BRITISH JOURNAL OF ADVANCE ACADEMIC RESEARCH
Volume 5 Number 1 (2016) pp. 27-37
ISSN 2050-6015 (Print)
ISSN 2050-6023 (Online)
Publishers: Sacha & Diamond, England, United Kingdom
www.sachajournals.com
Current Impact Factor: 26.8
Peer Reviewed Paper

FERTILITY AND CHILD MORTALITY: AN EVALUATIVE DISCOURSE

OYEDELE, Ovikuomagbe (PhD)
Department of Economics, Babcock University, Ogun State, Nigeria

ABSTRACT

High fertility and high child mortality are a challenge in sub-Saharan Africa, precisely Nigeria. Understanding the relationship between them would provide an insight into properly addressing the challenge they pose. Calculating the replacement rate of births to a child death for the Nigerian case also remains an unfilled gap. This study examined the relationship between fertility and child mortality using a simultaneous equation model and a two-stage estimation method. An increase in the number of child death was found to significantly increase the number of children ever born in both urban and rural locations, and in all six zones. An increase in fertility was found to reduce the number of child deaths only among educated women with the least education being a post-secondary education for the case of rural women. The replacement rate was 0.57. A significant reduction in child mortality is key towards fertility reduction.

Keywords: Number of children ever born, Child death, Endogeneity, Women,

1. INTRODUCTION

High fertility and child mortality rate have negative implications on an economy's development because of their resulting consequence of poor health state for mothers and children. This has a reduction effect on female productivity, total output and hence development. The interrelationship between fertility and child mortality has been shown by some studies. Benefo and Schultz (1996), Handa (2000) and Jaraet al. (2013) showed that fertility increases are explained by rising child mortality rates. This is as a result of the replacement and anticipatory effects of child mortality on fertility (Olsen, 1980). The death of a child is likely to influence the fertility decision of a woman in favour of an additional birth to replace the dead one. This is to provide consolation and maintain the desired number of children. A woman's fertility decision can also be influenced by the number of child deaths she experiences or by the experiences of other women such that in anticipation of such an occurrence, she gives birth to more than she desires. Thus, in the event of any loss(es), the number of children does not fall below her desired number. High child mortality has also been associated with increases in fertility levels because it leads to shorter birth intervals which increase the risk of mortality for mother and child (Canning and Schultz, 2012, Kozukiet al., 2013, Bhuyan, 2000). There have been several studies on the relationship between fertility and child mortality, they have shown that child mortality and fertility are interrelated (Jaraet al., 2013; Herzeret al., 2012; Benefo and Schultz, 1996;Handa, 2000;Rosenzweig and Schultz, 1983; Blackburn and Cipriani, 1998; and Chowdhurry, 1988). These studies reveal a positive and bi-causal relationship. Nonetheless, there remains the need for a current empirical evidence for the Nigerian case. Some studies have attempted to calculate the replacement rate of birth to a child death, for instance, Benefo and Schultz (1996), Maglad (1994), Handa (2000) and Ben-Porath (1974) calculated the replacement rates for Ghana and Cote d'ivoire, Sudan, Jamaica and Israel, respectively. This study contributes to literature on the empirical evidence on the nature of their relationship; it also calculates the replacement rate of births to a child death in Nigeria.

2. REVIEW OF LITERATURE

Some theoretical insights into the mortality-fertility relationship include Olsen's (1980) explanation of the effect of child deaths on the number of births. He was of the opinion that because of the high level of child mortality in less developed countries (LDCs), couples' decision on the number of children to have may not always be rational or based on the desired number of children but on the number of surviving children. Hence, the death of a child may disrupt the plans of couples and they may try to offset this by having one more birth. This, he referred to as the replacement hypothesis. The replacement rate is the average number of additional births, which occur in response to an additional child death incident. It is the rate at which dead children are replaced; thus it is the average number of new births as a direct result of each child death. The desired number of children is also affected by the anticipation that such deaths may occur, thus; parents in a high child mortality environment will require more births to achieve the desired number of survivors. Thus, parents may produce additional children in anticipation of some deaths, which he refers to as hoarding. He explains that using the number of child deaths enables a direct estimation of its effect on fertility rather than an indirect effect which the use of mortality rates and birth intervals offer.

