RAIS Journal for Social Sciences | VOL. 2, No. 1, 2018
ISSN 2574-0245 (Print) | ISSN 2574-1179 (Online) | DOI: 10.5281/zenodo.1248963

Maternal Participation in Agricultural Production and Population Growth in Cameroon

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ABSTRACT: This study attempts to investigate the effects of maternal agricultural production on Population Growth in Cameroon. We have as objectives: (a) explore the determinants of Women in Agriculture, (b) assessed the effects of women working in Agriculture on population growth and (c) derived policy implications on the basis of our analysis. To tackle these objectives, we shall make use of instrumental variable (2SLS) model. Empirical results are based on 2011 Demographic and Health survey collected by the government's statistics office and Department of statistics of the Ministry of Agriculture and Rural Development. Regarding the determinants of women participation in agricultural production, we observed that mother's health status, farm size, mother's education in complete years, urban residence and married women are positively and significantly correlating with women participation in agricultural production. We observed that women participation in agricultural production strongly affects population growth. Other factors positively affecting population growth in Cameroon include: mother's age in complete years, family size, married mothers and father's presence in the house. This is a gateway towards economic growth, food security and poverty alleviation in Cameroon.

KEYWORDS: Maternal Participation, Agricultural Production, Population Growth, 2SLS, Cameroon

1. Introduction

The challenges of women participating in agriculture in relation to their fertility rate are a call for concern. The struggle of women to have children and to increase family food supply has resulted to what the International Labour Organization (ILO) term as the violations of fundamental worker rights such as: the right to join unions and bargain collectively, the elimination of forced labour, the ending of child labour and the reduction of discriminatory hiring (ILO 2003). Generally, women participating in agricultural production are more vulnerable to these abuses because of the nature of precarious work. Other problems faced by women working in agriculture includes: no pesticide safety training, thus creating an unsafe exposure to pesticides which is a serious hazard for the agricultural women; a low number or absence of breaks during the working hours. At times their husbands and family size/composition will often pressure women in agriculture to work faster than a reasonable pace and without breaks. Women farm workers reported lack of water at their agricultural farm site, or that which is provided most often is dirty. In addition to environmental hazards, such as overexposure to sun light, poor topography of their farms, they equally suffer from difficult working conditions that can arise directly from themselves due to long distance trekking to the farm, poor farm working tools, hard method of farming, inadequate farming tools and insufficient assistance. Women farm workers are also at risk of human trafficking because their work sites are often geographically isolating areas and they represent one of the lowest resource work forces in terms of annual income and occupational benefits.

Fertility, as revealed in the literature, is the driving force of population growth in the world today and fertility is higher where infant and child mortality are high. It is not hard to understand the motivation of parents who keep bearing children, in fear that some of them will die in childhood, in order to achieve the family size that they really want. Principally the determinants of fertility are health status of mothers, age of first marriage, breast-feeding, contraception, abstinence and rhythm, social status, labour participation, household size, education and culture (Cramer 1980).

According to Johnson et al (2011), broader social, cultural, and economic conditions also influence fertility levels. High fertility is usually found in countries where poverty is widespread and deep. Where women do not often

work for significant wages, bearing and raising children is easily integrated into their traditional unpaid work: producing, processing, and preparing food, gathering fuel and water, and other work in and near the home. The wages for women who work outside the home in these countries are always low; a mother can take time out for childbirth without sacrificing much pay, and another child can in just a few years easily make up such a minor loss with its own labor. The need for child labor also drives fertility up, especially in agricultural communities but also anywhere that families rely on the physical environment for subsistence, as for gathering wood for fuel and drawing water. A lack of schooling opportunities reinforces this effect. Another important condition of high fertility is a culture in which women have little or no prestige except that gained by bearing children, especially sons. A preference for sons also increases fertility, as couples keep having children until they achieve the number of sons that they want. High rates of infant and child mortality have the same effect. Finally, in societies without public old-age pensions, children represent the only opportunity a couple has for support in old age.

Research indicates that women's employment participation may be adversely affected by childbearing/rearing (Norris 1996). That is, having children typically involves a discontinuity of employment and/or a change in employment status, resulting in a move from full-time to part-time work or leaving the labour force for a period of time. This discontinuity of employment and/or decreased level of labour force participation may have profound implications for Cameroonian women as individuals and for the broader Cameroon society. For example, decreased labour participation can exert downward pressure on women's wages and benefits, both in the short and long-term (McDonald 2003). However, there may also be substantial personal, family and societal implications for a mother who decides to remain continuously full-time employed following the birth of a child. For example, there is evidence that even full-time employed mothers retain a larger share of childcare and household duties than their partners, resulting in role overload (Fisher, 2002) or what has been termed by Hochschild (1989) a double shift. Also, recent evidence suggests that early, extensive and continuous formal child care poses some developmental risks for young children (Belsky 2002). Finally, fertility rates appear to be inversely related to women's attachment to the labour force (Fisher 2002) and falling fertility rates have implications for the ratio of working adults compared to the dependent population and subsequent economic growth (Barnes 2001).

