al, 2008). Most of these studies have different results depending on the approach used. Some of the studies failed to either acknowledge or handle the endogeneity problem (Salkever, 1982), others acknowledged the issue but did nothing about it (Bound et al, 1996) while others acknowledged and attempted to handle the problem (Powers, 2003; Frijters et al, 2008). However, our study differs from these studies in three ways: (1) the data set is different; (2) it deals with two separate economies with two separate setting, that is, a developed and a developing country; and (3) the mentality and well-being of the households concerned are different, meaning our study is targeting different grounds. We, therefore, estimated similar issues and compared our results with those of previous studies.

Objectives of study

The general objective of this study was to investigate the influence of child health on MLFP and verify its effects by sector of activity and marital status. The specific objectives were to:

- Investigate the influence of child health on maternal labour force participation
- Explore the heterogeneous effects of MLFP by sector of activity and marital status
- Propose policy implications on the basis of the findings.

2. Literature review and theoretical framework

Literature review

Fotso (2017) revealed that having a child whose disability requires low healthcare expenditure increases the probability that a non-graduate mother will be employed by 12%, and that she will work full-year by 3% and seasonally by 6%. Where the child's disability imposes time constraints, the probability of working all year for the non-graduated mother is reduced by 14%. Policy makers should, therefore, consider the variety of costs imposed by a child's disability and the heterogeneous effects according to the mother's level of education.

The effects of child health on maternal labour supply have been found to be of differing magnitudes, depending on the group in question: wives and female-household heads (Salkever, 1982). Salkever (1982) used the survey of income and education and found significant negative effects of child health on the probability of both wives and female-household heads working, but no effects on their number of working hours. These results suggest that it is mainly the decision to work that is affected by children's health problems, but not the number of working hours. Norberg (1998) whose study was based on similar child health data to ours, observed that low birth weight prolonged hospitalization after birth while disabilities influenced the mother's re-entry into the labour force up to five years after childbirth. Norberg (1998) used a national longitudinal survey of youth and found a significant negative effect of child health problems and mother's poor state of health on the time of re-entry into the labour force. The different anthropometric and annual monitoring indicators of child health appropriate for children aged 0 to 59 months stipulated in the health literature include: weight-for-age (WAZ) standard scores; height-for-age (HAZ) standard scores, such as stunting, shortness and chronic malnutrition; weight-for-height (WHZ) standard scores, such as wasting, thinness and acute malnutrition (WHO, 2006). According to WHO Working Group (2006), WAZ is a contemporaneous measure combining both HAZ and WHZ but a consideration of the three measures is the best. In addition, mortality as well as morbidity rates have been commonly used as indicators of child health status (Fotso, 2017).

Several more elaborate studies concerning the influence of the child's health on the mother's labour supply have been conducted by Powers (2003). In all of these, the authors controlled for possible endogeneity of the health variables. The endogeneity

problem could occur because measurement errors in health variables may be correlated with the working behaviour of mothers. For example, working mothers might report a better health status than non-working mothers in order to justify either why they are working or why they are not. In her study, Powers (2003) used the survey of income and programme participation from 1992 and 1993 to implement models of dynamic labour market outcomes such as the transition from not working to working that are less prone to endogeneity issues. In these studies, she found some support for endogeneity, mainly for wives: in the dynamic models the effects are smaller and for wives the effects are not significant. She failed to find a significant effect on working hours for wives in all model specifications, suggesting that at least for wives the child's disability affects mainly the probability of working but not the number of hours. For female household heads, the effects on the probability of working and on working hours remained significant in all model specifications and were always larger than for wives. Again, Powers (2003) also found a negative effect regarding the mother's own poor state of health on their involvement in the labour force.

Another study by Corman et al (2004) is based on fragile families and child well-being, covering 1998 to 2002. They also controlled for possible endogeneity of the child health variable. They investigated the influence of child health at a very young age (12 to 18 months) and used indicators of poor health such as low birth weight, the existence of a severe disability and a variable indicating whether the child crawls yet at the age of one. Using the number of adoption agencies in town and the existence of a neonatal intensive care unit in the hospital where the child was born as instruments for the health variable, they found no support for endogeneity of the health variable. Concerning maternal work behaviour, they found significant negative effects of a child's disability on the probability of the mother working, and on the number of working hours for both wives and female household heads. Here again, the effects for female household heads are stronger. Frijters et al (2008) hypothesized that a mother may react to having a poorly developing child by dropping out of the labour force to spend more time with the child, but could also increase their labour supply to be able to provide the funds for better education and health resources. These authors found that having a poorly developing child reduces the probability that a mother will participate in the labour market by about 25 percentage points. They used handedness (left), which has been shown to be a strong predictor of early childhood development, as an instrument to tackle the endogeneity problems between child development and MLFP. Results in Frijters et al (2008) point to endogeneity between child health and LFP with the negative effects running from child health to LFP.

Summarizing the results of these studies, one can say that the more recent studies have generally found stronger effects of health problems for female household heads than for married women, inconsistent results for working hours regarding the degree of statistical significance and no definite support for the issue of endogeneity of the health variables. The negative effects on the probability of working are always significant and seem to be robust for both married women and female household heads.

Theoretical framework

The economic model of the family developed by Becker (1965) forms the conceptual basis for our analysis of the consequences of maternal labour supply. The family's objective is assumed to be the maximization of the utility that it derives from consuming the various goods that it produces using inputs of family members' time and market-purchased goods and services. In addition, child services are viewed as consumption good from which parents derive utility. The family's level of consumption of child services depends on both the number of children that it produces and on the quality of each child (Rosenzweig and Schultz, 1983).