Another contribution to child death effect on fertility is Lloyd and Ivanov (1998) who stated that a general increase in child survival chances would tend to widen average inter-birth intervals because of reduced conception ability due to breastfeeding and this results in a decline in period and cohort fertility rates. They explained the insurance and replacement strategies as two family building strategies used by couples to achieve the desired number of surviving children. In anticipation of a probable loss, couples have excess number of births, usually higher during periods of high child mortality rates. Since parents do not know the actual probabilities of death faced by their children, they are likely to be risk averse such that they end up with more surviving children than desired. The replacement strategy is the replacement of children who actually die with an additional birth or births up to the end of a woman's reproductive span.

Heer (1983) also looked at the effects of child mortality on fertility in developing countries, which he states is an important factor. Thus, the demand for children is usually a demand for surviving children. Demand is not constant because individual fertility could be inversely proportional to perceived child survival probabilities and the costs of any target number of surviving children are affected by mortality levels. Thus, parents may also attempt to overcompensate for perceived mortality risks.

Considering empirically, the fertility behaviour that emanates from the uncertainty child mortality brings, some studies have shown that positive and negative relationships exist depending on parental preference for quality or quantity of children. Wolpin (1984) shows that life-cycle fertility within an environment where infant survival is uncertain has implications for the number, timing and spacing of children. Explaining the replacement effect of child mortality on fertility responses, his results showed that an infant death induces an increase in the number of children ever born. Therefore, the survival probability of a child has a negative effect on fertility.

Schultz (1973) divided the effect of child mortality on desired fertility into two such that child mortality affects first, the demand for survivors by increasing the expected cost per survival and second, the derived demand for births by increasing the number of births required to obtain a survivor. The positive relationship between the incidence of child mortality and the derived demand for births can be explained by parents being inelastic to changes in expected cost per survivor since they focus more on the future benefits expected from their mature surviving child.

Applying the perspective of economic growth and capital accumulation effects on fertility, Barro and Becker (1989) show that fertility tends to reduce with a high cost of raising children, however, only through an indirect channel when interest rates on capital are low. In explaining changes in the cost of rearing children, they identify an empirical example that a reduced rate of child mortality lowers the expected cost of raising a surviving child thus increasing fertility.

Investigating the effect of child mortality and access to land on fertility in rural Sudan, Maglad (1994) incorporated the wage from child labour since his study focused on a rural sector in a low-income country where agriculture is a major source of livelihood. Education was taken as a proxy for the wage rate because of the difficulty in measuring the wage variables, particularly for women who are not in the labour force. Assuming the mortality rate to be random and uncorrelated with fertility, the mortality rate is used as an instrument for the number of child deaths and the results show that child mortality is a highly significant factor influencing fertility, while the replacement effect coefficient is less than the OLS estimate replacement effect though both coefficients are positive. Considering the possibility of correlation between fertility and mortality rate, the number of child deaths was instrumented by a regional health dummy variable, which shows the presence of health care facilities in various regions. The result showed that the coefficient is negative but not significant. He explains the insignificance by the fact that health facility marginally affects the number of child deaths. Child death, woman's age and amount of land cultivated by the household have positive significant associations with fertility, with child mortality and age having the most influence. Using the Olsen method to correct for bias in the OLS estimate from the regression of the number of child deaths on fertility, the replacement rate was put at 0.63. The replacement rate coefficient from the IV estimation was 0.56, though not precisely estimated.

Some studies have evaluated the relationship between child mortality and fertility and have shown significant results. Surprisingly, high fertility directly reduces child mortality and delay in childbearing increases mortality rate (Rosenzweig and Schultz, 1983). However, a positive effect is observed when Bhuyan (2000) found that high parity women have high child loss in north-eastern Libya in the examination of the differentials in child mortality by fertility among 1,252 couples of childbearing ages in selected localities using the OLS method. Blackburn and Cipriani (1998) also proposed that fertility and mortality are positively related and a decline in fertility is usually preceded by a decline in mortality. Meanwhile, fertility tends to rise with PCI during the early stages of development in the United Kingdom.

Olsen and Wolpin (1983) examined the impact of exogenous child mortality on fertility using 1,262 households in Peninsular Malaysia and found families with high endowed mortality rates ultimately having more children so that families who choose to have high mortality by reducing their purchases of productive inputs also choose to have high fertility. Benefo and Schultz (1996) found that high child mortality rates significantly increase fertility in Ghana and Cote d'ivoire. Using the OLS and the two stage least squares (2SLS), the effect of child mortality was statistically significant only when child mortality was assumed exogenous.