In defining issues, demographically, fertility refers to the actual production of offspring, rather than the physical capability to produce which is termed *fecundity.* As noted earlier, fertility is the driving force of population growth in the world today. Population growth took off on its dramatic rise when death rates started to fall with the advent of industrialization and even more importantly, the development of the germ theory of disease, healthy sanitation practices, and antibiotics and other medicines. Demographers estimated that, as a matter of physical possibility, the average woman is capable of bearing 17 children in a reproductive lifetime stretching from 15 to 50 years of age. This can only be achieved by individual women, and on a country-wide basis does not occur in the world today even in the highest-fertility countries. What prevents humans from reaching this theoretical maximum? In some cases biological conditions reduce fertility. Some portion of any population is sterile, and another portion is sub fecund, or less fertile than it would be, because of malnutrition or disease, especially sexually transmitted disease. Even among fully fertile people, in most countries in the world today, women marry some years after age 15 or the onset of fertility.

Tsafack and Zamo-Akono (2010) in revealing the problems associated with fertility rate vis-à-vis agricultural production noted that in 2004, the fertility rate was 5.0 in Cameroon, the highest (6.1) being observed in rural areas (INS/ DNSC 2004). About 45% of women suffer from anaemia; those who have a child are almost 49%, the highest rates being observed in urban areas (54% in Yaoundé, 44% in Douala, and 42 % in rural areas). Female nutritional status (measured by the Body Mass Index), an important determinant of female mortality (WHO 1995), is also a concern in Cameroon: 7% of women have a BMI less than 18.5 and 29% are over 25, the highest BMI being observed in Yaoundé and Douala (25.5). These results in high maternal mortality rates: between 1998 and 2004, the rate was evaluated at 669 female deaths for 100,000; this rate is far higher than that observed in developed countries. Further, the value for fertility rate (births per woman) in Cameroon was 4.41 as of 2011, over the past 51 years this indicator reached a maximum value of 6.43 in 1980 and a minimum value of 4.41 in 2011. Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates. The act of child bearing is still look upon in Rural Cameroon as a source of power and wealth so an average woman has about 07

children. This means that women in rural communities of Cameroon relatively contribute so much in population growth and particularly in promoting the labour market of the country.

In this perspective, Logo and Bikie (2003) underscore that rural women in Cameroon spend most of their time on crop production activities (cultivating, harvesting, weeding, and processing) and domestic tasks (home improvement, and child rearing) with little rest for recreation. This observation was later confirmed by Fon and Edokat (2012), firstly that SSA women contribute a significant amount of their time in weeding, harvesting, animal husbandry, cleaning, fetching water, baking, cooking, sewing and childrearing, they have not received adequate recognition for the intensive time spent on their dual roles as producers and reproducers. They also observed that the bulk of the production processes are carried out by women, but they have the least access and use of those resources that lead to the final output. In addition, Anunobi (2003) said it is estimated that women in Africa spend about 15-18 hours a day performing these essential chores for the livelihood of the farming households. While in analyzing a United Nations document, Staudt, (1991) states that women represent half of the world's population and perform nearly 66 percent of all working hours but receive only one tenth of the income generated and own less than one percent of the property (Staudt 1991).

Despite the pressing need to reconcile the mother agricultural food and children productive roles, we observed that major study have attempted to quantify mother food production and population growth rate in case of Cameroon using the Demographic and Health Survey (DHS). Tsafack and Zamo-Akono (2010) attempted to link fertility, health and female labour force participation in urban Cameroon. This study is actually different or opposite to our attempt to quantify women effort in terms of work and reproduction. Secondly, our data and methodology use in this present study is different from theirs. For instance they used a cross-section data set obtained from a survey of the urban Cameroon population while we in turn to use DHS. We are not aware of another study attempting these issues as us. To address therefore, the above develop issues, we exploit the following objectives: (a) assess the effects of women participation in agricultural production on population growth; (b) find out the determinants of women participation in agriculture and (c) derived policy implications on the basis of our analysis.

