INVESTIGATION OF FAMILY PLANNING AS A FUNCTION OF WOMEN LIFESPAN USING A MULTIPLE REGRESSION APPROACH

Marufat B. Oyedeji

Federal College of Forestry, Jericho Hill, Ibadan

Correspondent Author: Marufat B. Oyedeji, marufatoyedeji@gmail.com

ABSTRACT: The focus of this study was to examine the effect of family planning based on the methods of contraceptives on women life span (female life expectancy), using the secondary data collected from the University College Hospital (UCH), Ibadan, Lagos Bureau of Statistics (LBS) and World Bank Statistical database. Analytically, regression model was employed in this study. The data, being a time series data was tested for stationarity using the augmented Dickey- Fuller test and the test indicates that the data were stationary.
The results obtained indicate that the method of contraceptives and age are statistically significant for predicting women life span. The coefficient of determination in the regression output also revealed that 93.37% (0.9337) of the total variation in life expectancy was accounted for by the use of contraceptive (injectable, Oral, pills and IUCD) and age with other variables in the expectancy. This study concludes that that the independent variables explain the dependent variable substantially and recommends the need to provide aggressively family planning education, so that people can understand the use, cope with it, take control and develop survival skills. The analyses were done in Minitab and E-views statistical packages to estimate the parameters of the model.
KEYWORDS: Family planning, Investigation, Regression approach, Women lifespan.

1. INTRODUCTION

The choice of a statistical technique is determined by the type of available data and comparison to be made in the study. The focus of this study was to examine the effect of family planning based on the methods of contraceptives on women life span (female life expectancy), using the secondary data collected from the University College Hospital (UCH), Ibadan, Lagos Bureau of Statistics (LBS) and World Bank Statistical database. Analytically, regression model was employed in the study. The data, being a time series data was tested for stationarity using the augmented Dickey- Fuller test and the test indicates that the data were stationary. Family planning is a conscious effort made to reduce and create gap in the number of children to bear by a couple through the use of contraceptives. This improves health, reduces poverty and empowers women. Contraceptive is the main issue galvanizing unprecedented efforts to the attainment of the themes of Millennium Development Goals of 2015 and action plan of the International Conference on Population and Development held in Cairo in 1994. However, over 200 million women in the developing nations still have unmet needs for modern contraception. Such women face numerous challenges such as inaccessibility of information and health care facilities, disagreement from their husbands and communities, misinformation about side effects, and cost. Overcoming these obstacles would bring upward reaction in the demand for family planning and numerous unwanted pregnancies, as well as maternal deaths, and infant deaths could also be prevented annually. This will enable the government to better invest in health facilities with a view to improving population health.

Family planning is usually used synonymously to the use of birth control. Other techniques commonly used include sexual education, prevention and management of sexually transmitted diseases, pre-conception counseling, management and infertility management ([Ola09]). However, family planning enables couples to minimize the number of children to have and control the timing of pregnancy. This is known as spacing of children. Family planning may encompass sterilization, as well as pregnancy termination. It also includes raising a child with methods that require significant amount of resources namely: time, social, financial and environmental. Family planning measures are designed to regulate the number and spacing of children within a family, largely to curb population growth and ensure each family has access to limited resources. The first attempt to offer family planning services began with private groups and often aroused strong opposition. Activists, such as Margaret Sanger in the U.S., Marie Stopes in England and Dhanvanthis Rama Rou in India, eventually succeeded in establishing clinics for family planning and healthcare. Today, many countries have established national policies and encouraged the use of public family services ([WHO13]).