The time spent by women in activities such as food preparation, breastfeeding, fetching water and fuel as well as seeking preventive and curative medical care is an important input into the provision of infant or child health. Mothers who work, however, may lack the time to adequately breastfeed or prepare nutritious foods for their young children or make use of public services designed to improve child nutrition. Although market substitutes for some time-intensive inputs exist (e.g., prepared foods, hired domestic help), these may be too costly for many women. For many other time-related inputs into health, there are unlikely to be functioning markets. Working women may rely on other members of the household to provide child care while they work, but the quality of care provided by these substitutes, especially if they are older children, may be poor (Rosenzweig and Schultz, 1983). However, women's income-generating activities also increase the level of household resources, which should improve nutrition. As a result, detrimental effects of changes in time allocation may be partially or completely offset. Moreover, some evidence exists indicating that women are more likely than men to spend their income in ways that improve children's welfare. What then can we say? The net effect of child health on maternal labour force participation outcomes is an empirical question/issue.

Thus, borrowing from the child health production function model as proposed by Rosenzweig and Schultz (1983) and applied by Mwabu (2009), here, the demand behaviour for child health services by a mother is analysed within the framework of utility maximization behaviour of the mother as follows:

$$U = U(X, Y, H) \tag{1}$$

Where U is utility derived from the consumption of goods and services (including child health), X is health neutral goods that yield utility to a mother but have no direct effect on reproductive health status of the mother, Y is health-related goods or behaviour that yields utility to the mother and also affects child health while H is health status of the child measured by HAZ. Thus, the reproductive health function is given by:

$$H = H(Y, Z, \mu) \tag{2}$$

Where Z is purchased market inputs such as medical care (immunization, time spent by mother taking care of the child, disease incidence), nutrient intake, that affect child health directly, μ is the component of child health due to either genetic or environmental conditions not influenced by behaviour. It is also a vector summarizing all unobservable characteristics of the child, mother, household or community that affect child health.

As observed from the utility maximization behaviour of the mother (Equation 1) and the reproductive health production function (Equation 2), the mother maximizes (1) and (2) subject to the budget constraint thus:

$$I = XP_x + YP_y + ZP_Z \tag{3}$$

Where, I is the exogenous income (including the value of the time endowment of the household and non-labour income), Px, Py, Pz are the prices of health neutral good X (such as clothing), health-related consumer good Y (such as quitting smoking) and health investment good Z (such as tetanus immunization) respectively. The health investment goods are purchased only to improve the child's health, so they enter the mother's utility only through H. The health production function (Equation 2) has the property of constrained utility maximization behaviour of the mother (Equation 1 and Equation 3) (Mwabu, 2009). Equations 1, 2 and 3 can be re-expressed to yield reproductive health care demand functions of the form:

$$X = Dx(Px, Py, Pz, I, \mu) \tag{4a}$$

$$Y = Dy(Px, Py, Pz, I, \mu) \tag{4b}$$

$$Z = Dz(Px, Pv, Pz, I, \mu) \tag{4c}$$

The effects of the changes in the prices of the three goods on health input demand can be derived from (4a), (4b) and (4c) since from (2) a change in child health can be expressed as follows;

$$dH = FvdY + FzdZ + F\mu d\mu \tag{5}$$

Where, $Fy, Fz, F\mu$ are the marginal products of health inputs Y, Z and μ respectively computed as follows: $Fy = \delta H / \partial Y; Fz = \delta H / \delta Z; F\mu = \delta H / \delta \mu.$ From Equation 2, the change in health can be related to changes in respective prices of health inputs:

$$dH / dPx = FvdY / dPx + FzdZ / dPx + F\mu d\mu / dPx \tag{6a}$$

$$dH / dPy = FydY / dPy + FzdZ / dPy + F\mu d\mu / dPy \tag{6b}$$

$$dH / dPz = FvdY / dPz + FzdZ / dPv + F\mu d\mu / dPz \quad (6c)$$

Where $d\mu / dPi = 0,$ for i = x, y and z so that the terms $F\mu(.) = 0$ in Equation 6a, 6b and 6c, μ is a random variable unrelated to commodity prices.

3. Methodology and empirical specification

Econometric issues and models linking Child Health to MLFP

As already discussed, we used the economic model of the family developed by Becker (1965) and as applied by Frijters et al (2008). This forms the conceptual basis for our analysis of the consequences of child health on MLFP. Based on these authors, the relationship between child's health and MLFP can be described within the framework of a simple household production model. Thus, the generic model of MLFP for family i, is assumed to be:

$$MLFP_i = \lambda_1 \chi_i + \delta_1 haz_i + \varepsilon_{1i} \quad (7)$$

Where $MLFP_i$ is a binary variable representing mother $i's$ participation, χ_i is a vector of household characteristics (sex of household head, ownership of land, residence); mother characteristics (education, age, time taken to fetch water, tetanus immunization status, occupation, marital status); father characteristics (age, occupation) and child characteristics (child size at birth, siblings). The haz_i is child health and ε_i is a random error term. The coefficient δ_1 is the parameter of primary interest and represents the impact that child health has on MLFP. However, this single-equation estimate may be upward or downward biased depending upon the effect that maternal employment has on child health and on the correlation between omitted variables and child health. For example, Frijters et al (2008) noted that if maternal employment has a positive impact on child health, then we would expect the ordinary least square (OLS) estimate of δ_1 to be biased upward.