2. Literature Review

Owing to this literature, Weller (1977) and Cramer (1980) gave four possible explanations of the association between fertility and female labour force participation: women's fertility influences their labour force behaviour; women's labour force behaviour influences their fertility; a reciprocal relationship exists between the two variables; and the association is spurious, reflecting other factors. If some evidence supports the first three hypotheses, the fourth one has proven more difficult to support. Furthermore, most estimates of this relationship have found a negative relationship between the number of children and a woman's labour supply (see Brewster and Rindfuss, 2000 for a review). The problem with these estimates is that they cannot say anything about causality.

Still in the last few decades, the labour force participation of mothers with young children has increased dramatically. However, in Cameroon the labour force participation of mothers with very young children is relatively low in comparison to other countries, this may be due to individual factors such as poor health that can present obstacles (Wolfe and Hill 1995) leading to higher physical and mental health risks at childbirth and increased stress in everyday life due to childcare on the one hand, and on the other, poor health of the child can create increased demands regarding childcare. On average, the care giving 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 carter for the sick child. Apart from this direct effect, we might also expect to find indirect effects due to the lower availability and higher costs of daycare for unhealthy children (Brandon 2000) also resulting in additional time costs (Dunkelberg and Spiess 2007) all of which may produce a negative impact on women participation in agricultural production.

In relation to productivity, the absence of women in basic food crop (yams, rice, maize, potatoes) agricultural production may result to untold malnutrition. As noted in the literature, malnourished children are much more likely to die due to a common childhood disease than those who are sufficiently nourished. Many studies have shown that malnutrition is highly associated with high child mortality and therefore child survival could be accelerated by reducing the general level of malnutrition. On the other hand, better nutrition during early childhood improves educational attainment and post-schooling performances. Amongst recent studies, Hoddinott et al (2008)

found that a nutrition intervention in early childhood (food supplementation during 0 - 24 months) led to 46 percent increase in the average wage in the male sample in Guatemalan villages.

About 61 percent of all mothers are working within three months after their child's birth, with about half of these mothers returning to work in agricultural production within the first two months after giving birth (Klerman and Leibowitz, 1990). Many of these women found that child health production, agricultural production and domestic activities increasingly compete for their time. Consequently, many employed pregnant women return to work quickly after giving birth to keep their families, taking only a brief period of time off from work. Johnson et al (2011) revealed that Cameroon has a relatively high proportion of births to mothers under age 18, about 11 percent; this figure has not changed over time. Similarly, about 11 percent of births are to mothers over age 34, marginally lower than in most other countries in this analysis; this figure also has a flat trend. The median birth interval has increased marginally over the course of the three survey periods. However, the median birth interval of 32 months observed in 2004 still does not fall within the recommended range of 36-59 months (3-5 years).

Broeck and Maertens (2014) hypothesize that female wage employment may lower fertility rates through an income effect, an empowerment effect and a substitution effect, and address this question empirically using household survey data and two different regression techniques (a Difference-in-Differences estimator and an Instrumental Variable approach). They found that besides education, female employment has a significant negative effect on fertility rates.

Given the critical importance of the agricultural sector to the national economies, and in view of the important productive role of women within this sector, economic development and food security are affected by the degree of commitment shown by governments to the agricultural sector and to rural women. As emphasized in the literature (IFAD 1993), gender disaggregated statistics that accurately illustrate the nature and role of women's involvement in agriculture are indispensable in gaining this commitment and for the formulation of successful policies, programmes and projects in the agricultural sector. Generally, In Sub-Saharan Africa, agriculture accounts for approximately 21% of the continent's GDP and women contribute 60-80% of the labour used to produce food both for household consumption and for sale. In-addition, IFAD (1993) reveals that In Africa, several regional trends have

had an impact on women's productive role in agriculture, forestry and fisheries, including: (1) structural adjustment policies adopted by many governments over the last ten years, in the face of global recession, decreased commodity prices and growing foreign debt; (2) population pressure and environmental degradation; (3) high rates of male rural-to-urban migration in search of income earning employment opportunities; and, (4) increased attention to the importance of women in national agricultural plans and policies. This literature is important in the understanding of women role in agriculture in general and population growth in particular.

