

The Effect of Fertility on Women's Labour Supply in West Africa

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M. Kenneth C. Kponou

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Abstract

This study sought to identify and analyze the effect of childbirth on female labour supply, specifically that of married women with at least one young child under 6 years of age. The number of children is the result of a decision that is endogenous. To take this endogeneity into account, the study used twins as an instrument. Accordingly, we estimated an instrumented Probit model given that female labour supply is measured by two different binary variables. Based on Demographic and Health Survey (DHS) data from five countries (Benin, Cote d'Ivoire, Ghana, Nigeria and Senegal), the study's key findings are the following: (i) the effect of fertility on female labour supply is not uniform across all the countries considered, and (ii) the relationship between fertility and female labour force participation is sensitive to the measure of participation used to measure it. Based on our findings, we make the following key recommendations: (i) put in place policies to encourage the transition of women from traditional jobs that are quite vulnerable to more formal jobs; and (ii) implement corrective measures so that young children are no longer a penalty for women's access to formal jobs.

Keywords: Fertility; Labour supply; Work; Households; Instrumental variables

JEL Classification: C25; D13; J13; J32; O55

1. Introduction

Women's participation in economic activities is an important aspect of their empowerment and well-being. This empowerment entails their participation in less traditional activities, ones that go beyond agricultural work, family employment, and domestic production. There has been a downward trend in fertility in developing countries in recent decades (United Nations, 2002). According to Heath and Jayachandran (2017), an increase in female labour force participation and a reduction in gaps (between boys and girls) in school enrolment rates are two important recent trends that have been observed in most developing countries. Research has highlighted the negative effect of education on fertility through different channels (Rindfuss and Bumpass, 1978 Basu, 2002; Güneş, 2013).

Staying within the rationale of human capital theories, which have been developed in various versions (Becker, 1962; Arrow, 1973; Spence, 1973; Stiglitz, 1975), a higher level of education creates more employment opportunities and thus improves the chances of participating in the labour market. In this perspective, higher levels of women's education and lower fertility rates on their part predisposes them to better employment opportunities.

In developing countries, and Africa in particular, women are more likely to work at home, on family farms, or to be self-employed in activities where they can manage their time more flexibly (Younger, 2006). Women are under-represented in wage employment in both the developed and the developing countries. Recent literature suggests that gender plays a role in the labour market. First, there is gender segregation in the labour market (Borrowman and Klasen, 2020). Second, uneven distribution of time of homework (or care economy) between males and females affects labour market choices. In this regard, Schaner and Das (2016) have shown that in Indonesia, women leave wage employment due to family-related reasons and due to childcare burdens. Female labour supply behaviour has important implications for several other phenomena such as marriage, fertility, divorce, family income distribution, and the gender wage gap (Killingsworth and Heckman, 1986).

In addition to the traditional division of labour in a household that is reflected in gender roles, there is evidence that women can increase their labour supply to compensate for shock-related losses in household income. For example, based on data from Senegal, Comblon and Marazyan (2017) found that in the case of a shock manifested in a chronic illness of an adult male household member, girls and women

were more likely to work, especially when the man was working. This led the authors to suggest that traditional gender roles could be ignored to compensate for a household's income loss. Such a suggestion points to not only the potential additional income but also the extra welfare that could be gained by a household by even slightly modifying the traditional division of labour to allow for more female labour supply.

Several studies conducted in developed countries found that fertility had a negative impact on women's labour supply (Angrist and Evans, 1998; Heath and Jayachandran, 2016). The question arises therefore of whether the same findings can be made in developing countries. The relevance of such a question lies in the differences that exist between labour markets in developed and developing countries. For Younger (2006), it is important for policy makers in Africa to understand the relationship between demographic transition and differences in time allocation, hence the relationship between fertility and labour supply in a poverty-reduction perspective. According to the author, increasing women's employment opportunities or improving their wages can lead to a significant reduction in fertility, since women will choose to spend less time raising their children and more time working. This in turn will lead to income gains for the household and, ultimately, to poverty reduction.

What is the effect of fertility on women's labour supply? This study seeks to identify and analyse the effect of births on married women's labour supply in a sample of developing countries. According to Gündüz-Hoşgör and Smits (2008), given the high significance of actions in favour of women's empowerment, it is important to deepen our understanding of the factors that promote or inhibit female employment in developing countries. This study is an empirical one, which focuses on a sample of five (5) member countries of the Economic Community of West African States (ECOWAS): Benin, Côte d'Ivoire, Senegal, Ghana, and Nigeria.

This study's contribution is three-fold: (i) the study uses a country-specific estimation, which enables it to highlight differences in effect by country; (ii) it uses two measures of female labour force participation to capture the possible specificities of occupational status; and (iii) it enables a comparison between French- and English-speaking countries belonging to the same economic space. The study leads to differentiated effects according to the two groups of countries (French-speaking and English-speaking). To the best of our best knowledge, no study has been specific on these specific countries before. The remaining parts of the paper are structured as follows: section 2 presents trends in infertility and female labour force participation; section 3 presents economic analysis of women's labour supply; section 4 discusses the methodology; section 5 presents results and discussion and section 6 concludes the study.

2. Trends in fertility and female labour force participation

Women are much more likely to work as self-employed in the informal sector, than to earn a regular salary from formal work. In the formal sector, women occupy four out of 10 jobs and earn on average two-thirds of what their male colleagues earn (BAD, 2015). Globally, the gender wage gap is estimated at 23%; in other words, women earn 77% of what men earn. Even when hourly rates are considered (since women work shorter hours than men), women still face a wage gap of 10% or more in countries for which data are available. These gender wage gaps cannot be explained by differences in education or age alone; they are also related to the undervaluing of women's work and skills in female-dominated occupations, to discriminatory practices, and to the need for women to take career breaks to be able to take on other responsibilities, especially after the birth of a child (OIT, 2016).