Handa (2000) also found that increasing rates of infant mortality significantly induce high fertility using a 1989 Jamaica Survey of Living Conditions. The influence of infant mortality however was non linear. Education and income also had a strong negative effect on births with the impact of education being higher.

Herzer*et al*. (2012) examined the long run relationship between fertility, mortality and income by estimating the long run effects of mortality and income per capita on fertility using Panel cointegration techniques for a 100-year, from 1900 to 1999 and 400 observations from some 20 countries geographically dispersed around the world. Fertility was measured as the CBR, mortality was measured as the crude death rate (CDR) while GDP per capita was used as a measure of economic development. Estimating the long run elasticities of fertility with respect to mortality and PCI, they find mortality was highly significant and positive while GDP per capita had a highly significant negative effect. Splitting all the countries used into two sub-samples of developed (OECD) and developing (Non-OECD), the result are still the same, showing no significant differences in the associations of mortality and economic development with fertility between rich and poor countries. Controlling for sample selection bias from using only 20 countries, they re-estimated for a second sample with 1,190 observations for 119 countries from 1950 to 1999. The positive significant relationship between fertility and mortality and the negative significant relationship between fertility and income are still recorded. Using infant mortality as an alternative measure of mortality, they find that the long run associations of mortality and GDP per capita with fertility are still positive and negative respectively. Thus, regardless of the sample and mortality measure used, the results were robust to different samples and measures of mortality. Conducting a Granger-causality test, they found that the growth of income per capita leads to reduced fertility. A decline in fertility also causes income growth to rise further. Thus, low fertility is a cause and consequence of successful economic development. Education was also found to be an important explanatory variable with increased average years of primary schooling significantly associated with reduced fertility.

Lawson et al. (2012) examined the relationship between fertility and less than five years child mortality using data compiled from national demographic surveys for 27 sub-Saharan African countries. They provide empirical support for the predicted life-history trade-off between quantity and quality of offspring from their result, which showed that each additional maternal birth decreases the odds of child survival in all countries. They also found that optimal fertility for maximizing reproductive success was contingent on both local risk of child death and the effect of fertility on that risk, that is, the trade-off function. The relative costs of high fertility on child survival, estimated by the percentage reduction in odds of child survival per additional birth were largest in low-mortality countries and where maternal somatic (height) and extrasomatic (education) capital is high. They found trade-offs to be stronger for mothers who attained high fertility at a relatively young age.

3. METHODS AND MATERIALS

The theoretical framework employed in this study is based on Olsen (1980) theory of child mortality effects on the number of births. This theory explains fertility behavior in a situation of high death rates. The Olsen (1980) theory of the effect of child mortality on the number of births assumes that because of the high level of child mortality in developing countries, couples decision on the number of children may not always be rational or based on the desired number of children but would depend on the number of surviving children. It predicts that among otherwise identical couples, those suffering one more child death will tend to have one more birth. This is known as the replacement hypothesis. Child mortality reduction is a measure among others taken to influence the development of a country thus, it is important to know the rate at which child deaths (or the prevention of child deaths) produce more or fewer births. The occurrence of a death or the anticipation that such a death may occur also enters into the determination of the number of children ever born.

3.1 Model Specification

This study mainly examines the relationship between fertility and child mortality. Thus, the estimated model takes a simultaneous equation form as presented in equation (1).

$$Y_1 = \boldsymbol{\delta}_f Y_2 + \boldsymbol{\delta}_f X_f + \varepsilon_f \qquad (a)$$

$$Y_2 = \boldsymbol{\delta}_c Y_1 + \boldsymbol{\delta}_c X_c + \varepsilon_c \qquad (b) \qquad (1)$$

Where: equation (a) represents the fertility equation and (b) is the child mortality equation. Fertility (Y_1) is a function of child mortality (Y_2), and the exogenous variables (X_f); ε_f is the error term. Equation (b) is defined along the same lines. In the fertility equation (a), the exogenous variables (X_f) include the productive capacity of a woman's time, which depends on her education, household characteristics such as household size, individual characteristics such as age, marital status, age at first childbirth, and household income proxied by household per capita expenditure. The exogenous variables (X_c) in the child mortality equation include a woman's education, age, individual characteristics of the child including hospital delivery and vaccination use, household characteristics including per capita household expenditure, marital status and community and environmental characteristics such as distance to the nearest hospital.