In empirical estimation, the prime difficulty of the two-way causality that comes in the effect of child health and MLFP may cause the classical endogeneity problem. To avoid the strong likelihood of this endogeneity bias, confounded by the problem of variables that is missing in the empirical data, we used a two-stage least squares (2SLS) estimation approach. Thus, the first-stage equation in this approach is:

$$haz_i = \beta_1 \chi_i + \alpha_1 CV_i + \pi_{1i} \quad (8)$$

Whereby CV_i is child vaccination (the child vaccination used in this study is captured at the cluster level); the 2SLS model should capture the causal effect of child health for those children whose health is affected by vaccination. Importantly, though haz_i is ordinal, 2SLS estimates of δ_1 can be interpreted as estimating the average marginal effect of a unit increase in haz_i for children whose health is affected by vaccination (Angrist and Imbens, 1995). We will use the vaccination information as our instrument for the endogenous variable. Vaccination is an exogenous instrument which makes it a better instrument for our endogenous input. Focusing on vaccination in Cameroon as our endogenous instrument, the vaccination is used to capture effects of child vaccination on the demand for medical services and also embody the relative price and substitution effects.

For the child vaccination instrument to overcome the potential endogeneity problem between child health and MLFP: the instrument must be:

(i) strongly correlated with child health measures; and,

(ii) uncorrelated with MLFP, except through the child health (see Angrist and Imbens, 1995).

Based on this, two main factors can lead to bias in the estimated impact of child health on maternal labour force participation. Firstly, there are likely to be unobservable characteristics relating to the mother and child that are correlated with both child health and MLFP. Two obvious candidates are the natural/heritage effects of the household effect on the health of the mother and the child and the extent to which a mother cares about her career relative to her child. The second source of potential bias arises from the direct effect of maternal employment on child health. If the vaccinated children are few, then we will expect maternal employment to have a negative impact on child health, then children of working mothers will be less developed than children of non-working mothers, creating a downward bias on the estimated impact. On the contrary, if the number of vaccinated children is high, then one will expect maternal employment to have a positive impact on child health and so the bias will be upward.

Before we can present the 2SLS estimates, we first present a reduced form analysis of child health. Here we would expect to observe mothers with many vaccinated children to have higher participation, because child health is positively affected by vaccination. The 2SLS estimation allows us to scale the probit marginal effects into the effects on an increase in our ordinal child health measure. We used vaccination as an instrument to overcome the endogeneity problem between child health and maternal labour supply which cannot be adequately controlled for by observable characteristics. Assuming that child vaccination is a valid instrument; we can use the ivprobit model (probit model controlling for endogeneity) which better respects the binary nature of MLFP as represented by the following two equations:

$$MlFP^{*}=\lambda_{2}\chi_{i}+\delta_{2}haz_{i}+\varepsilon_{2i} \quad (9)$$

$$haz_{i}=\beta_{2}\chi_{i}+\alpha_{2}RF_{i}+\pi_{2i} \quad (10)$$

Where $MlFP_{i}$ denotes actual labour supply and $MlFP^{*}{}_{i}$ represents desired MLFP, note that $MlFP_{i}=1$ if $MlFP^{*}>0$ and zero otherwise, and the error terms ε_{2i} and π_{2i} follow a bivariate normal distribution with non-zero correlation. In addition, as reviewed in Frijters et al (2008), we can calculate the marginal effects of a variable χ^{k} as the average of the marginal effect of everyone in the sample, thus:

where χ_{i} is a vector of characteristics with χ_{i}^{k} the k'th element in that vector, thus, the marginal effect of child health on MLFP will be:.

$$ME((\chi)=\frac{1}{N}\sum_{i}\langle P(MLFP_{i}=1haz_{i}=1)-P(MLFP_{i}=1haz_{i}=0)\rangle$$

Note that the control function methods cannot be used here as it is justified in situations where "plug-in" approaches are known to produce inconsistent estimators of parameters and partial effects (Wooldridge, 2015). This implies that our ivprobit, derived from out linear probability model of Equation 1 is the best fit. Moreover, the instrumental variable and control function would produce the same results if both the first and second stage regressions were linear probability models.

4. Data presentation and sample characteristics

We analysed data from children aged 0 to 59 months old born to female respondents in the 2004 and 2011 Demographic and Health Survey (NIS, 2011) with about 8,127 (2004) and 11,732 (2011) observations. We focused on preschool age children since the largest inputs of a mother's time would traditionally be directed at these children. Restricting the sample to the preschool group also enabled us to obtain results uncontaminated by other social factors, for example, the possibility of the child living with another person at that tender age is practically difficult. Respondents in the 2004 and 2011 DHS (NIS, 2011) were aged 15 to 49 months, thus our sample comprises children with relatively productive mothers who tend to participate in the job market. An advantage of our focus on children's health during the preschool years is that parental inputs are likely to be particularly important, whereas educational attainment and IQ at adulthood may be influenced by a variety of other factors for which it is difficult to control. We also used rainfall data from administrative sources of Ministry of Agriculture and Rural Development to complement our estimations.

In our study, the child health status indicator was the independent endogenous variable, using HAZ z-scores. The z-score is computed as the difference between the value for an individual child and the mean value of the reference population for the same age, divided by the standard deviation of the reference population (WHO, 2006). HAZ represents accumulated consequences of repeated health omissions and inadequate food intake from birth; we consider it a good measure of child health status over time. Besides, HAZ reflects overall social conditions and has been suggested as a measure of overall social deprivation (WHO, 2006). In association to HAZ, WAZ is a composite index representing that sum of the information given by HAZ and WHZ and any protein-energy malnutrition (underweight). Although it does not distinguish between wasting (acute malnutrition (WHZ)) and stunting (chronic malnutrition (HAZ)) it is practical for giving an overview of the distribution of nutritional problems in a country (WHO, 2006). After due consideration, we used the three scores. This is better than child disability that can possibly go on perpetually.