Women in Africa do most of the agricultural work; but they own only a third of all businesses. Beyond their income-generating activities, they are the main drivers of the domestic economy and family welfare and play an indispensable – but often unrecognized – leadership role in their communities and countries. Yet, across the African continent, women face a range of barriers to realizing their full potential: from restrictive cultural practices and discriminatory laws to highly segmented labour markets. Eliminating gender inequality and empowering women could increase the productive potential of a billion Africans and would significantly boost the continent's development potential (BAD, 2015).

One of the consequences of the burden of domestic production and childcare on women is that they are relegated to vulnerable employment. Table 1 highlights the comparative fertility rate in the five countries included in the study.

Table 1: Fertility rate

Years	Benin	Côte d'Ivoire	Ghana	Nigeria	Senegal
2000	5.962	5.870	4.826	6.106	5.448
2001	5.889	5.793	4.753	6.083	5.365
2002	5.820	5.713	4.681	6.060	5.292
2003	5.754	5.630	4.612	6.036	5.232
2004	5.691	5.545	4.548	6.011	5.185
2005	5.632	5.460	4.490	5.985	5.149
2006	5.576	5.376	4.438	5.958	5.124
2007	5.522	5.296	4.392	5.930	5.107
2008	5.469	5.221	4.350	5.902	5.094
2009	5.416	5.152	4.311	5.872	5.081
2010	5.362	5.088	4.273	5.839	5.064
2011	5.305	5.029	4.234	5.802	5.039
2012	5.246	4.974	4.192	5.758	5.005
2013	5.183	4.920	4.146	5.709	4.960
2014	5.116	4.867	4.095	5.653	4.905
2015	5.047	4.813	4.041	5.592	4.841
2016	4.977	4.759	3.984	5.526	4.770
2017	4.906	4.704	3.926	5.457	4.697
2018	4.836	4.649	3.870	5.387	4.625
2019	4.767	4.593	3.816	5.317	4.556

Source: World Bank (Various), World Development Indicators

Table 1 shows the total fertility rate over the past 20 years. 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 age-specific fertility rates of the specified year.

Table 1 shows that the birth per woman has declined over the past 20 years but the mean of fertility rate on the five countries (4.86) is still high compared to that of the world (2.45) and approximately the same to that of Sub-Saharan Africa (4.91) on the same period. The average labour force participation (labour force participation rate is the proportion of the population aged 15 and older that is economically active: all people who supply labour to produce goods and services during a specified period) in the five countries is over that of the world (41.72) and under that of Sub-Saharan Africa (61.35). The average rate of vulnerable employment is contributing family workers and own-account workers as a percentage of total employment of women is over that of the world (45.49) and that of Sub-Saharan Africa (83.75). It is important to identify the empirical relation between fertility and women participation in the labour market.

Table 2: Proportion of vulnerable employment for women and men in the five countries in the sample

Years	Benin		Côte d'Ivoire		Ghana		Nigeria		Senegal	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
2000	95.1	84.1	93.5	72.7	88.6	76.3	91.6	85.5	86.2	75.0
2001	94.9	83.6	93.7	73.8	88.3	75.8	91.9	86.0	85.1	73.7
2002	94.8	83.4	93.5	73.8	87.9	75.3	92.0	86.0	84.8	72.9
2003	94.8	83.2	93.3	73.9	87.5	74.8	91.1	84.6	84.3	72.3
2004	94.8	83.3	92.9	73.4	87.1	74.2	90.3	83.2	83.3	71.2
2005	94.7	83.1	92.6	73.2	86.7	73.7	89.7	82.4	82.6	70.5
2006	94.8	83.1	92.2	72.7	86.0	72.2	89.5	82.1	82.0	69.7
2007	94.8	83.1	91.9	72.3	85.6	71.6	89.1	81.5	80.7	68.7
2008	94.9	83.2	91.3	71.6	85.3	70.8	88.5	80.5	80.1	67.9
2009	94.8	83.0	90.7	70.8	85.0	70.3	88.4	80.3	79.2	66.9
2010	94.7	82.9	90.4	70.8	84.3	69.1	87.1	78.3	78.3	66.0
2011	94.8	83.0	89.8	70.8	82.4	66.6	85.9	76.6	77.2	64.8
2012	94.8	83.0	88.8	69.1	81.3	64.7	86.5	76.9	76.3	63.7
2013	94.6	82.7	86.7	68.5	80.6	63.3	87.1	77.1	75.6	62.9
2014	94.3	82.4	85.9	67.1	79.6	62.2	86.9	76.9	74.4	61.7
2015	94.1	81.9	85.7	66.0	79.3	61.8	87.4	77.6	73.3	60.7
2016	94.1	82.1	85.1	64.6	79.2	61.8	87.5	78.1	72.5	60.0
2017	93.8	81.6	82.7	64.3	78.3	60.5	86.6	76.8	71.5	59.3
2018	93.6	81.3	81.5	62.9	77.4	59.4	85.7	75.6	70.7	58.7
2019	93.1	80.6	80.4	61.5	76.7	58.4	85.2	74.9	69.8	58.1
Mean	94.515	82.730	89.130	69.690	83.355	68.140	88.400	80.045	78.395	66.235

Source: World Bank (Various) reports

Table 2 shows that women are more involved in vulnerable employment than men (referring to the mean in Table 2). In African societies, women are generally oriented towards domestic production, employment in agriculture, and small-scale income-generating activities, rather than towards paid work. The question is to know how women's fertility can affect the level of women's labour market participation or the quality of their labour market integration. By relating women's fertility rate to vulnerable employment across all the five countries, a strong positive correlation can be observed (for example 0.97 for Ghana and Senegal).¹ This correlation means that the more children a woman has to care for, the more likely she is to be employed in family employment or to be self-employed.