The 1990 Demographic and Health Survey found out that only 11% of sexually active women within age bracket 15-19 years ever used any modern contraceptive method. Contraceptive use among Nigerian adolescents must be encouraged if their reproductive health is to be improved. According to the United States National Library of Medicine (2014), the Life expectancy in the United States is 77.34 years for women. Women who take oral contraceptives (OCs) for five years before the age of 30 years old can expect to live about four days longer due to protection against ovarian and endometrial cancers. Women that take pills for five years in their thirties will have a maximum loss of 18 days averagely, and for women over 45, this may rise to 80 days. Increased mortality from myocardial infarction and stroke has reduced life expectancy. Family planning in the modern concept includes the Planned Parenthood Federation of Nigeria which has her Headquarters in Lagos and offices in twenty seven states and the Federal capital territory Abuja. The Planned Parenthood Federation of Nigeria is today Nigeria's largest and oldest non-religious, non-political, non-profit-making organization.

2. EMPIRICAL STUDIES

The possibility in analyzing data on survival is to classify individuals according to their status at a fixed duration of follow-up. As a result, two groups can be created including those who continue and those who do not continue. Logistic regression model can be used in analyzing the data from these two groups with the goal of estimating the probability of continuation given the length of time. When a linear regression coefficient is estimated for a variable, the implication is that a unit change in the value should have the same effect on the output. This also occurs with independent binary variables but with ranked variables. Several gradients may occur as the variable moves through its series of ordinal categories. To overcome the linearity assumption, we have to expand the variable to a higher power before adding it to the model. This linearity assumption should be checked irrespective of the use of statistical techniques while the proportionality assumption is checked only in the case of Cox Proportional Hazard analysis. After an indepth understanding of each of these methods, Kleinbaum ([Kle96]) recommended that at least two of these methods should be adopted. Ingram and Kleinman ([IK89]) and Green and Symons ([GS83]) also examined the relationship between the results obtained from logistic regression and Cox models. Ingram and Kleinman ([IK89]) assumed that the true population distribution followed a Weibull distribution with a singular explanatory variable that took on two values, and that the distribution could be thought of as group membership. They concluded that the estimated regression coefficients were similar (same sign and magnitude) for logistic regression and Cox models when the patients were followed for a short period of time. They classified the cases as alive if they survived the follow-up period. They noted that for a short period, relatively few patients died. The range of survival times would be less for a longer period for those who died. But, as the length of follow-up increased, the logistic regression coefficients increased in magnitude whereas the coefficients for the Cox model remained the same. The estimates of the standard error for the Cox model decreased as the follow-up time advanced. Besides, the logistic regression coefficient became biased when there was greater censoring in one group than in the other, but the regression coefficients from the Cox model remained unbiased (50% censoring was used). Third, the estimated regression coefficients were similar for the two methods when the proportion of dying is small. That minor violation of the proportional hazards assumption had a small effect on the estimated coefficients for the Cox model. But for contraceptives, more people are likely to discontinue within a short period of time for post-enrolment. It is therefore essential, that biases inherent in the logistic model should be precluded given the fact that over time, the process of discontinuation stabilizes and several variables behave in different ways over time. Klein et al. ([KM97]) also proposed techniques for censored and truncated data in survival analysis.

3. METHODOLOGY

This research investigated the effect of family planning (use of contraceptives) on a woman's lifespan. The contraceptives used are injectibles, oral pills and IUCD. Data on life expectancy, contraceptive use and age were collected for the available years from 1995 to 2014. The resulting variables were tested for stationarity using Dickey-Fuller test (ADF). Regression models were developed for life expectancy on the use of contraceptives and age differences.

Assuming that a linear relationship exists between a variable Y and k explanatory variables $X_1, X_2, \ldots, X_k$ and a disturbance term, e with a sample of n-observations, then

$$Y_i = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki} + e_i \quad i=1,2,\ldots,n \qquad (1)$$

The Beta coefficients and the parameter of the e distribution are known and the problem is to obtain estimates of these unknowns, where;

β_0 =intercept.
$\beta_1, \ldots, \beta_k$ =partial slope coefficients.
e=stochastic disturbance term and *ith* observations being the size of the population.
Alternatively, this can be presented in matrix form;

$$\underset{n\times 1}{\begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}} = \underset{n\times(k+1)}{\begin{bmatrix} 1 & X_{11} & \ldots & X_{k1} \\ 1 & X_{12} & \ldots & X_{k1} \\ \vdots & \vdots & \vdots & \vdots \\ 1 & X_{1n} & \ldots & X_{kn} \end{bmatrix}} \underset{(k+1)\times 1}{\begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix}} + \underset{n\times 1}{\begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{bmatrix}} \quad (2)$$