3.2 Estimation Procedure and Technique

The estimation procedure began with a test for endogeneity of the two main variables of focus; fertility and child mortality. Fertility was measured as the number of children ever born; child mortality was measured as the number of child deaths. The endogeneity test was conducted using the Hausman test. Following Maddala (1992) and Longwe *et al.* (2013), the Hausman test involves obtaining the residual of the potentially endogenous explanatory variables from the first stage regression of their reduced form equations. Thereafter, the actual values of the potential endogenous explanatory variables and their residuals are included in the original equation (as shown in equation (2) and estimated.

$$Y = \boldsymbol{\delta} Y_a + \boldsymbol{\delta} r_a + \boldsymbol{\delta} X_+ \varepsilon \qquad (2)$$

Where Y is the dependent variable, Y_a is an endogenous explanatory variables, r_a is the residuals from the first stage regression of the reduced form equation of the endogenous explanatory variables, and X are the exogenous explanatory variables.

We test the hypothesis that the coefficients of the residual are not significantly different from zero using the T-test. If the hypothesis is rejected, the variables cannot be treated as exogenous. If it is accepted, they can be treated as exogenous. In the fertility equation, we test for endogeneity of the number of child death. In the child mortality equation, we test for the endogeneity of the number of children ever born. A test for heteroskedasticity was also conducted using the Breusch-Pagan Cook-Weisberg test. The decision rule states that heteroskedasticity is present if the chi-square value Chi2(1) obtained is statistically significant.

The estimation technique employed is the two-stage estimation method. The two-stage estimation method for models with mixed continuous and qualitative variables was applied because the two equations estimated, that is the fertility and child mortality equation include continuous and qualitative variables, some of which have potential endogeneity. The two-stage method involved the OLS and the probit methods.

3.3 Fertility Equation

For the fertility equation, the first stage estimation involved estimating the reduced form equation of the endogenous explanatory variable and obtaining its predicted value. The OLS method was used to estimate the number of child deaths. The predicted value of the endogenous explanatory variable obtained from their first stage regression was then substituted for its actual value in the second stage estimation. The second stage estimation involved employing the OLS method in estimating the determinants of fertility measured by the number of children ever born. The estimation for the determinants of fertility was carried out at the national level, for rural and urban locations and for the six geopolitical zones. Some interaction variables are subsequently introduced into the fertility equation and re-estimated.

3.4 Child Mortality Equation

For the child mortality equation, the first stage estimation involved estimating the reduced form equation of the endogenous explanatory variable and obtaining its predicted value. The OLS method was used to estimate the number of children ever born. The predicted value of the endogenous explanatory variable obtained from their first stage regression was substituted for its actual value in the second stage estimation. The second stage estimation involved employing the OLS in estimating the determinants of child mortality measured by the number of child deaths. The estimation for the determinants of child mortality was carried out at the national level, for rural and urban locations and for the six geopolitical zones. Some interaction variables are subsequently introduced into the child mortality equation and re-estimated. The Harmonized Nigeria Living Standard Survey (HNLSS) questionnaire does not explicitly specify an age limit for child deaths; hence there is the possibility that the death of older children may be included in the mortality data. To control for the possible exposure time to death which this problem poses, the child mortality equation is also estimated using the mortality rate as another measure of child mortality (Handa, 2000), to ascertain if the results obtained are significantly different from the results obtained using the number of child deaths.

3.5 Birth Replacement Rate

The study proceeded to calculate the replacement rate of births. The following guide for calculating the replacement rate was derived from Trussell and Olsen (1983) which states that there are two regression estimators upon which the calculated replacement rate for births are based: First, is the ordinary least squares (OLS) estimate, denoted by r_{OLS}, obtained by regressing the number of births (n_i) on the number of deaths (d_i);and Second, is the instrumental variables (IV) estimate, denoted by r_{IV}, obtained in a two-step process. In the two-step process, first d_i is regressed on the proportion dead (p_i) = d_i/n_i, then the predicted values of d_i from this regression (d_i^) are employed as regressors; n_i is then regressed on d_i^ and not d_i.