¹ See Appendix 1 for country correlations.

3. Economic analysis of women's labour supply

According to Nicoletti et al. (2018), the historical increase in female labour force participation has declined over the past decades, while the proportion of mothers working full-time has increased in Norway. In the developing countries, there are still many barriers to women's labour supply, especially for married women. The barriers include the education level and fertility rate; the latter remains high compared to that in other regions of the world, although it is on a downward trend. Using Mexican and Argentinean data, Cruces and Galiani (2007) found that there was a negative relationship between women's having more than two children and their labour supply. Using "preference for the sex of the child" as an instrument for the endogeneity of fertility, the authors found an effect that was robust for the different estimation techniques they used, namely the OLS and the instrumental variables. While analysing the effect of fertility on women's labour supply in Sub-Saharan Africa, Jong et al. (2017) used "giving birth to twins" as an instrument for the number of children and found that the number of young children was negatively associated with women's participation in non-farm employment. This finding indicates a negative causal effect of fertility on women's employment opportunities in Africa.

Dayıoğlu and Kırdar (2010) have shown that women's fertility behaviour is very important in their labour force participation decision, since children influence the opportunity costs of labour. The authors found, in the case of Turkey, that women who had at least one child participated less in the labour market, especially in urban areas. For their part, Hupkau and Leturcq (2017) found mixed effects. Using "time of conception of the first child" as an exogenous variation of the probability of having more children, the authors found that having more children decreased the probability of holding sustainable jobs but did not reduce the labour supply of high- and medium-skilled mothers. Their results indicated that among the highly qualified women, it is those who tended to have only one child who were most attracted by the labour market. The authors' explanation for such findings is that these seem to stem from unobserved attributes that negatively affect labour market outcomes, and the probability of the woman remaining in a relationship with the father of her first child, which in turn negatively affects the probability of having a second child.

The mixed results show that family size is not a determinant of highly qualified women's employment. This means that the effect of fertility on women's labour supply is not linear.

With the aim of accounting for the endogeneity of fertility and employment decisions, Longwe et al. (2013) used "the unmet need for family planning" as an instrument for the number and spacing of recent births and found that these two variables had negative effects on women's labour supply. Interaction analysis showed that the most highly educated women and those living in urban areas suffered the most from this negative. This led the authors to suggest that investment in birth control techniques could improve women's wage-employment opportunities. Benefo and Pillai (2003) found that the presence of children under the age of five in a household reduced the probability of participating in the labour market in Ghana. In contrast, Baah-Boateng et al. (2013) reported a complementary relationship between women's labour supply and their having young children. In other words, women with children were more likely to participate in the labour market.

It seems that the empirical relationship between fertility and women's labour supply is not yet fully understood in the literature, and that the magnitude of its effects is still subject to debate. For example, Salamaliki et al. (2013) found that women's labour supply and fertility were in an indirect bidirectional causal relationship both in aggregate terms and in specific age groups. However, Agüero and Marks (2008) were less affirmative about the effect of fertility on female labour force participation: they showed that for women who did not actively control their fertility, having a child was not a barrier to their labour supply. They pointed out that their results were consistent with the hypothesis that an increase in women's labour supply in Latin America could be attributed to a decrease in family size. Thus, in their opinion, policies that focused exclusively on family planning were unlikely to increase women's labour supply.

In the same vein, using the two instruments commonly reported in the literature (the sex of the first two children and giving birth to twins), Aaronson et al. (2020) made three main findings by using a compiled data set of 441 censuses and surveys from between 1787 and 2015: first, the effect of fertility on women's labour supply is small and indiscernible in the case of low-income women but large and negative in the case of high-income ones. Secondly, that effect is robust across time in developed countries and cross-sectionally in developing countries. Thirdly, the results are robust in relation to other instruments, to different demographic groups, to different education level groups, to redefinitions of the labour supply base, and to different specifications and data. For the authors, these results are consistent with a negative substitution effect related to an increase in wage rates due to changes in the structure of formal non-agricultural jobs held by women depending on their country's level of development.

4. Methodology

This study's analysis is underpinned by the standard theory of allocation of time, coupled with a consideration of the preference for children.

Theoretical Model

The study follows the collective household decision model to represent a couple's choice of giving birth to children and participating in the labour market. This model of household behaviour is based on two assumptions: (i) each individual in the household has specific preferences; and (ii) the outcome of the decision process is Pareto efficient. Each spouse has to allocate a unit of time between work and childcare. In addition to consumption, each spouse obtains some utility by contributing a certain fraction of time to the formation of a family of size n , which brings utility $v(n)$. The family is a public good that provides utility, which can be represented by a homogeneous quasi-concave function of a degree that is less than 1.

$$V(n) = H(a_1; a_2) \quad (1)$$

where a_i expresses the fraction of time dedicated to the family by a member of household $i=1,2$. The woman is represented by 1 and her partner by 2. The consumption utility is represented by a strictly concave function:

$$U(C_i) > 0 \quad (2)$$

Where C_i represents the consumption of $i=1, 2$. The couple will thus maximize the following function:

$$\Delta = \varphi[U(w_2(1-a_2) + R_2) + H(a_1 + a_2)] + (1-\varphi)[U(w_1(1-a_1) + R_1) + H(a_1 + a_2)] \quad (3)$$

Where w_i is the wage rate and R_i the non-wage income. The parameter φ measures the husband's bargaining power, which depends on both $w_2 - w_1$ and $R_2 - R_1$, and on other factors related to tradition and customs. To ensure that the problem is solved, we posit the following:

$$H(a_1 + a_2) = a_1^\alpha a_2^\beta \quad (4)$$

Where α and β measure the interest in and the capacity of the woman and the man to make a family.