3. Theoretical Framework, Empirical Specification and Methodology of study

Theoretical Framework

We use the fertility production function model as proposed by Rosenzweig and Schultz (1983) and Mwabu (2009), here, the demand behaviour for children services by a women in agriculture is analyzed within the framework of utility maximization behaviour of mothers in agriculture will be as follows:

$$UWA = UWA\ (HNG, HRG, HSM) \quad (1)$$

$$HSM = HSM\ (HRG, MI, \Pi) \quad (2)$$

$$Ex = HNGP_{hng} + HRGP_{hrg} + HSMP_{\text{hsm}} \quad (3)$$

Where *UWA* is utility derived from the consumption of goods and services, is *HNG* is health neutral goods that yield utility to a women in agricultural production but has no direct effect on reproductive health status of the mother, *HRG* is health related goods or behaviour that yields utility to mothers in agriculture and also affects fertility while *HSM* is the health status of the population measured by the fertility rate, this is reflected in the reproductive health function as shown in equation (2). Further, *MI* is purchased market inputs such as medical care (agricultural inputs, time spent by mother taking care of the child, disease incidence), nutrient intake, that affect child health directly, Π is the component of mothers' health due to either genetic or environmental conditions not influenced by behavior or character of the person. It's also a vector summarizing all unobservable characteristics of the mother in agriculture, child, household or community that affect mother's fertility. 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 as seen in equation (3).

From equation (3), *Ex* is the exogenous income (including the value of the time endowment of the household and non labour income), P_{hng}, P_{hrg}, P_{hms} are the prices of health neutral good *HNG* (such as clothing), health related consumer good *HRG* (such as quitting smoking) and health investment good *HMS* (such as agricultural product) respectively. The health investment goods are purchased only for the purpose of improving the fertility, so they enter the mother's utility only through *HMS*. The health production function (equation 2) has the property of constrained utility maximization behaviour of the mother (equation 1 and 3) (Bategeka et al., 2009). Equations (1)–(3) can be re-expressed to yield reproductive health care demand functions of the form:

$$HNG = D_{hng}\,(P_{hng}, P_{hrg}, P_{mi}, \Pi) \tag{4a}$$

$$HRG = D_{hrg}\,(P_{hng}, P_{hrg}, P_{mi}, \Pi) \tag{4b}$$

$$MI = D_{mi}\,(P_{hng}, P_{hrg}, P_{mi}, \Pi) \tag{4c}$$

The effects of the changes in the prices of the three goods on health input demand can be derived from equations (4a) – (4b) since from equation (2) a change in child health can be expressed as follows:

$$HSM = F_{hrg}\,, dHRG + F_{mi} dMI + F_{\Pi}\, d\Pi \tag{5}$$

Where F_{hrg}, F_{mi}, F_{Π} the marginal products of health are inputs *HRG, MI* and Π respectively computed as: $F_{hrg} = \delta HSM / \delta HRG$; $F_{mi} = \delta HSM / \delta MI$; $F_{\Pi} = \delta HSM / \delta \Pi$. From equation (2), the change in health can be related to changes in respective prices of health inputs:

$$dHSM / dP_{hng} = F_{hrg} dHRG / dP_{hng} + F_{mi} dMI / dP_{hng} + F_{II} d\Pi / dP_{hng} \tag{6a}$$

$$dHSM / dP_{hrg} = F_{hrg} dHRG / dP_{hrg} + F_{mi} dMI / dP_{hrg} + F_{II} d\Pi / dP_{hrg} \tag{6b}$$

$$dHSM / dP_{mi} = F_{mi} dHRG / dP_{mi} + F_{mi} dMI / dP_{hng} + F_{II} d\Pi / dP_{mi} \tag{6c}$$

Here $d\Pi / dP_{wa} = 0$, for $i = hng, hrg, mi$ so that the terms $F_{\Pi}(.) = 0$ in equation (6) as Π is a random variable unrelated to commodity prices.

Empirical Specification and Methodology of study

Viewing the determinants of women in agriculture (principally education, family size, participation in women group, age, income, landholding, place of residence, occupation of partner, marital status, culture, health status and farm size) and the determinants of fertility (principally determine: health status of mothers, age of first marriage, breast-feeding, contraception, abstinence

and rhythm, social status, labour participation, household size, education and culture) as empirically demonstrated in the literature, we observed that they are closely related. It appears the same principal factors explaining women participation in agricultural are similar to those explaining fertility rate in Cameroon. Women in agriculture are noted to be more in rural areas with low level of education, fertility is observed to be high in rural areas and among low level of education, this clearly shows the strong influence women in agriculture on population growth. To clearly understand this relationship, econometrically, the relationship between population growth and women in agriculture can be express as follows:

$$POPG_i = l + \Phi WAP_i + \sigma E_i + \varpi_i \quad (7)$$

In this equation *POPG* is simply population growth and our outcome variable of interest, *WAP* is women in agricultural production which is the principal endogenous variable, *E* is the exogenous demographics of the mother in agriculture, father, environment and community characteristics, Φ and σ are parameters to be estimated, however, Φ represent the actual effect of women in agriculture on population growth, ϖ and *i* represent the error term and the unit of observation such as population growth as capture by fertility rate, given that fertility is the driving force of population growth in the world today. Noting that some, because of omitted variables, *WAP* and ϖ may not be necessarily zero, hence our estimate of Φ may be inconsistent resulting to the problem of endogeneity (Morrill 2008). Further, estimating the causal impact of women in agriculture on fertility rates is not straightforward, because employment is probably endogenous. These sources of endogeneity may lead to an under- or overestimation of the impact: omitted variable bias and reversed causality. According to Broeck and Maertens, (2014) social norms and values in a traditional, rural setting such as in ours, might prevent that women participate in the wage labour market.