Y = X β + e

where;
Y=n×1, column vector of observation on the dependent Y.
X= n×(k+1) matrix giving n observations on k+1 variables X_1 to X_k, the first column of 1's representing the intercept term (this matrix is also known as data matrix). β= (k+1)×1 column vector of parameters $\beta_0, \beta_1, \ldots, \beta_k$.
e= n×1 column vector of n disturbances, e_i.
Equation (2) can be set out compactly in matrix notation as

$$Y = X\beta + e \quad (3)$$

4. RESULTS AND DISCUSSION

The descriptive analysis was used to summarize the characteristic of the methods of family planning considered in this study with a view to showing the important features of each of the three selected family planning methods using time plots.

The time plot presented in Figure 1 showed a short-term movement of the value in the family planning method series in different direction over a period of 20 years under consideration. This movement is characterized by a sinusoidal increase in the values of the injectable methods over the period of time. This movement is referred to as secular variation or secular movement. By fitting a straight line freely by hand on the plotted points on the time plot for injectable revisit and injectable current stretching over the period, this plotted point forms a line and this line is the trend of the time plot for injectable series. The above time plot also indicates that the revisit injectable is highly accepted than the current injectable over the years.
The time plot for IUCD given in Figure 2 showed a short-term movement in the family planning method series in different direction over the period of 20 years under consideration. By fitting a straight line freely by hand on the plotted points on the time plot for IUCD stretching over the period, this plotted point forms a line and this line is the trend of the time plot for IUCD's. The above time plot also indicates that the revisit IUCD is highly accepted over the selected years.
The time plot presented in Figure 3 for Oral-pill showed a short-term movement of the value of the family planning method series in different direction over the period of 20 years considered. This movement is characterized by a sinusoidal increase in the values of the Oral-pill over the period of time and this also showed a sinusoidal increase in the value of Oral-pill in the selected years in Nigeria. The above graph also indicated that the revisit Oral-pill method was highly accepted over current Oral-pill except for the year of 1998.