The structure of our variables is such that: the outcome variable of interest is mother labour market participation; the principal endogenous variable is HAZ, WAZ and WHZ; the instrument for endogenous variable is child vaccination; and the exogenous characteristics are mother's education in years of schooling, mother's age, cluster mean of time taken by mother to fetch water, cluster mean of mother's

tetanus immunization status, sex of household head, father's age, father's occupation, child siblings alive in the household, place of residence and mother's education times father's education. The result of this study will be computed using Stata software.

5. Results

Characteristics of maternal labour and factors impacting MLFP

Table 1 presents the study variables and descriptive statistics for the full sample, non-participants and participant mothers in Cameroon respectively. From Table 1, a total of 8,213 (2004) children whose data on height for age were available and data for children were collected for children aged between 0 to 59 months (i.e., under fiveyears old). Considering the full sample of 19,857 observations, about 68% of mothers participated in work or were available to work while 32% were either housewives not actually engaged in the labour market or were in school.

As mentioned previously, in this study the outcome variable is mother labour participation and the endogenous determinant variable is height-for-age standard deviations from the reference median (HAZ). Child vaccination shows that 86.6% of the children were vaccinated and this value is consistent with the value obtained in Kenya by Mwabu (2009). The exogenous covariates were: mother's educational level, measured in completed years of schooling; mother's age; cluster mean of tetanus immunization status; cluster mean of time taken to fetch water; father's age; occupation; interaction of mother's times father's education; intercept of mother education; child siblings; sex of household head; household urban residence; and the time dummy. Other authors in this domain (Fotso, 2017) have used similar variables and obtained similar results.

The negative mean value of height-for-age on mother labour participation proves that the relationship between child health effects and MLFP is inversely proportional, implying that it is difficult for mothers to enter the job market while their children are ill. However, it becomes controversial to see a negative value of -1.0437 z-score on non-labour participant mothers. This value simply indicates that though the mothers are available to take care of their children, they are unable to afford health care for their children. It is worth mentioning that the mean values of weight-for-age (-0.7876) and weight-for-height (-0.0790) z-score depict the same trend.

Table 1: Sample descriptive statistics for non-participant and participant mothers

Variables	Full sample		Non-participant		Participant mothers	
	Mean	SDV	**Mean**	**SDV**	**Mean**	**SDV**
Outcome variable						
Mother labour market participation (1 = mother participates, 0 otherwise)	0.681	0.466	0.000	0.000	1.000	0.000
Main endogenous variable						
Height-for-Age z- Score (HAZ)	-1.179	1.615	-1.043	1.605	-1.240	1.616
Weight-for-Age z- Score (WAZ)	-0.787	1.364	-0.737	1.387	-0.809	1.353
Weight-for-height z-score (WHZ)	-0.079	1.211	-0.122	1.257	-0.059	1.189
Potential instrument for endogenous input						
Cluster level of children vaccinated (= 1 if vaccinated)	0.866	0.214	0.535	0.492	0.362	0.422
Exogenous characteristics						
Mother's education in complete years	4.475	3.941	4.610	4.177	4.411	3.824
Mother's age (age of child's mother)	28.469	7.013	26.573	6.675	29.355	6.992
Female siblings alive in the household	1.535	1.282	1.375	1.219	1.611	1.303
Cluster mean of time taken by mother to fetch water (time_mpu)	24.107	16.388	23.012	17.083	24.616	16.030
Cluster mean of mother's tetanus immunization status	0.361	0.162	0.366	0.157	0.359	0.163
Male household head	0.859	0.347	0.865	0.341	0.856	0.350
Father's Age (age of child's father)	39.891	11.096	38.447	10.529	40.566	11.289
Father's occupation (1 = skilled labour, 0 otherwise)	0.306	0.461	0.354	0.478	0.284	0.451
Residence (1= urban, 0 otherwise)	0.401	0.490	0.534	0.498	0.339	0.473
Interactions and intercepts/dummy variables						
Mother's × father's education	33.988	48.274	36.034	51.659	33.032	46.579
Mother's education × 2011 dummy	2.703	3.840	2.665	3.989	2.722	3.768
2011 dummy (1 = 2011, 0 otherwise)	0.588	0.492	0.583	0.493	0.591	0.492
Variables Identifying Maternal Occupation and Marital Status						
Mother agriculturalist_mpu	0.073	0.261	0.014	0.117	0.101	0.302
Mother non-agriculturalist_mpu	0.925	0.263	0.984	0.123	0.897	0.303
Married women	0.881	0.323	0.861	0.346	0.891	0.311
Singles	0.080	0.272	0.096	0.294	0.073	0.260
Number of observation	19857		6272		13585	

Source: Computed by the Author

Following our pooled 2004 and 2011 DHS data set, many educated women were not working (4.6%). We also observed that fathers in such homes were more engaged in skilled jobs that attract higher pay. Hence, it is likely that these men go to work and allow their wives, though educated, to take care of the children. It is also expected that most people in skilled jobs are educated so probably fathers in such homes are educated and so would prefer to marry educated women than otherwise. In addition, there were more aged fathers in households that had working mothers than otherwise (40.5 > 38.4), implying that many retired personnel were living in urban centres, and this explains why they are more engaged in paid jobs and wives not working. The asset index serving as the principal endogenous instrument revealed that at least 19% of the total sample population were asset owners. These assets were household holdings

excluding land. However, comparing the set of mothers, we observed that mothers participating in the labour market were more likely to own more assets than mothers who were not. Interestingly, many of the women who were not working were from male-headed households (86.5%). This may explain why these women were not part of the labour market. In this same 2004/2011 survey data, most women were engaged in working in the agriculture sector than the skilled labour sector and many married women were more involved in the job market than otherwise while the time dummy revealed that in 2011, about 59% of women participated in labour as compared to 58% in 2004. On the whole, of the 19,857 observations, 13,583 participated in work or were available to work while 6,272 did not participate in the job market.