These two parameters respect the condition: $\alpha + \beta < 1$. Thus, the first-order conditions (FOCs) give the following:

$$\begin{cases} \frac{\delta\Delta}{\delta a_2} = -\varphi U'(C_2)w_2 + \beta[a_2^{\beta-1}a_1^\alpha] = 0 \\ \frac{\delta\Delta}{\delta a_1} = -(1-\varphi)U'(C_1)w_1 + \beta[a_2^\beta a_1^{\alpha-1}] = 0 \end{cases} \quad (5)$$

From the first-order conditions, we get:

$$\frac{a_1}{a_2} = \frac{\alpha}{\beta} \frac{\varphi U'(C_2)w_2}{(1-\varphi)U'(C_1)w_1} \quad (6)$$

This equation reflects the fact that the relative involvement of the woman in the fertility process increases with her ability, with her partner's bargaining power, and the partner's relative wage and marginal utility. Based on the first-order conditions, the labour supply functions of the woman and her partner can be expressed as follows:

$$L_i = 1 - a_i = f(w_i, R_i, \varphi, \alpha, \beta, w_j, R_j) \text{ with } i \neq j \quad (7)$$

Empirical Analysis

The present study's aim is to empirically measure the effect of fertility on women's labour supply.

The study's model and variables

The effect of fertility on women's labour supply can be estimated by the following model:

$$Participation_i = c_0 + c_1 Fertility_i + c_2 V_i + E_i \quad (8)$$

Where participation denotes the participation of women to labour market, C_0 is the constant term, fertility is the number of children under 5, V denotes other explanatory variables and E is the error term.

Fertility measurement and target population

In this study, fertility is measured by the number of children under 6 years of age in the household. This variable can be easily constructed from the DHS database based on answers to questions related to the age of children and their number. From these two questions, the fertility variable corresponds to the total number of children under the age of 6. The choice of this age is justified by the fact that these are the children who require the most care. Taking into account the African context where domestic production is mostly assumed by women, the number of children under 6 can therefore have a direct influence on women's participation in the labour market.

Measures of female labour force participation and of the other variables

Two measures of female labour force participation are used in this study. The first one is binary and takes the value 1 when the woman is employed and 0 if not. Reference is here made to both paid and unpaid employment. The second measure is also binary but excludes agricultural work and unpaid work. In other words, this second measure takes the value 1 when the woman is engaged in paid activities other than agriculture, and 0 otherwise. The target population for this study is all married women aged 18-49 and having at least one child under the age of 6.

Women's labour supply, in particular that of married women, is not a phenomenon to be studied independently. This is because women face certain constraints such as childcare and domestic production (Mon, 2000). This means that their employment decision often depends on factors external to them, factors having to do with their husbands and the environment around them in general. In this regard, Kalenkoski et al. (2009) found that an increase in the woman's spouse's wage caused the woman to increase her daily primary care of her children and at the same time decreased her supply of weekday work. It is therefore important to also consider the variables that are related to other people than the woman herself. The other variables to take account of are the age of the woman, whether she was pregnant (1) or not (0) at the time of the survey, the husband's occupational status, the presence (1) or not (0) of other adult women aged 18 and above in the household, the education level of the woman and that of her husband and the area of residence

Endogeneity and estimation technique

Estimating a woman's labour market participation by taking account of her level of fertility poses econometric problems because of her household's decision process that influences her fertility and labour force participation choices. Following Cáceres-Delpiano (2008), since fertility and family resource allocation are jointly and simultaneously determined within a lifetime household decision-making framework, it is therefore expected that unobserved economic constraints on the family and parental preferences will have an impact on fertility decisions and other household behaviour such as female labour force participation. Fertility is therefore endogenous.

The source and nature of endogeneity

According to Montgomery and Trussell (1987), one of the rites of passage for a labour economist is to estimate a Probit model for women's labour market participation. It is standard practice for the Probit equation to include some indicators of a woman's marital status and the number and age of her children. But in estimating such a model, the labour economist dangerously veers towards a theory of household formation, childbearing and labour supply, a theory which suggests that household formation and fertility can be safely considered exogenous to a woman's supply of hours. Schultz (1990) criticizes such an approach by arguing that scepticism about the causal interpretation of associations between fertility and labour supply stems in part from the fact that there are strong theoretical reasons to believe that fertility and labour supply are jointly determined.

For Agüero and Marks (2011), interpreting the relationship between family size and the mother's work is complicated by the endogeneity of fertility. The number of children a woman has is a choice variable that is influenced by her labour market participation. Additionally, unobserved factors are likely to influence both fertility and female labour force participation. For example, more independent women may choose to have few (or no) children, which makes it likely that the same women are also over-represented in the labour force. Thus, the observed negative relationship between children and labour force participation could be biased. The magnitude of the bias may vary according to levels of development, since the need for women's employment decreases with economic development. In this regard, if poorer women have fewer choices, OLS estimations for this group should be less affected by bias. To clearly identify the relationship between a woman having children and her labour force participation, an exogenous source of variation in family size is needed. That is why He and Zhu (2013) argue that the endogeneity of fertility results from unobserved heterogeneity and reverse causality. This means that there is a simultaneity bias between the number of children a woman has and her labour force participation that needs to be considered to have valid results. Several types of instruments have been used in the literature to correct for this endogeneity bias. Table 3 gives a summary of instruments most used to that effect.