Unobservable characteristics, such as the bargaining power of women before they engage in work as for those that are not working in their own farms, influence whether they are allowed to participate in the labour market or not (Basu 2006). Broeck and Maertens (2014) also reveal that; firstly, one cannot observe initial bargaining power directly, while this is probably also correlated with fertility rates. Secondly, female employment status on agricultural activity has an effect on fertility rates, but the presence of children might also determine whether a woman is able to participate in the labour market or not (Cramer 1980).

To tackle the endogeneity problem, we apply an Instrumental Variable (IV) approach, an instrumental variable is one that partially determines women participation in agricultural production but is uncorrelated with ϖ. This IV is also known as treatment variable (T), with such an instrument, a two stage regression model can be estimated with the first stage equation (8).

$$WAP_i = l_{FS} + \Phi_{FS}T_i + \sigma_{FS}E_i + \mu_i \quad (8)$$

Following this equation, the consistency of Φ the estimate of strongly relies on the validity of the instrument $Cov(T,\varpi)=0$, thus, if Φ is uncorrelated with ϖ, then the IV estimate of Φ is consistent, however, as indicated earlier, this will depend on the assumption that (a) the unobservable variables are uncorrelated with excluded instruments or that the correlation is linear; (b) the estimation sample is randomly selected among households. The model can be estimated by taking the predicted (fitted) value of *WAP* from equation (2) and substituting it in for *WAP* in equation (1) in a 2SLS model. In this case, the IV estimate of Φ can also be thought of as resulting from the division of the "reduced form" estimate, Φ_{RF} below, by the first-stage coefficient derived above, Φ_{FS}. The reduced form equation is the regression of the women in agriculture outcome on the instrument (Morrill 2008):

$$POPG_i = l_{RF} + \Phi_{RF}T_i + \sigma_{RF}E_i + \theta_i \quad (9)$$

Equation (9) indicates whether the instrument is correlated with population growth. The interpretation of the treatment variable estimate (Φ_{IV}) as the causal effect is reliant on the assumption that the effect of the instrument on population growth (Φ_{RF}) operates solely through women participation in agricultural production. Given that the fertility variable is a continuous variable gives an advantage to its 2SLS estimation. Other variables which could serve as good instruments include adjustment programs and government policies but these are not available. It is therefore important to acknowledge that simultaneity, heterogeneity, measurement errors and omitted variables may still be issues to contend with in this type of analysis (Mwabu 2009).

4. Data Presentation

We have made of use the fourth Cameroon demographic and health survey (DHS 4). The Ministry of Economic Affairs, Programming and Regional Development is the executing agency of the DHS and it is the National Institute

of Statistics that collects the data. The fourth Cameroon demographic and health survey (DHS 4) was realized in 2011 after the first (DHS I), second (DHS 2) and (DHS 3) in 1991, 1998 and 2004 respectively. The DHS 4 was aimed at a national representative sample of about 42312 households, 11732 children (0-59 months); 42312 women (15 – 49 years). While in 2004 there were 10,462 households, 10,656 women, (15–49 years), 5,280 men (17 - 97 years), 8,125 children (0 - 59 months) with women of reproductive age, alive and living within the selected zones of sample as well as a sub sample of about 50% of households for the men. The results of these surveys were presented for Cameroon, Yaounde and Douala (two great metropolitan cities), other towns, urban and rural zones and each of the 12 areas of study (constituting the 10 regions (formally provinces) plus Douala and Yaounde. All the members of households drawn are registered in household questionnaire.

In this study, the outcome variable is population growth (as capture by fertility rate). The main endogenous variable is women participates in agricultural production and the endogenous instrument is log of size of farm while the exogenous demographics are: mother's age in complete years of living, mother's education in years of schooling, labour market participation, family size, member of professional association, cultural background identity, health status of the mother, marital status, ownership of land, father present in the house, social status and place of residence. It should be noted that variable such as size of farmers farm were imported from the department of statistics of the ministry of Agriculture and Rural Development.