Comparing these summary statistics with the existing literature, we observed consistency with Dunkelberg and Spiess (2007), who indicated that participating mothers systematically differ from non-participating mothers on various characteristics. Thus, mothers who participate in the labour market are older, have fewer children, and are more highly educated than non-participants (see, Dunkelberg and Spiess, 2007). In terms of child health, tchildren whose mothers participated in the labour force had significantly better development scores (0.715 vs. 1.032) than children whose mothers stayed at home. The details of this analysis are summarized in Table 1.

Parsimonious model estimate of MLFP with child health and maternal characteristics

Computing the marginal effects of MFLP with child health and maternal characteristics as indicated in Table 2, we observed that child health is hypothesized to be statistically and significantly associated with MLFP. This variable is statistically significant at the 1% level for HAZ, WAZ or HWZ. That is, an improvement in the stock of child health by 1% increases the probability of mothers with young children participating in the labour market. This result is true for 2SLS and ivprobit respectively for HAZ, WAZ and WHZ. The positive association between child health and MLFP is largely due to improvement in child health medication and increased knowledge/awareness among households in Cameroon.

Maternal characteristics relatively contributing to this increase are: mother's education, cluster mean of mother's tetanus immunization status and mother's age. These variables are significant at 1% level for the three measures of child health (HAZ, WAZ and WHZ) and for 2SLS and ivprobit. Time taken by mothers to fetch water and mothers working in the agriculture sector significantly reduce the effect and are not significant. The intercept term revealed that child health effect on MLFP in terms of probability effect was stronger in 2011 than in 2004. This may be due to an increase in the provision of child medication services in recent times. The Cragg-Donald F-statistics revealed that our asset index is strong and it is necessary to test the assumption that the instrument is uncorrelated with the structural error term.

Table 2: Parsimonious model estimate of MLFP with child health and maternal characteristics

Variable	2SLS			ivprobit		
	Maternal Labour Force Participation					
	HAZ	WAZ	WHZ	HAZ	**WAZ**	**WHZ**
Child health (HAZ, WAZ, HWZ)	0.625***	0.344***	0.191***	0.811***	0.431***	0.677***
	(2.91)	(2.96)	(2.66)	(9.70)	(11.11)	(17.35)
Mother's education	0.102**	0.053***	0.096**	0.010***	0.070***	0.069***
	(2.14)	(4.28)	(2.52)	(1.35)	(11.38)	(17.10)
Mother work in Agriculture_mpu	0.042	0.039	-0.001	0.024	0.123*	0.002 (0.03)
	(1.22)	(1.01)	(0.01)	(0.82)	(1.85)	
Mother's age	0.012***	0.013***	0.014***	0.165**	0.023***	0.011***
	(8.79)	(9.84)	(5.80)	(2.53)	(6.37)	(2.62)
Cluster mean of time to fetch water	-0.000	-0.000	0.001	-0.000	-0.000	-0.000
	(0.79)	(0.10)	(0.97)	(0.12)	(0.37)	(0.06)
Cluster mean of mother's tetanus immunization status	0.120***	0.094***	0.018***	-0.139***	0.114***	0.010***
	(3.28)	(3.31)	(0.55)	(4.72)	(4.06)	(3.40)
Child siblings	-0.162**	-0.138*	-0.001***	-0.167**	-0.206	0.015***
	(2.12)	(1.80)	(-6.53)	(2.20)	(1.46)	(4.31)
2011 dummy	0.058**	-0.022	-0.174**	0.124**	-0.031	-0.129***
	(2.27)	(1.10)	(2.26))	(2.47)	(1.05)	(4.77)
Constant	-0.435**	-0.335**	-0.117	n/a	n/a	n/a
	(2.17)	(2.06)	(0.58)			
Uncentered R-square	0.0502	0.2019	0.0333	n/a	n/a	n/a
F test of excluded instruments	22.14 [1, 6663; 0.0000]	29.44 [1, 6663; 0.0000]	7.50 [1, 6663; 0.0000]	n/a	n/a	n/a
LR chi^2/F^2: Prob > chi^2/ Wald chi^2	13.78 [7, 6673; 0.0000]	16.40 [7, 6673; 0.0000]	5.35 [7, 6673; 0.0000]	1345.25 [7; 0.0000]	1308.69 [7; 0.0000]	5395.09 [7; 0.0000]
Rho	n/a	n/a	n/a	0.819	0.828	0.977
				(0.058)	(0.056)	(0.021)
Sigma	n/a	n/a	n/a	1.561	1.255	1.140
				(0.013)	(0.010)	(0.009)
Cragg-Donald F-Stat	22.135 [16.38]	29.436 [16.38]	17.499 [16.38]	n/a	n/a	n/a
Number of observation	6681	6681	6681	6681	6681	6681

Source: Computed author. N/B: Absolute value of robust t-statistics in parentheses beneath estimates,* indicates statistical significance at 10%, ** at the 5% and *** at the 1% level.

Overall result of basic marginal effect estimates of MLFP

To determine the basic marginal effect of child health on MLFP, Table 3 presents the results of 2SLS and ivprobit. The main results represent the estimates of δ_1 from Equation 7 which corresponds to the 2SLS and the estimates of δ_2 from Equation 9 which corresponds to the ivprobit. As mentioned earlier, the results in Table 3 show that child health is consistently significant in predicting MLFP. It implies that, if the stock of child health improves by 1%, the probability of mothers with children (0–59 months old) participating in the labour market will increase and will be significant at 1% level, respectively, for HAZ, WAZ and WHZ. The result is also true for 2SLS and for ivprobit. This result is consistent with those ofFrijters et al (2008). This effect can be due to improvement in biomedical inputs such as nutrition, immunization against tetanus,

and the number of antenatal care visits when the mother was pregnant as well as the availability of children's drugs in medical centres. From the above, the decision makers should always ensure they measure the unintended outcomes of job policies and secure the policy evaluation data. Lastly, more flexible work arrangements enabling mothers to work from home would help those with disabled children participate to some degree in the labour force.