Table 3: Summary of the instruments used to correct for the endogeneity bias

Authors	Instruments used
Rosenzweig and Wolpin (1980)	Use of twins
He and Zhu (2013)	
Jong et al. (2017)	
Vera (2015)	Sex of the first two births (sexual similarity of the first two children)
Cáceres-Delpiano (2012)	Multiple births
Agüero and Marks (2008)	Infertility shock (infertile women = women not using contraception because they cannot have children and women who cannot have any more children)

Instrument choice and estimation technique

The aim of this study is to identify the causal effect of fertility on married women's labour supply. But research on the effect of child-bearing on women's labour supply is complex because of the endogeneity of fertility (Angrist and Evans, 1998). That is why it is crucial to choose an identification strategy that can enable the present study to achieve the desired causal effect.

$$DF_i = a_0 + a_1PJ_i + a_2X_i + \gamma_i \quad (9)$$

Where Y is the dichotomous measure of women's labour supply; DF is the fertility decision, which is endogenous; X is the matrix of other explanatory variables, including household characteristics and those related to area of residence, which are assumed to be exogenous; and μ is the error term. Given this endogeneity, equation (9) does not lead to a causal effect. Due to lack of relevant data, the present study was not able to control for the possible effect of gender differences in children on women's labour supply. It can be argued that if the first births are children of the same sex, some couples may be led to want to have other children, which in turn may affect the labour supply behaviour not only of the woman but also of her husband/partner. Following Jong et al. (2017), this study uses the presence of twins in the number of children aged under six as an instrument because twins are an exogenous variation in the number of children. This choice can be explained by the possibilities offered by the data used in the study. Thus, we have:

$$\Pr ob (Y_i = 1) = \alpha_0 + \alpha_1DF_i + \alpha_2X_i + \mu \quad (10)$$

Where PJ is the presence of twins, DF is the fertility decision measured by the number of children and μ the error term. This equation will be estimated using the OLS. To test for endogeneity, to equation (9) will be added the error term of equation (10). The significance of its coefficient will indicate whether there is endogeneity or not. Equation (9) is then estimated with IV-Probit.

The data

The data used in this study comes from the Demographic and Health Survey (DHS)², which is representative of household surveys. This type of survey is conducted in several developing countries by national institutes of statistics and is a reliable basis for information collected on households and individuals. This information concerns all the members of the households surveyed, but part of the survey focuses on women aged 16 to 49 years and collects detailed information about the latter.

² Dates of the DHS in the 5 countries: Benin (DHS 2018); Côte d'Ivoire (DHS 2012); Ghana (DHS 2019); Nigeria (DHS 2018) ; Senegal (DHS 2017)

Table 4: Descriptive statistics

Variables	Benin		Côte d'Ivoire		Ghana		Nigeria		Senegal	
	Frequency / Mean*	Std. Dev.	Frequency / Mean*	Std. Dev.	Frequency / Mean*	Std. Dev.	Frequency / Mean*	Std. Dev.	Frequency / Mean*	Std. Dev.
Proportion of twins	4.33	0,20	4.62	0,19	5.02	0,20	3.72	0,17	3.81	0,16
Number of children aged below 6	3.75*	1.95*	3.33*	2.02*	3.64*	1.86*	3.66*	2.11*	3.65*	2.15*
Proportion of married women participating in the labour market	84.04	0,37	75.84	0,43	65.48	0,48	53.09	0,46	62.30	0,48
Proportion of households living in the rural area (residence place)	57.34	0,49	66.77	0,47	63.18	0,48	65.51	0,47	66.24	0,46
Age of the women surveyed	29.98*	6.47*	28.64*	7.012*	29.32*	6.35*	29.79*	6.75*	29.74*	7.06*
Years of education for the woman surveyed	3.47*	4.82*	2.73*	4.32*	2.80*	4.30*	6.56*	6.07*	1.43*	3.58*
Years of education for the woman's partner	3.71*	5.00*	3.69*	5.39*	3.22*	4.78*	9.61*	5.08*	2.35*	4.75*
Occupational status of her partner	-	-	-	-	-	-	-	-	-	-
Unemployed	7.87		2.09		1.46		3.39		11.97	
Employed in agriculture	42.06		62.37		52.71		42.11		26.25	
Employed in other sectors	50.06	0,52	35.54	0,51	45.83	0,52	54.50	0,57	61.78	0,57
Pregnancy (reference: yes)	11, 91	0,32	11.80	0,12	10.96	0,31	13.17	0,34	11.44	0,32
Number of female adults in household	1.35*	0.72	1.51*	0.92	1.40*	0.76	1.51*	0.84	2.44*	1.69
Size of the sample		7,728		4,976		10,952		28,294		12,185

Source: Author's calculation based on DHS data; (*) stands for mean in the table

The descriptive statistics in Table 4 shows that there is a variability in the data. For example, regarding women participation in labour market variable, Benin is the country with higher rate followed by Cote d'Ivoire. The lower participation rate is observed in Nigeria. At the same time, Benin presents the high average of children under six years followed by Senegal and Cote d'Ivoire, which have the lowest average. Based on this variability, we can hypothesize that the link between fertility and women participation to labour market will have some particularities by countries.

Link between the theoretical model and the empirical approach

The theoretical model used in this study is cast within the logic of economic theory, which expresses the time allocated to work for each spouse. That makes it a labour supply model. However, the data at our disposal could not enable the study to estimate a labour supply equation econometrically. That is why it instead estimated a labour force participation equation, which is a more restrictive equation than the supply function, which shows economic agents' level of participation. The study thus used other proxy variables than those in equation 7. These variables not only underpin the labour force participation decision, but also help to explain labour supply. Among those variables are education level, fertility rate, age, and area of residence.

5. Results and discussion

Tables 5 and 6 present the estimation results of the study's models without and with correction for endogeneity bias for the five countries considered. In both tables, the equations in (a) represent models for which the variable to be explained is the first measure of female labour force participation (a measure that takes account of both agricultural work and unpaid work). For their part, the equations in (b) represent models for which the variable to be explained is the second measure of female labour force participation (a measure that considers only paid work, thus excluding agricultural work and any unpaid work). The models (a) and (b) are estimated by IV Probit. Overall, the estimations presented in Table 6 show that the use of instrumental variables has enabled the study to correct for an existing endogeneity bias.