The OLS coefficient is always a biased and inconsistent estimate of the true replacement rate, hence it must be corrected. The IV estimate is sometimes consistent; under some circumstances, however, it too could be corrected where necessary. If n_i and p_i (the mortality rate calculated as d_i/n_i) are uncorrelated, the corrected OLS estimator and the uncorrected IV estimator can be used. However, if n_i and p_i are correlated, either the corrected OLS or the corrected IV coefficients could be used. A finding that the two methods give different results with the IV estimate being substantially greater, the discrepancy may be a sign of random coefficients and in this case, the IV based estimator is preferred. Trussell and Olsen (1983) also identified five recommendations that guide the selection of the particular estimator that is appropriate for calculating the replacement rate, these recommendations are based on a variety of circumstances centering on the implied within-parity variance of the mortality rate ($б^2_{p/n}$).

The study applied the fourth recommendation because the implied average within parity variance in mortality rates is very small or negative, and the variance of the number of child deaths (d) is different from its predicted value. Here, the corrected OLS estimator and the IV estimator are used since n_i and p_i are correlated, however, the IV estimator cannot be corrected in this case.

3.6 Data Collection, Variable Description and Descriptive Statistics

A total of 41,575 women within the reproductive ages of 15 and 49 with at least a child ever born were used to estimate the fertility equation out of a total number of 332,928 respondents in the HNLSS 2010 after the necessary data cleaning. The unit of observation is the woman (family); women with no births are excluded because they cannot provide information on the relation between fertility and mortality. In estimating the child mortality determinants, 40,382 women out of the 41,575 were used because they had complete information in all the child mortality variables. This study makes use of the HNLSS data of 2010 developed by the National Bureau of Statistics (NBS) and its sponsors, comprising the Federal Government of Nigeria, World Bank, United Nations Children's Funds (UNICEF) and the Department of International Development (DFID). The HNLSS is the latest in a series of poverty survey instruments developed by NBS and its development partners.

In this study, fertility is measured as the number of children ever born by a woman. This measure helps capture the fertility stock. This measure is used to estimate a stock regression. Child mortality is measured as the number of child deaths a woman has experienced. This measure was used because it takes into consideration the individual or private cost of child mortality experience of each woman.

4. RESULTS AND DISCUSSION

From the exogeneity test, the number of child deaths was found to be endogenous in the fertility equation. The number of children ever born was also endogenous in the child mortality equation. A robust estimation was also carried out to control for heteroskedasticity bias. To test for the relevance of the instruments used, the first stage regression of the reduced form equations of the endogenous variables were estimated and the instruments used were relevant. Based on a validity test, the instruments used were found to be valid because they do not have any significant effect on the dependent variables.

4.1 Fertility Equation

There is a highly significant positive effect of the number of child death on the number of children ever born in both urban and rural areas. The effect however is greater in urban than rural areas. The positive effect is highly significant for all geopolitical zones except the South East where it was negative but insignificant. A unit increase in the number of child deaths brings about more than a unit increase in the number of children ever born. Thus the high child mortality rate in the country is a significant reason for the high fertility level. Other control variables include age at first childbirth, which was found to significantly reduce fertility if women had their first childbirth at a later stage in their life. This was significant in both urban and rural locations and in all zones except the North East zone. Thus early childbearing (due to teenage pregnancy or early marriage) is a catalyst for high fertility. Getting an education did not significantly reduce fertility since educated women at all levels still had higher number of children ever born than those with no education. This positive significant effect of education was consistent in all zones except in the South West zone where it was insignificant. Education was found to have a lower effect compared to the number of child death. Thus in a high child mortality prevailing society, education is not a solution to high fertility but a decline in child mortality.