The ivprobit estimates tell a similar story as the instrumental variable (IV), however, their results differ in terms of magnitude. Focusing on HAZ, the ivprobit estimate (0.422) coefficient on MLFP is about 10 times as large as the IV estimate, thus ivprobit estimates show a stronger correlation between child health and MLFP relationship. This result confirms the fact that ivprobit model better respects the binary nature of MLFP as represented by Equation 7 and Equation 9. The IV results presented here are not biased per se, but rather they are understated due to the binary nature of MLFP; this is consistent with what has been observed in the literature (see Fotso, 2017). The Cragg-Donald F-statistics also revealed that our household asset index was marginally strong and so valid. Moreover, the Wald test confirms that, overall, our results were robust (see Table 3).

Table 3: Marginal effects of maternal labour force participation

Variable	2SLS			IVPROBIT		
	Maternal labour force participation					
	HAZ	WAZ	WHZ	HAZ	WAZ	WHZ
Child health (HAZ, WAZ, HWZ)	0.313** (2.39)	0.300** (2.39)	0.560** (2.01)	0.422*** (4.02)	0.507*** (3.92)	0.799*** (8.63)
Mother's education	0.012** (2.29)	0.031** (3.08)	0.059** (2.20)	0.013* (1.71)	0.042*** (3.50)	0.068*** (7.29)
Mother's age	0.014*** (10.21)	0.014*** (11.44)	0.013*** (8.07))	0.036*** (5.54)	0.038*** (6.18)	0.020* (1.95)
Mother work in agriculture	0.042 (1.28)	0.034 (1.13)	0.013 (0.28)	0.167** (2.29)	0.145* (1.93)	0.029 (0.36)
Cluster mean of time to fetch water	-0.000 (0.95)	-0.000 (0.43)	0.000 (0.55)	-0.000 (0.57)	-0.000 (0.60)	-0.000 (0.15)
Cluster mean of mother's tetanus immunization status	0.094** (2.22)	0.059** (2.27)	0.011** (0.54)	0.452*** (3.97)	0.104*** (3.19)	0.017 (0.58)
Mother's × father's education	0.07*** (-4.63)	-0.001** (2.50)	-0.002*** (2.86)	0.000*** (3.28)	-0.001** (2.57)	-0.002*** (2.97)
Mother's education × 2011 dummy	-0.000 (0.07)	0.016*** (3.39)	0.015** (2.37)	0.042*** (4.63)	0.042*** (4.67)	0.023** (2.06)
Household male head	-0.031 (1.26)	-0.012 (0.59)	0.014 (0.44)	-0.084** (1.96)	-0.080* (1.87)	-0.024 (0.58)
Father's age	-0.002 (-12.39)	-0.001* (1.75)	0.000 (0.02)	-0.007*** (3.70)	-0.007*** (3.55)	-0.003 (1.29)
Father has skill labour	0.016 (0.68)	0.009 (0.49)	-0.005 (0.21)	-0.023 (0.56)	-0.025 (0.61)	-0.010 (0.27)
Child siblings	-0.161** (-2.03)	-0.003*** (3.66)	-0.114*** (-3.01)	-0.106* (1.88)	-0.294*** (6.68)	0.027 (1.18
Urban residence	-0.077** (2.14)	-0.087*** (3.03)	-0.090** (2.54)	-0.229** (2.55)	-0.219** (2.40)	-0.080 (0.70)
2011 dummy	-0.032 (1.21)	-0.085*** (3.10)	-0.158** (2.37)	-0.147** (2.57)	-0.217*** (4.15)	-0.226*** (4.46)
Constant	-0.066 (0.29)	0.021 (0.13)	0.138 (0.81)	n/a	n/a	n/a
Uncentered R^2	0.4048	0.4048	0.1175	n/a	n/a	n/a
F test of excluded instruments	9.74 [1, 6667; 0.0018]	16.58 [1, 6667; 0.0000]	5.99 [1, 6717; 0.0018]	n/a	n/a	n/a
LR chi^2/F^2: Prob > chi^2/ Wald chi^2	17.36 [13, 6667; 0.0000]	17.36 [13, 6667; 0.0000]	11.50 [13, 6717; 0.0000]	880.40 [13; 0.0000]	848.54 [13; 0.0000]	3252.37 [13; 0.0000]
Rho	n/a	n/a	n/a	0.621 (0.169)	0.624 (0.163)	0.924 (0.095)
Sigma	n/a	n/a	n/a	1.555 (0.013)	1.250 (0. 010)	1.139 (0.009)
Cragg-Donald F-Stat	9.738 [16.38]	16.576 [16.38]	5.994 [16.38]	n/a	n/a	n/a
Number of observation	6681	6681	6681	6681	6681	6681

Source: Computed by author. N/B: Absolute value of robust t-statistics in parentheses beneath estimates,* indicates statistical significance at 10%, ** at the 5% and *** at the 1% level.

Of all the variables included in our estimation model, only child health strongly influences MLFP. Most of the other factors affect MLFP with a smaller magnitude. From this result, we observed that understanding impediments to labour participation is critical, especially when designing policies aimed at improving family welfare. Our results are an important contribution to knowledge within this area in Cameroon. In addition, our results have important consequences for the literature that examines the impact of child health on maternal employment. Given the difficulty in finding a variable that is correlated with child health and not maternal employment (an instrument), most studies struggle to identify the causal impact. Our results, therefore, provide new evidence on the likely direction and size of bias in the estimates of previous studies. Further, in line with other studies in this domain (Fotso, 2017), our results imply that at least child health increases MLFP. Thus, when a family is presented with a child with health problems, it often exerts emotional stress and imposes a physical demand for care on family members. A family member, usually the mother as the primary carer, consequently reduces work commitment or even leaves the labour force to care for the ill child. Hence, to provide a safety net for the affected families and children, the government needs to offer financial or related support.