Table 5: Results of the estimation of the model without correction for the endogeneity bias

Variables	Dependent variable: Women participation to labour market								
	Benin	Senegal	Côte d'Ivoire	Ghana	Nigeria	Senegal	Côte d'Ivoire	Ghana	Nigeria
	(a)	(b)							
Number of children	0.003*** (0.019)	0.008 (0.019)	0.048** (0.022)	-0.041* (0.021)	-0.017* (0.009)	-0.006 (0.009)	-0.020** (0.010)	-0.017* (0.009)	-0.017* (0.009)
Age of the woman	0.025* (0.006)	0.014 (0.014)	0.190*** (0.016)	-0.027* (0.015)	0.064*** (0.017)	0.071*** (0.017)	0.0095*** (0.017)	0.101*** (0.016)	0.101*** (0.016)
Age of the woman squared	0.000 (0.000)	0.000 (0.000)	-0.002*** (0.001)	0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Age of her husband	-0.023* (0.004)	-0.002 (0.003)	-0.006* (0.004)	-0.003 (0.004)	0.003** (0.002)	-0.003 (0.002)	-0.003 (0.002)	0.001 (0.002)	0.001 (0.002)
Education level of the woman	0.022 (0.019)	0.038 (0.024)	0.056** (0.026)	0.018 (0.021)	-0.051*** (0.011)	-0.013 (0.011)	0.006 (0.010)	0.007 (0.010)	0.007 (0.010)
Education level of her husband	0.202** (0.099)	-0.208* (0.124)	-0.184 (0.137)	0.038 (0.110)	0.397*** (0.057)	0.277*** (0.054)	0.156*** (0.056)	0.043 (0.052)	0.043 (0.052)
Husband's employment status (Reference: Unemployed)									
Employed in agriculture	0.471** (0.185)	-0.284 (0.182)	-0.552*** (0.177)	-0.659*** (0.204)	0.019 (0.126)	-0.282** (0.124)	1.331*** (0.081)	0.0607*** (0.083)	0.0607*** (0.083)
Employed in other sectors	0.642*** (0.185)	-0.464*** (0.178)	0.004 (0.170)	0.073 (0.202)	0.131 (0.124)	0.378*** (0.122)	1.302*** (0.081)	1.326*** (0.083)	1.326*** (0.083)
Pregnant	-0.114 (0.073)	-0.060 (0.094)	-0.055 (0.109)	0.017 (0.094)	0.0667 (0.041)	0.022 (0.041)	-0.044 (0.041)	-0.024 (0.039)	-0.024 (0.039)
Number of female adults	-0.140*** (0.032)	0.077*** (0.017)	0.036* (0.018)	-0.090** (0.035)	0.002 (0.017)	-0.068*** (0.017)	-0.017 (0.018)	0.012 (0.017)	0.012 (0.017)
Area of residence (Reference: Urban area)	-0.298*** (0.053)	-0.224*** (0.073)	0.687*** (0.076)	0.592*** (0.077)	-0.217*** (0.029)	-0.058* (0.029)	0.055*** (0.033)	0.254*** (0.031)	0.254*** (0.031)
Size of the sample	7,728	12,185	4,976	10,952	28,294				

Table 6: Results of the estimation of the model with correction for the endogeneity bias

Variables	Dependent variable: Women participation to labour market				
	Benin	Senegal	Côte d'Ivoire	Ghana	Nigeria
Number of children (instrumental variable)	0.155* (0.089)	0.597*** (0.204)	0.059** (0.023)	0.137* (0.070)	-0.023** (0.010)
Age of the woman	0.073** (0.041)	0.264*** (0.050)	0.074** (0.035)	0.022 (0.029)	0.095*** (0.017)
Age of the woman squared	-0.001*** (0.008)	-0.002*** (0.000)	-0.001 (0.000)	-0.000 (0.000)	-0.001*** (0.000)
Age of her husband	0.008** (0.004)	0.008* (0.004)	-0.006 (0.004)	0.002 (0.002)	0.000 (0.002)
Education level of the woman	-0.015** (0.020)	-0.034 (0.038)	0.003 (0.022)	-0.043*** (0.021)	0.006 (0.010)
Education level of her husband	0.211 (0.101)	0.387*** (0.134)	-0.007 (0.113)	0.385*** (0.057)	0.154** (0.056)
Husband's employment status (Reference: unemployed)					
Unemployed in agriculture	0.663 (0.195)	0.343 (0.277)	0.484** (0.212)	-0.044 (0.131)	1.7332*** (0.081)
Employed in other sectors	0.881 (0.192)	0.198 (0.322)	0.370* (0.215)	0.105 (0.125)	1.301*** (0.081)
Pregnant	-0.047 (0.186)	-0.420*** (0.203)	-0.128 (0.128)	0.120** (0.052)	-0.045 (0.041)
Number of female adults	0.08 (0.123)	0.044 (0.132)	-0.069** (0.091)	-0.004 (0.052)	0.020 (0.040)
Area of residence (Reference: Urban area)	-0.267* (0.056)	-0.615*** (0.103)	-0.124 (0.081)	-0.190*** (0.033)	0.057* (0.033)
Residuals	-0.005** (0.002)	-0.000** (0.000)	0.000** (0.000)	-0.122* (0.071)	-2.820*** (0.264)
Wald Exogeneity test	0.760	0.156	0.780	0.590	0.991
Size of the sample	7,728	12,185	4,976	10,952	28,294

Endogeneity correction

The probabilities of the Wald exogeneity tests (shown in the table above) are higher than 5%; therefore, it allows us to accept the null hypothesis of exogeneity. This shows that the instrument used is exogenous. We, therefore, have statistically consistent results.