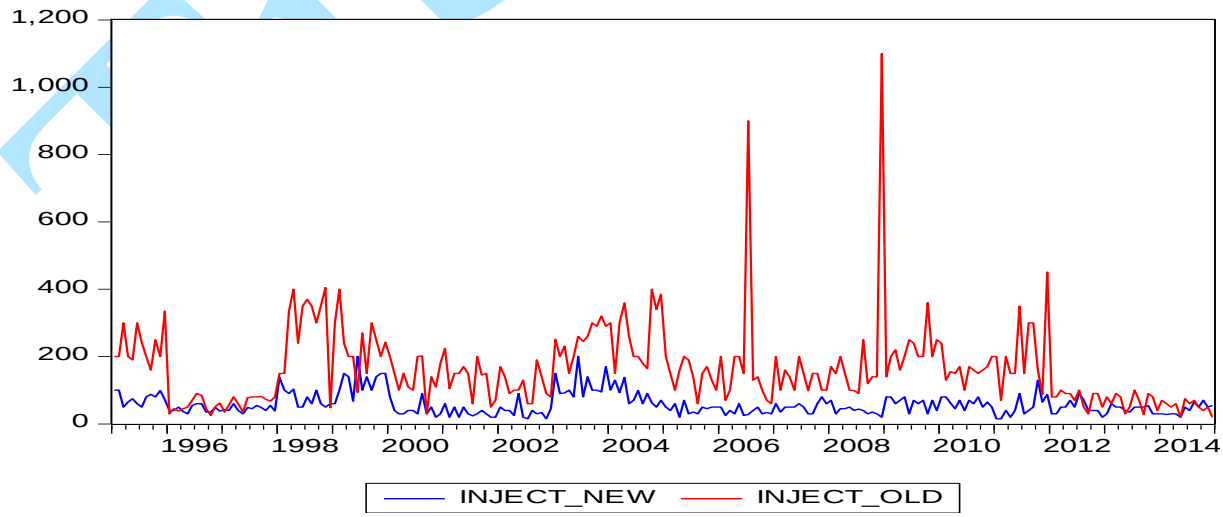

Figure 1: Time plot of contraceptive (Injectibles) for the period 1995-2014

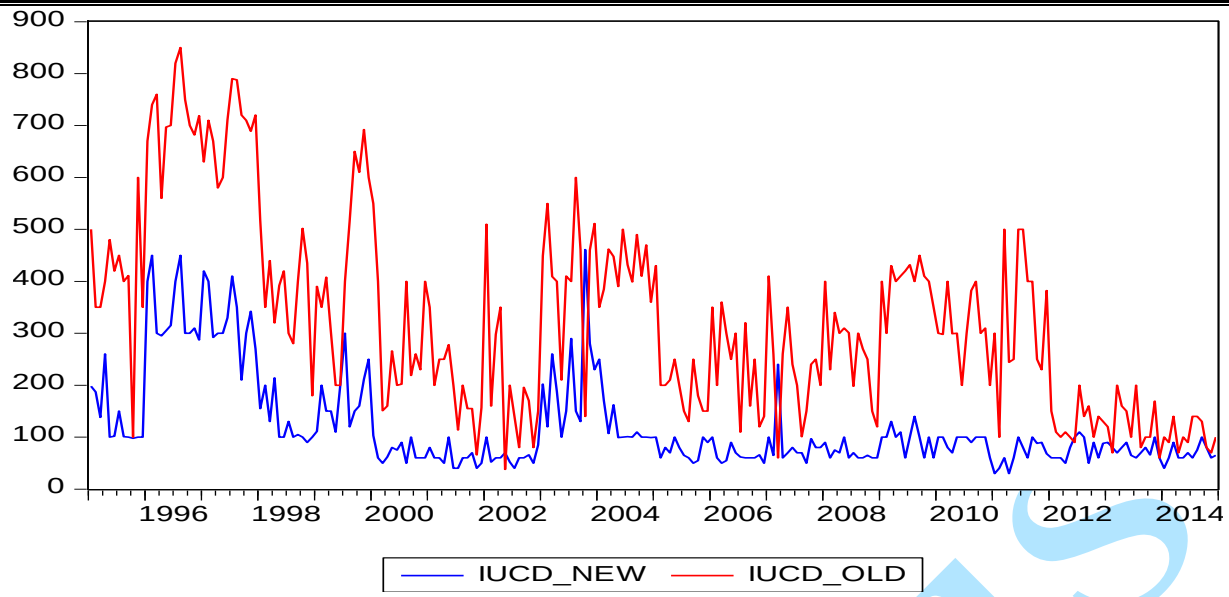

Figure 2: Time plot for IUCD for the period 1995-2014

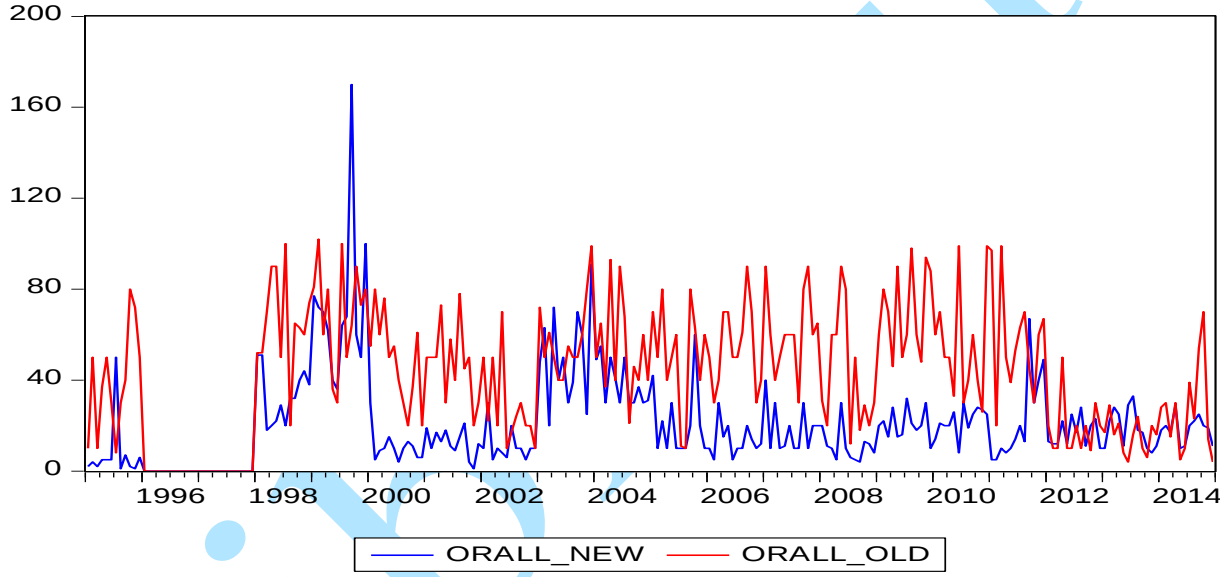

Figure 3: Time plot for Oral Pills for the period 1995-2014

To avoid running a spurious regression, a stationary test was carried out to ensure that all the variables are mean reverting. That is, they have constant mean, constant variance and constant covariance. The Augmented Dickey-Fuller ADF test was used for this analysis in order to adjust for serial correlation. The test was done with the following hypothesis:

Null hypothesis (H_1): Variable contains unit root and hence is non-stationary.

Alternative hypothesis (H_0): Variable does not contain unit root and hence is stationary.

Decision rule: If the calculated A-D-F test statistic is greater than the MacKinnon critical values A (both in the absolute term) at the chosen level of significance, reject the null hypothesis of nonstatonarity and accept the alternative hypothesis of stationarity, otherwise we retain the null hypothesis of non-stationarity. The results are summarized in Table 1 below.

The results presented in Table 1 showed that all the variables were stationary at first difference. Therefore, this evidence suggests that first differencing is sufficient in modelling the problem in this study.