However, Lu and Zuo (2010) argued that findings of existing international studies on the impacts of child health/disability on the mother's labour supply are mixed. While most studies found a negative effect on the mother's decision on whether to participate in the labour force, the findings are inconclusive concerning the number of hours of work, if they are in the labour force. On close inspection, we found that child health/disability is defined differently in different studies. Different definitions of child disability could contribute differently to the findings. For example, Gould (2004) argues that children with an illness that requires significant medical expenses could contribute positively to the mothers' work activities as the mothers are under pressure to work more to cover the extra expenses associated with the treatment of their sick children. Consequently, Gould defines child disability according to the intensity of care and expense of treatment associated with a disabled child. Our study has explored the possible situation of child health on the mother's work activity following the Cameroon demographic health survey data. Our finding that mothers react strongly to their child health by reducing their labour force participation indicates that previous estimates may suffer from endogeneity bias. This result confirms that of Engelbert (1989) in Germany who found that a child with health problems is cared for mainly within the family and by mothers themselves. This is true for Cameroon and hence the decision makers need to quickly formulate maternal work policies.

5.4 Marginal effect estimates of MLFP by sector and marital status

Correlates of agricultural and non-agricultural occupation

Table 4 relates to mothers working in agriculture and non-agriculture sectors. We observed that mothers in the agriculture sector increased the probability of MLFP

with a probability effect of 0.440 significant at 1% level. In Cameroon agriculture occupies about 75% of economic activity. Thus, most mothers, especially in rural communities (93%), work in this sector and will participate in the job market even when their children are sick. To this effect mothers in agricultural sector will want to engage in work to meet their seasonal obligations during planting and harvesting. Mothers will, therefore, go to the farm even when a child is ill so as to prepare for future consumption and investment. This is not the case with urban mothers since most of them are either in white collar jobs or business.

Table 4: Marginal effects of the determinants of MLFP by sector of activity and marital status

	Estimation Method: IV Probit							
	Sector of Activity				Marital Status			
Variable	Coef	ME	Coef	ME	Coef	ME	Coef	ME
	Agric		Non-Agric		Married		Single	
Child health (HAZ)	0.433**	0.440***	0.300**	0.296***	0.016***	0.223**	0.245**	0.563***
	(3.85)	(2.69)	(2.39)	(2.98)	(3.39)	(2.15)	(2.12)	(3.26)
Mother's education in years	0.029**	0.143	0.031**	0.000	0.588***	0.031***	0.034***	-0.025
	(2.08)	(1.50)	(3.08)	(0.03)	(6.59)	(2.90)	(4.36)	(-0.85)
Mother works in agriculture_MPU	n/a	n/a	n/a	n/a.	0.012***	1.370***	0.009	0.66
					(2.70)	(10.31)	(0.97)	(0.80)
Mother's age	0.053	0.051*	0.034	0.040***	0.005***	0.036***	-0.037***	0.033
	(5.63)	(1.81)	(1.13)	(7.89)	(-7.27)	(8.23)	(-4.35)	(0.80)
Mother time to fetch water_MPU	-0.002	0.005	-0.000	0.001	0.185**	0.001	0.005	-0.001
	(1.32)	(0.71)	(0.43)	(0.85)	(2.17)	(0.72)	(0.49)	(-0.22)
Mother's immunization status_MPU	0.105**	-0.159	0.059**	0.461***	-0.050***	0.555***	0.017*	0.335
	(2.01)	(-0.20)	(2.27)	(3.98)	(-4.29)	(4.46)	(1.66)	(1.03)
Mother's education × 2011 dummy	-0.007	-0.229	-0.001**	0.018**	-0.002***	0.019**	-0.000***	-0.037
	(0.46)	(-1.37)	(2.50)	(2.25)	(2.86)	(2.31)	(-2.85)	(-1.15)
Male household head	-0.230	0.585*	0.016***	-0.107***	0.015**	-0.035	0.007	-0.201**
	(3.07)	(1.73)	(3.39)	(-2.62)	(2.37)	(-0.75)	(1.08)	(-2.00)
Father's age	-0.011	-0.027*	-0.012	-0.005**	0.014	-0.002	0.000	0.015***
	(3.14)	(-1.82)	(0.59)	(-2.40)	(0.44)	(-1.32)	(0.70)	(3.99)
Father has a skill labour	0.031	0.258	-0.001*	-0.093***	0.000	-0.118***	0.271***	-0.305
	(0.58)	(0.81)	(1.75)	(-2.88)	(0.02)	(-3.41)	(20.79)	(-1.54)
Mother's × father's education	0.000*	-0.002	0.009	-0.002**	-0.005	-0.004***	0.043***	-0.001
	(0.13)	(-0.38)	(0.49)	(-4.44)	(0.21)	(-6.12)	(4.75)	(-0.54)
Child siblings	0.033***	-0.092**	0.306**	-0.092**	0.212***	0.011*	0. 060*	0.024*
	(3.57)	(-2.25)	(2.03)	(-2.25)	(6.75)	(2.40)	(1.93)	(1.71)
Household urban residence	-0.077**	0.071	-0.087***	-0.499***	-0.090**	-0.514***	-0.003	-0.213
	(2.14)	(0.24)	(3.03)	(-14.00)	(2.54)	(-14.24)	(-0.29)	(-0.99)
2011 dummy	-0.185	1.432	-0.085***	0.013	0.012**	-0.03	-0.158**	0.411
	(1.71)	(1,30)	(3.10)	(0,26)	(2.70)	(-0.58)	(2,37)	(1,08)
Constant	-0. 421 **	n/a	0.300**	n/a	-0.006***	n/a	0.560**	n/a
	(8.04)		(2,39)		(-8.67)		(2,01)	
Wald chi^2	8.88	n/a	4.51	n/a	9.34	n/a	9.36	n/a
	[0.0002]		[0.0038]		[0.0040]		[0.0031]	
Rho	0.576	n/a	0.451	n/a	0.016	n/a	0.108	n/a
	[0.161]		[0.182]		[0.034]		(0.090)	
Sigma	1.394	n/a	1.554	n/a	0.231	n/a	0.238	n/a
	[0.020]		[0.014]		[0.001]		(0.002)	
Number of observation	502		6037		5702		1200	