Fertility and female labour force participation: Non-uniform effects

Our results show that the effect of fertility on female labour force participation is not uniform across the five countries considered. In this study, labour force participation was measured as the sum of both paid and unpaid work.

Indeed, our results can be classified into two categories according to the countries of the study: the first category is composed of Benin, Senegal and Côte d'Ivoire. While the other category comprises of Ghana and Nigeria. For the first category, we find that the effect of fertility is sensitive to the measure of employment used, unlike the second group where the effect is uniform. More precisely, for the countries of the first group, the results indicate that fertility has a positive effect on the probability of participation of women in the labour market, when we measure their participation by all paid activities or not. On the contrary, for the countries of this same group, the results show that when women's participation in the labour market is measured by paid jobs, excluding agricultural and unpaid work, fertility reduces women's chances of employment. This contrast clearly indicates that the effect of fertility on participation in the labour market is sensitive to the measurement of participation in the countries of the first group. Regarding the countries of the second group, we note that the sign is the same whatever the measure of participation adopted. Indeed, we find that in Ghana, fertility has a positive effect on women's participation in the labour market but that it is the opposite in Nigeria. This allows us to conclude that fertility has a uniform effect on women's employment in these two countries.

The study found that fertility had a positive effect in the first country group (0.155 for Benin, 0.597 for Senegal, and 0.059 for Côte d'Ivoire) when participation is measured by all paid activities or not. A positive effect means that as the number of children under the age of six increases, women are more likely to participate in the labour market. This effect can be explained by the fact that women with more young children to care for participate more in activities that can increase their family income, or the fact that they are more represented in agricultural activities, which makes up for a large proportion of jobs, especially in rural areas. The same explanation is valid for the opposite effect obtained when labour force participation is used to refer only to paid and non-agricultural work in the cases of Benin, Senegal, and Côte d'Ivoire. In the case of Senegal, for example, WFDD (2016) find that in contrast to some Muslim-majority countries, issues of women's mobility or dress rarely prevent Senegalese women from seeking work outside the home. However, there are other

barriers to employment. Women in Senegal are active in agriculture, but overall levels of employment have changed slowly- the share of women over 15 working increased from 54.0% in 1991 to 57.5% in 2014. Although significantly more women are now engaged in the formal sector than 25 years ago, unpaid family workers and own-account workers represent a significant share of those employed (68% in 2011).

This study's results concerning Benin, Senegal, and Côte d'Ivoire and showing a positive effect of fertility on female labour force participation can also be linked to the nature of employment the women were engaged in. This is because the positive effect was observed when employment covered both paid and unpaid work, including agricultural work. It can be argued that once the labour market is defined as dominated by informal jobs and agricultural jobs, this raises the probability that women with young children will be employed. Indeed, the formal or informal nature of employment can somehow influence the relationship between fertility and women's labour supply. For example, Tumen and Turan (2020) specifically studied how informal employment affected the labour supply behaviour of mothers after they had given birth and found results that are different from those of this study. Tumen and Turan (2020) used an instrumental variables strategy based on data about twin births in Turkey. They found a causal relationship between fertility and women's labour supply. They observed that after the first birth of twins, women's labour supply decreased significantly and the women who left their jobs were mostly employed in the informal sector. The authors further observed that after further increases in family size arising from the second and third births (that is an unplanned increase from one to three children and from two children to four children), the women employed in the formal sector began to reduce their working hours. Wages and job search intensity on the part of women also declined when the number of births increased. In the same way, Finlay (2020) finds in low- and middle-income countries, that women can increase their labour supply with the addition of an extra child if there are other women in the household who can share childcare responsibilities, or if the composition of age, birth intervals and number of children enables women to combine work and childcare.

In the case of the Ghana and Nigeria, we find that fertility has a positive effect on the participation of women in the labour market, whatever the measure of employment used in Ghana (0.137) and a negative effect (-0.023) in the case of Nigeria. The positive effect obtained in the case of Ghana can be explained by a population policy that controls births by women. Indeed, the official policy of Ghana is to have a maximum of three children per woman. This fertility rate is relatively low compared to the same rate in the other countries in the study. We note that Ghana has the lowest rate over the last 20 years among the five countries considered. This low fertility rate may explain why there is relatively less pressure on Ghanaian women in terms of childcare. This has a positive effect on women's participation in the labour market. In contrast to Ghana, we find that fertility has a uniform negative effect on women's participation in the labour market regardless of the measure of employment used. Considering the fertility rate of the five countries in the study, Nigeria had the highest fertility rate over the past 20 years. This relatively high number of children per woman may explain the

negative effect obtained in the case of Nigeria. This finding is in line with that made by Jong et al. (2017), who found, in a sample of 24 African countries, that the number of children under six years of age in a woman's care significantly reduced her chances of engaging in non-agricultural paid work.

It can be observed that results may be sensitive to the definition used for employment or labour force participation in terms of effect or magnitude. For example, Vera (2015) used different definitions of women's labour supply variables. Based on the different definitions, the author observed that having a third child had a nine-percentage-point negative impact on women's labour supply across all the definitions of employment for married women, while for all the women it had an 8-percentage-point negative impact on "being employed outside the home", when this latter definition is used as a measure of women's labour supply.

Other variables and female labour force participation

Fertility is a complex decision, as is the decision to participate in the labour market. Both decisions are broadly based on similar factors. That is why this study's estimations considered decision variables such as the spouses' education level, their ages, the husband's occupational status, whether the wife was pregnant or not, the number of women aged 18 and above living in the same household, and the area of residence. But the study's analysis focused on the variables "age of the woman", "education level of the spouses", and "area of residence".