5. Empirical Results

We present the empirical result such that in section 5.1 we have the sample descriptive statistics; in 5.2, we have the determinants of women participation in agriculture and population growth from where we derive the results of (1) factors influencing women working in the agricultural sector (FSLS) and (2) the implications of women in agriculture on population growth in Cameroon (OLS and 2SLS). Finally in 5.3 we have women participation in agricultural production and food security in rural Cameroon as revealed in OLS and 2SLS.

5.1 Sample Descriptive Statistics

As noted in the data, we have about 11732 observations, in which 1.8 percent of households including women are involved in the production of rice. Critically,

rich is one of the staple food crops in Cameroon that is most consumed by most Cameroonians especially the children. The quantity of rice production looks small but in terms of consumption very high, if most Cameroonians get to be producing rice, considering the financial and consumption value then the food security problem will not be an issue again in Cameroon. About 62.4 percent of women are participating in agricultural production revealing the fact that there are more women in agricultural production than men; this may be cause partly by culture and educational reasons.

Table 1: Summary of Descriptive Statistics

Variable	Observation	Mean	Standard Deviation
Food Security (rice production)	11732	0.01811	0.0226
Population growth (capture by fertility rate)	11732	4.3191	2.6172
Women in Agriculture (1 = woman participates in agricultural production, 0 otherwise)	11732	0.6240	0.1532
Mother's age in complete years of living	11732	28.4959	6.9755
Mother's education in years of schooling	11732	4.5933	4.0461
Labour market participation (1= Mother currently working, 0 otherwise)	11732	0.6845	0.4647
Family size/household size	11732	10.2125	5.5991
Member of professional association	11732	0.0273	0.3603
Cultural background/ethnicity	11732	4.6148	2.6887
Health status of the mother	11732	1243.72	1226.735
Marital status (1= married women, 0 otherwise)	11732	0.6877	0.5140
Ownership of land	11732	0.4616	0.4985
Father present in the house	11732	0.7243	0.4468
Social status (1= non poor, 0 otherwise)	11732	0.5383	0.4985
Place of Residence (1 = urban, 0 otherwise)	11732	0.3943	0.4887
Log of size of rice farm	11732	-7.7268	4.0603

Source: Author

Most rural women are fertile with about 59 percent at-least completed the primary school, while 68 percent are fully participating in the labour market with only 2.7 percent involve in professional association having a relatively

stable health status. In addition, 39 percent of women live in urban centers and on the total 53 percent of the women are living in non-poor households, of which 72 percent are actually married and 46 percent own farms with an average size. All these statistics reveal that there are more women in the agricultural sector in Cameroon than the men, the women engage in this sector are relatively full time though their activities might constantly be interrupted by other domestic activities such as child bearing, washing, serving, cooking fetching water and firewood. Generally, most men in rural Cameroon married women according to their ability to do these things than otherwise.

5.2 Determinants of Women Participation in Agriculture and Population Growth

From table 2 presented below, we present the results of: (1) factors influencing women working in the agricultural sector (first stage least square, (FSLS)) and (2) the implications of women in agriculture on population growth in Cameroon.

5.2.1 The Implication of Women Participation in Agriculture on Population Growth

Table 2 also presents the result of ordinary least square and two stage least square. The result of the two estimates shows that women participation in agricultural production has a great impact on population growth. The OLS and 2SLS are based on the assumption that: (a) the unobservable variables are uncorrelated with excluded instruments or that the correlation is linear; (b) the estimation sample is randomly selected among households. Comparing the two results, we observed that the result of the ordinary least squares has a higher magnitude than those of the two stage least square. However, the Durbin-Wu-Hausman chi-square statistic test (21.963 [0.0000]) as shown in table three rejects exogeneity of all fertility inputs (women participation in agricultural production) indicating that OLS is not a valid estimation method.

Considering the two stage least square, we observed that women participation in agricultural production strongly affects population growth to about 15.88 percent, significant at five percent level. In Cameroon, this result sounds strong for the following reasons:

- Inadequate knowledge of family planning,
- Children are still believed to be an asset/source of riches or manpower (supply of labour),

- Considering that agriculture required much energy and efforts, most couples in villages always go to bed early after each extortive day of work, from the medical literature, the closeness of being together increases the proximity of having sex and consequently many children.
- The quest for having another sex of a child or the last child being a boy or otherwise always result to having many children.
- In the case of polygamy, having many children is wining the interest of the husband and in-laws or gaining control of the household ownership.
- The age of marriage is another problem with women in agricultural production. Most women in this sector of activities easily get married early and so having many children early.