4.2 Child Mortality Equation

The child mortality estimation reveal a positive significant effect of fertility on the number of child deaths only in urban locations. Considering the six geopolitical zones, there is a significant effect only in the North West; however, it is negative. This result does not provide enough information thus we examine the effect of fertility when women have attained some level of education using an interaction model. From the interaction model estimates, fertility becomes significant to explain the number of child death only when interacted with education. An increase in the number of children ever born significantly reduced the number of child death only among educated women. Urban women with a high number of children ever born who had a primary education had less number of child deaths than those with no education. Rural women with a high number of children ever born who had a post secondary education, had significantly less number of child deaths than those with no education. Thus education plays a key role in reducing the number of child deaths as fertility levels increase. However, an education beyond the primary level did not significantly influence the effect of fertility on the number of child death among urban women. In rural locations, education below the post secondary level did not influence the effect of fertility on the number of child death. Women with a high number of children ever born who had a primary education, had significantly less number of child deaths than those with no education in the North East and North West. This significant reduction was obtained among women with a post secondary education than among those with no education in the North Central and North East zones only. Considering other control variables included in the equation, the number of child death was highly significantly lower among women with at least a primary education than among women with no education. This was obtained in both urban and rural locations and in the North Central and North East zones. Married women and women who were once married had less number of child death than those who are single. High cost of vaccine (probably synonymous with better quality in terms of potency) and shorter distance to the hospital reduce child mortality. While cost of vaccine was significant in the North East and South West, a shorter distance to the hospital was significant in the North Central and South South zones.

When the mortality rate was used in order to control for the possibility that the death of older children may be included in the mortality data (since the HNLSS does not explicitly specify an age limit for child deaths), the results obtained were not significantly different from the results obtained using the number of child deaths. Thus it can be concluded that the estimates obtained using the number of child deaths are reliable.

4.3 The Replacement Rate

The number of more births the death of a child would produce is shown by the replacement rate. The corrected OLS method and the instrumental variables (IV) estimation method were employed since the number of births and the mortality rate were correlated. The instrumental variable estimate cannot be corrected because the implied average within parity variance in mortality rates was very small or negative, and the variance of the number of child deaths was different from its predicted value (Olsen 1980). Since the instrumental variables replacement rate estimates cannot be corrected, we can only rely on the OLS estimator results for the replacement rate. From the empirical analysis, the national implied replacement rate was 0.57. Thus, an additional child death experienced by a woman would produce 57 per cent more births. The implied replacement rate of 0.59 in the urban area was slightly higher than 0.56 in the rural location. Thus urban women tend to replace a child death by having more additional births than rural women. This could be explained by the fact that most parts of urban cities are largely rural in characteristic (agrarian with little or no industralisation, and most women are barely educated) and hence, are mere extensions of rural areas though in an urban location. Thus the manual services of a large number of children would be useful. Also, the relatively higher child labour income contribution to household income in urban locations could explain the higher replacement rate in urban than rural locations. The rural and urban replacement rates calculated for Nigeria in this study are lower than 0.70 and 0.66 for rural and urban respectively reported by Handa (2000) for Jamaica but higher than the range of 0.20 to 0.25 reported by Benefo and Schultz (1996) for both urban and rural locations of Ghana and Cote d'Ivoire.

The analysis shows that the implied replacement rate of 0.61 in the South-West was the highest amongst the six geopolitical zones, followed by 0.60 in the North Central and 0.54 in the North-East, North-West and South-South. Thus, a unit increase in the total number of child deaths in the South-West would produce 61 per cent more births. Women in the South-East had the least number of births as replacement for a dead child than women in other zones. The relatively high replacement rate discussed above shows that reducing the number of child deaths experienced by women should be a major target of policy if fertility rates are to fall significantly. It also shows that women tend to have more births or number of children in the event of the death of a child jin the bid to replace a dead child.

5. CONCLUSION

The relationship between fertility and child mortality is such that while high child mortality has a significantly increasing effect on fertility in both urban and rural locations, fertility does not seem to have a clear effect on child mortality except when it is interacted with education. Fertility is then seen to have a decreasing effect on child mortality only when a woman is educated. However, an education beyond the primary level does not significantly influence the effect of fertility on the number of child death among urban women. In rural locations, education below the post secondary level does not influence the effect of fertility on the number of child death. Thus the high fertility level in the country is as a result of the low child survival level. Efforts towards reducing the high child mortality situation in the country would significantly reduce fertility levels.

REFERENCES

Barro R I, Becker G S. 1989. Fertility choice in a model of economic growth. Econometrica 57(2): 481-501.

Benefo K, Schultz T P. 1996. Fertility and child mortality in Cote d'ivoire and Ghana. The World Bank Economic Review 10(1): 123-158.

Ben-Porath Y. 1974. Economic analysis of fertility in Israel. Economics of the family: marriage, children and human capital. T. W. Schultz. National Bureau of Economic Research, UMI Publisher. 1974. 189-224.

Bhuyan K C. 2000. Differential in child mortality by fertility in North-Eastern Libya. The Indian Journal of Statistics Series B 62.2:317-326.