Source: Computed by author. N/B: absolute value of robust t-statistics in parentheses beneath estimates. * indicates statistical significance at the 10%, ** 5% and *** 1% level.

Conversely, in the non-agriculture sector, a 1% increase in child health has a probability effect of 0.296 increase in MLFP, significant at 1% level. Mothers in the non-agriculture sector include public service workers and private sector workers (formal and informal), that is, mothers working principally in both the secondary and tertiary sectors. Many of these sectors are located in urban centres where accessibility to medical facilities/services is better than in rural areas and babysitter and house aid services are available. Mothers gain from these services to cater for their children, leaving them with more time to participate in the labour market than mothers working in the agriculture sector. Our results also revealed that in 2011 more women participated in labour in the agriculture sector than in the non-agriculture sector. Further, many mothers were more educated in 2004 than in 2011. Other variables associated with these to favouring agricultural supply include: mother's education, mother's age, male-headed households, household residence and father's occupation. The variables favouring the non-agriculture sector include mother's education, age and immunization status.

Correlates of married women and single mothers

Estimates of married women reveal an increase in the MLFP with a probability effect of 0.223 significant at 5% level in married households. This result shows that a marginal change in child health will cause an increased probability of 0.223 in married women participating in the labour market. In this line, Fotso (2017) shows that having a child who is unable to do age-standard activities reduces labour for participation for married women (wives) by six percentage points. Our coefficient is, therefore, reasonably similar in size to previous findings. Other factors that significantly contribute in this domain are: mother's education, occupation, age, immunization status and household residence.

For single women, an average marginal change in child health increased the probability of single maternal labour supply by 0.563 point, significant at 1% level. We observed that the magnitude of the estimate of singles was greater than that of married women. The result is so because single women face more pressure in satisfying their needs than wives, whose husbands contribute to providing basic household needs. In a given child health status, therefore, single women are expected to participate more than married women. Other variables contributing in labour participation of single women are: mother's education, age, immunization status and male child. In 2011, many single women participated more in the labour market (41.1%) than did married women. However, more married women had higher education levels (19.8%), implying that while single women sought jobs in 2011, married women pursued. The estimated results for WAZ and WHZ depict the same story for both mother's occupation and marital status.

6. Conclusion

The objectives of this study were: to investigate the influence of child health on MLFP and to explore the heterogeneous effects of MLFP by sector of activity and marital status. The outcome variable was MLFP; the endogenous determinant was HAZ; the endogenous instrument used was cluster level of children vaccinated; and the exogenous covariates were: mother's education measured in completed years of schooling, mother's age, child sibling, cluster mean of time taken to fetch water, father's age, mother's occupation, immunization status, interaction of mother times father's education, intercept of mother education, sex of household head, household urban residence and the time dummy. From our used pooled data, these variables were treated and average marginal effects computed using stata software.

The ivprobit revealed stronger probability marginal effects of child health on MLFP. The ivprobit effect of child health on maternal labour supply was much larger than the 2SLS. This confirms the fact that the ivprobit model better respects the binary nature of MLFP and the results are consistent with those found by Fotso (2017) and by Frijters et al (2008). Estimates of married women revealed that a marginal change in the health of a child caused an increased probability effect in the participation of married women in the labour market. For single women, an average marginal change in child health increased their MLFP by a stronger probability effect. We observed that the magnitude of the estimate of single women was greater than that of wives. This is because single women are under more pressure to satisfy their needs than are married women, whose husbands help in the provision of household basic needs. Considering the agriculture and non-agriculture working sectors of the mother, we observed that mothers in the agriculture sector had a stronger probability effect than mothers in the non-agriculture sector implying that mothers in agriculture can easily ration their time to take care of their children than mothers in non-agricultural sector who depend on their office work schedules.

We observed that understanding the impediments of child health on MLFP is critical. From a policy point of view, investing in child health, given the right conditions, is an important enabler for women to use the extra time at their disposal to participate additionally in the labour market and in training opportunities. The results also indicate the importance of creating awareness for mothers with very young children who work for financial reasons. This means creating more flexible work arrangements that enable mothers to work from home, especially those in the non-agriculture sector. Decision makers can also increase maternal leave payment

and health insurance coverage. Considering the sector of activity and marital status, these results have implications for public interventions that enable single mothers, especially those working in the agriculture sector, to take additional advantage of labour market/training opportunities as a means of improving the economic well-being of their households.

The limiting factor of this type of study is the use of a single cross-section data, single child health measure and the use of many assumptions. We stipulated that the IV estimates were based on the assumptions that: (i) the unobservable variables are uncorrelated with excluded instruments or that the correlation is linear; and (ii) the estimation sample is randomly selected among children of age 0 to 59 months. Future research in this domain should use more than one child health measure among the host of child anthropometrics and other sources of data to carry out their analysis.

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