Other factors positively affecting population growth in Cameroon include: mother's age in complete years, family size, married mothers and father's presence in the house while factors such as mothers education in complete years of schooling, cultural background, mother's health status, member of professional association, health status of the mother, non-poor household and urban residence are negatively correlating with population growth.

Still in table 2, from the joint F test, we realized that the instrument used in this study is valid both for the input equation. The first-stage F statistic on excluded instrument is about 16.542 (p-value = 0.0000), while the statistic for the R-squared is 0.6214 (p-value = 0.0000). The Sargan statistic (0.000, p-value = 0.0000) proves that the instrument is valid and so relevant, however, looking at the Cragg-Donald F-statistic we realized that though the instrument are relevant, they are marginally weak (6.574 [16.38]). This is necessary in the sense that, since there is an endogenous regressor and an instrument, there is need to check that the problem is exactly identified. In addition, diagnostic tests indicate that the input into population growth function is endogenous, since the Durbin-Wu-Hausman Chi-square Statistic, which indicates that the OLS estimates are not reliable for inference. Stock et al (2002) argued that an instrument is relevant but weak if their joint effect is statistically significant but at a low F statistic, typically less than 10. When the instrument is relevant but weak the 2SLS estimator is biased toward the OLS estimator, which is known to be inconsistent (Bound et al., 1995). However, if the bias of the 2SLS estimator, relative to the inconsistency of the OLS estimator is small (at most 10%) weak instruments are still reliable for inference as seen in our case. This result is shown in table 2:

Table 2: Women in Agriculture; Determinants and Population Growth in Cameroon

Variable	FSLS	OLS	2SLS
	Women in Agriculture	Population Growth	
Women in Agriculture	n/a	0.3091*** (3.42)	0.1588** (2.29)
Mother's age in complete years of living	0.0005*** (2.60)	0.2670*** (128.71)	0.2574*** (42.46)
Mother's education in complete years of schooling	-0.0017*** (-3.51)	-0.1533*** (-31.58)	-0.1231*** (-7.32)
Labour market	-0.0071** (-2.25)	-0.0497 (-1.61)	0.0711 (0.85)
Family size	-0.0018*** (-6.81)	0.0321*** (12.52)	0.0625*** (4.30)
Member of professional association	-0.0001 (-0.04)	-0.0773** (-2.00)	-0.0783 (-0.97)
Cultural background/ethnicity	0.0004 (0.61)	-0.0216*** (-3.27)	-0.0374** (-2.42)
Health status of the mother	0.22e-06*** (3.03)	0.0000 (0.96)	-0.0000 (-1.42)
Marital status	0.0149*** (4.39)	-0.0232 (-0.70)	0.2880** (2.1)
Father present in the house	-0.0099*** (-2.84)	0.4473*** (13.03)	0.6318*** (5.81)
Social status	0.0024 (0.58)	-0.1274*** (-3.03)	-0.1827** (-2.01)
Urban Residence	0.0207*** (5.01)	-0.2063*** (-5.12)	-0.5574*** (-3.15)
Log of rice farm size	0.0009** (2.56)	n/a	n/a
Constant term	0.0200** (2.16)	-2.9480*** (-36.06)	-3.1227*** (-16.70)
R-squared/Uncentered R2	0.0357	0.6748	0.6214
Chi square	11.64[12, 11666; 0.0000]	2017.28[12, 11666; 0.0000]	465.35 [12, 11666; 0.0000]
Cragg-Donald Wald F statistic Test	n/a	n/a	6.574 [16.38]
Sargan statistic	n/a	n/a	0.000 [0.0000]
Durbin-Wu-Hausman χ^2 Statistic	n/a	n/a	21.963 [0.0000]

Angrist-Pischke multivariate F test	n/a	n/a	16.57 [1, 11666; 0.0004]
Number of observations	11679		

Source: author; *FSLS = first stage least square, OLS = ordinary least square and 2SLS = Two stage least square.*

5.2.2 The Determinants of Women Participation in Agricultural Production

Table 2 reveals that mother's health status is a major determinant of women participation in agricultural production significant at one percent level. Health has been proven to be significantly correlating with labour, everything being equally whenever one is ill, the strength and energy to work is lost. Therefore our result supposes that whenever women participating in agricultural production are in good health, they work more in their farms so as to produce in large quantity and hence, reducing the problem of food insecurity. However, the problem of food security may be interrupted if the woman's health permits them to conceive and give birth, since health is the first principal condition that permits any one to do work in life. This result is consistent with the issues raised by Aguayo-Rico et al (2005), that health is one of the most important assets a human being has; it permits us to fully develop our capacities and if this asset erodes or it is not developed completely, it can cause physical and emotional weakening, causing obstacles in the lives of people (Smith 1999). Nowadays, it is possible for every person to expect to live a long and healthy life from which its economic value is huge, given that health gains have many economic consequences widespread in economic well-being. Meaning an escape of ill-health traps is greatly associated with increase agricultural productivity, domestic savings and investment (WHO 1999).