Blackburn K, Cipriani G P. 1998. Endogenous fertility, mortality and growth Journal of Population Economics 11(4): 517-534.

Canning D, Schultz T P. 2012. The economic consequences of reproductive health and family planning Family Planning *4(*12): 60827-7

Chowdhhury A R. 1988. The infant mortality – fertility debate: some international evidence. Southern Economic Journal 54(3):666-674.

Handa S. 2000. The impact of education, income and mortality on fertility in Jamaica World Development Review 28(1):173-186.

Heer D M. 1983. Infant and child mortality and the demand for children. *Determinants of fertility in developing countries: a summary of knowledge*. R. A. Bulatao, R. D. Lee, P. E. Hollerbach and J. Bongaarts. Eds.Committee on Population and demography Report No. 15A. Washington, D. C.: National Academy Press. Chapter 11:299-131

Herzer D, Strulik H, Vollmer S. 2012. The long-run determinants of fertility: one century of demographic change 1900-1999. Journal of Economic Growth 17:357-385.

Jara D, Dejene T, Taha M. 2013. Determinants of high fertility status among married women in gilgel gibe field research center of jimma university, oromia, Ethiopia: a case control Study. Public Health Research 3(2): 9-17.

Kozuki N, Lee A C C, Silveira M F, Victora C G, Adair L, Humphrey J, Ntozini R, Black R E, Kayz J. and child health epidemiology reference Group small-for-gestational-age-preterm birth working group 2013. The association of birth intervals with small-for-gestational-age, preterm, and neonatal and infant mortality: a meta-analysis. Biomed Central Public Health 13.suppl3.

Lawson D W, Alvergne A, Gibson M A 2012. The life history trade-off between fertility and child survival. Proceedings of the Royal Society *B* 279.1748 DOI: 10.1098/rspb.2012.1635

Lloyd C B, Ivanov S. 1998. The effect of improved child survival on family planning practice and fertility. Studies in Family Planning 19.3.141-161.

Longwe A, Smits J, Jong E. 2013. Number and spacing of children and women's employment in Africa. Nijmegen Center for Economics (NiCE) Working Paper 13-103. Institute for Management Research, Radboud University Nijmegen, The Netherlands

Maddala G S. 1992. Introduction to econometrics. 2nd ed. New York: Macmillian Publishing Company.

Maglad N E. 1994. Fertility in rural Sudan: the effect of landholding and child mortality Economic Development and Cultural Change 42(4):761-772.

National Bureau of Statistics Abuja, Nigeria 2010. Harmonised Nigeria living standard survey 2008/09 Part A (CWIQ). Draft report.

Olsen R J. 1980. Estimating the effect of child mortality on the number of births. Demography 17(4): 429-443.

Olsen R J, Wolpin K I. 1983. The impact of exogenous child mortality on fertility: a waiting time regression with dynamic regressors. Econometrica 51(3): 731-750.

Rosenzweig M R, Schultz T P. 1983. Consumer demand and household production; the relationship between fertility and child mortality. American Economic Review 73(2): 38-42.

Schultz T P. 1973. A preliminary survey of economic analysis of fertility. The American Economic Review 63.2. Papers and Proceedings of the Eighty-Fifth Annual Meeting of the American Economic Association 71-78.

Trussel J, Olsen R. 1983. Evaluation of the Olsen technique for estimating the fertility response to child mortality Demography 20(3):391-405.

Wolpin K I. 1984. An estimable dynamic stochastic model of fertility and child mortality. The Journal of Political Economy 92(5): 852-874.

Sacha & Diamond Academic Publishers, Meridian Centre,
258 Kingsland Road, Hackney, London E8 4DG, England, United Kingdom.
In Compliance with the Standards Approved by the UK Arts and Humanities Research Council
Abstracting and Indexing in:
GIGA - The Electronic Journals Library of the German Institute of Global and Area Studies, Information Centre, Hamburg; Google Scholar; Global Development Network (GDNet); Social Science Research Network (SSRN); Econlit - The American Economic Association's Index; EBSCO; IndexCopernicus USA; British International Libraries; Anton's Weekly Digest;
Econlit (USA); International Abstracts in Operations Research; Environmental Science and Pollution Management; Research Alert

For the Advancement of Knowledge to the World. www.sachajournals.com