The results of our study show that, overall, the relationship between a woman's age and her participation in the labour market is non-linear for all the countries in the sample. Regarding her education level, no clear link emerges from the results. A negative effect was obtained for Benin and Ghana, but this finding is counterintuitive, since it shows that women with a high level of education are less likely to enter the labour market, which goes against the predictions of human capital theories. However, put in its context, the result can be explained by the fact that the way the notion of labour market was defined does not fully accommodate the participation of economic agents with a high level of education. In other words, the narrowness and the segmentation of the labour market may be an explanation for that finding. This result can also be a prediction of particular barriers to women's participation in labour markets in these two countries. In the case of Benin, the negative effect obtained is in line with Cece(2020). Indeed, this author has shown that the level of education has no influence on the probability of participation of women in the labour market. However, the level of education of women has a negative but not significant sign. At the same time, Cece (2020) finds marriage to be a hindrance to women's employment. These results are in line with ours, especially since our study focuses on married women and the negative sign obtained is due to married women considered here. It would perhaps be interesting in future research to focus on these aspects by cross-referencing the marital status with the level of education of women, if necessary.

Area of residence was also found to be an important factor in women's labour supply, although the results indicated a non-uniform effect. Still, they showed that the urban setting was related to a higher probability of female labour force participation when employment referred only to non-agricultural paid work. Using panel data, Tong and Gong (2020) tested the effect, on female labour force participation of an increase in the number of children born as a result of changes in women's fertility level. They found that the effect of the number of children on married women's labour force participation had a non-linear U-shaped relationship dominated by the substitution effect and the income effect. The turning point for urban married women between the substitution effect and the income effect was found to occur earlier than for rural married women. This means that urban married women are more sensitive to the economic pressure resulting from childbirth.

6. Conclusion and policy implications

This study has analyzed the effect of fertility on female labour force participation in Benin, Senegal, Côte d'Ivoire, Ghana, and Nigeria. Methodologically, it used instrumental variables to correct for the endogeneity bias of the fertility decision. The target population consisted of married women aged 18-49 years with at least one dependent child under six years of age. Labour force participation was measured by two binary variables: one that considered both paid and unpaid work and another that considered only paid non-farm employment. Using these two different measures of labour force participation has enabled the study to test the robustness of the effects and to highlight possible contextual specificities. The key findings from the study are the following: (i) the effect of fertility on female labour supply is not uniform across all the countries considered; and (ii) the relationship between fertility and female labour force participation is sensitive to the measure of participation used.

Based on our findings, we make the following policy recommendations:

For Benin, Senegal and Côte d'Ivoire:

- It would be important to put in place policies to encourage the transition of women from traditional jobs that are quite vulnerable to more formal jobs.
- Put in place corrective measures so that young children are no longer a penalty for women's access to formal jobs.

For Ghana:

- Even if fertility does not seem to be an obstacle for women, it would be good for public policies to reassure themselves that women benefit from equitable access to the labour market in the same proportions as men.

For Nigeria:

- Put in place incentive measures to encourage and promote the participation of married women with young children in charge of the labour market.

Future studies could look at the costs of motherhood on women's labour supply by considering aspects such as the number of children, the inter-birth interval and childcare. This will provide other explanations for the different relationships between fertility and women's participation in the labour market.

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Appendix

Appendix 1: Correlation between fertility and vulnerable employment

Country	Vulnerable employment
Benin	0.7944
Côte d'Ivoire	0.9263
Ghana	0.9746
Nigeria	0.8686
Senegal	0.9748

Appendix 2: Female fertility and unemployment rates

Year	Benin		Côte d'Ivoire		Ghana		Nigeria		Senegal	
	Fertility	Unemployment	Fertility	Unemployment	Fertility	Unemployment	Fertility	Unemployment	Fertility	Unemployment
2000	5.962	0.50	5.870	4.30	4.826	10.68	6.106	3.66	5.448	7.81
2001	5.889	0.46	5.793	4.53	4.753	9.54	6.083	3.68	5.365	7.83
2002	5.820	0.43	5.713	4.72	4.681	8.51	6.060	3.85	5.292	7.80
2003	5.754	0.50	5.630	4.97	4.612	7.54	6.036	3.77	5.232	9.33
2004	5.691	0.57	5.545	5.19	4.548	6.62	6.011	3.76	5.185	10.70
2005	5.632	0.62	5.460	5.38	4.490	5.70	5.985	3.67	5.149	12.27
2006	5.576	0.69	5.376	5.45	4.438	4.77	5.958	3.59	5.124	13.76
2007	5.522	0.74	5.296	5.58	4.392	4.82	5.930	3.55	5.107	13.62
2008	5.469	0.79	5.221	5.79	4.350	5.11	5.902	3.51	5.094	13.45
2009	5.416	1.00	5.152	6.30	4.311	5.44	5.872	3.71	5.081	13.86
2010	5.362	1.15	5.088	6.62	4.273	5.81	5.839	3.78	5.064	13.96
2011	5.305	2.87	5.029	6.66	4.234	6.13	5.802	3.69	5.039	13.90
2012	5.246	2.87	4.974	7.35	4.192	6.21	5.758	3.51	5.005	12.07
2013	5.183	2.88	4.920	5.24	4.146	6.38	5.709	3.36	4.960	10.27
2014	5.116	2.79	4.867	4.58	4.095	6.42	5.653	5.40	4.905	8.74
2015	5.047	2.76	4.813	3.98	4.041	6.57	5.592	5.11	4.841	7.30
2016	4.977	2.74	4.759	3.38	3.984	5.42	5.526	8.11	4.770	7.25
2017	4.906	2.65	4.704	3.87	3.926	4.39	5.457	9.27	4.697	7.18
2018	4.836	2.55	4.649	3.81	3.870	4.29	5.387	8.36	4.625	7.09
2019	4.767	2.48	4.593	3.76	3.816	4.29	5.317	7.45	4.556	7.02



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