Mother's age in complete years of living is positive and significantly influencing women participation in agricultural production, age plays a major role in terms of participation in agricultural production. Farm activities require much effort implying that the younger population can do more work than the aging population. However, ironically though farm activity required efforts; this effort is more of being patient, persistent and consistently working hard putting longer hours and persevering until the harvest is due. These qualities are mostly possessed by women most often more than 30 years of age. The youths, on the other hand, are very hard working and can use a shorter time to do greater works but *ceteris paribus* they generally lack the endurance to stay on duty doing the same thing.

Married women correlate with participation in agricultural production. In most parts of Cameroon, married rural women are more involve in agriculture. The situation is worse when the man is uneducated even those living in the cities, will prefer to take agriculture for a living especially where the plot of land is available rather than doing another thing else. Agriculture has been a long term activity in Cameroon, so even educated mothers working and living in the city take agriculture as a secondary activity to meet up with basic necessities and so alleviating poverty and the food security problem while increasing the population for a better labour market.

Urban residence is a major factor positively influencing women participation in agricultural production, agriculture in Cameroon have recently taken another turn since the introduction of the concept of second generation agriculture by the president of the republic via the prime minister and as popularized by the minister of Agriculture. The idea of this type of agriculture is based on mechanization, good seeds, improved varieties and irrigation in farming, in an effort to triple crop yields for consumption and the market. The government of Cameroon recently supported many farmers of both sex located around the urban centers with seeds and other farm inputs to bolster their activities in the farming sector. This gesture has motivated many urban women to engage in participating in agricultural production.

Farm size plays a major role in productivity if proper input is applied. Households with much farm land in Cameroon, often either participate in agricultural production themselves or they can give out the land for rents for others to cultivate. This is exactly what happens in most urban centers where land is relatively expensive, so most women resolve to rents and carry out their agricultural production. Other factors negatively and significantly influencing women participation in agricultural production include: mother's education in complete years of schooling, father's presence in the house and family size of households.

Conclusion

This study seeks to: assess the effects of women working in Agriculture on population growth, discussed the factors influencing women working in agriculture and to derived policy implications on the basis of our analysis. To tackle these issues, we make use of 2SLS model. Empirical results are based

on 2011 DHS collected by the government's statistics office and Department of statistics of MINADER. The OLS and 2SLS are based on the assumption that: (a) the unobservable variables are uncorrelated with excluded instrument or that the correlation is linear; (b) the estimation sample is randomly selected among households. Comparing the two results, we observed that the result of the ordinary least squares has a higher magnitude than those of the two stage least square. The Durbin-Wu-Hausman statistic test rejects exogeneity of all fertility inputs indicating that OLS is not a valid estimation method.

Regarding the determinants of women participation in agricultural production we observed that mother's health status, farm size, mother's education in complete years, urban residence and married women are positively and significantly correlating with women participation in agricultural production. We observed that women participation in agricultural production strongly affects population growth to about 15.88 percent, significant at five percent level. In Cameroon, this result sound strong for the following reasons: inadequate knowledge of family planning, children are still believe to be an asset/source of riches or manpower (supply of labour), considering that agriculture required much energy and efforts, most couples in villages always go to bed early after each extortive day of work, from the medical literature, the closeness of being together increases the proximity of having sex and consequently many children. The quest for having another sex of a child or the last child being a boy or otherwise always result to having many children. In the case of polygamy, having many children is wining the interest of the husband and in-laws or gaining control of the household ownership. The age of marriage is another problem with women in agricultural production. Most women in this sector of activities easily get married early and so having many children early. Other factors positively affecting population growth in Cameroon include: mother's age in complete years, family size, married mothers and father's presence in the house.

From the above analysis, one can undoubtedly understand the major role of women in relation to population growth. Fon and Edokat (2012) intimated that the underestimation of women's contributions to crop production makes them invisible to planners and policymakers, hence making it difficult to advocate appropriate policies and programs that recognize and compensate women based on their level of contribution to the growth of the national economy. Women Participating in Agricultural Production are indeed working

machine in terms of reproduction and other activities in Cameroon, like any other machine, they need fuel to function well. The decision makers must put at the top of their agenda women empowerment and support programs, as well as medical services at the disposal of women to permit them do their job effectively. This is a gateway towards economic growth, food security and poverty alleviation in rural households.

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