Table 1: Results of Augmented Dickey-Fuller -ADF Unit Root Test

Variables	ADF Statistics	Critical values	Order of Integration
Life Expectancy	-4.413	-4.309	I(1)
Injectibles	-6.699	-4.296	I(1)
Oral Pills	-4.586	-4.356	I(1)
IUCD	-6.542	-4.296	I(1)
Age	-4.028	-3.58	I(1)

Table 2: Output of Regression Analysis

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Constant	-0.577519	1.21509	-0.4753	0.64729	
Injectibles	0.0192445	0.0087129	2.2087	0.0582	*
Oral Pills	5.28E-07	2.51E-07	2.0991	0.06904	*
IUCD	-0.0123188	0.0130538	-0.9437	0.03725	**
Age	0.926949	0.107341	8.6355	0.00003	***

Mean dependent var	2.021429	S.D. dependent var	0.56864
Sum squared resid	0.278626	S.E. of regression	0.186623
R-squared	0.933717	Adjusted R-squared	0.89229
F(5, 8)	22.53887	P-value(F)	0.000161
Log-likelihood	7.553459	Akaike criterion	-3.106917
Schwarz criterion	0.727427	Hannan-Quinn	-3.461856
Rho	0.229769	Durbin-Watson	1.464704

The model obtained is given as:

$$Women\ Lifespan = -0.5775 + 0.0192Inj - 0.00000052Oral - 0.0123IUCD + 0.9269Age \quad (4)$$

From the fitted model in equation (4), the three variables such as injectibles, oral pills and IUCD are statistically significant. It also proved a goodness of fit test as the calculated F-statistics showed that all the variables in the model are simultaneously significant at the 5% critical level. The estimated coefficient of determination revealed that 93.37% (represented by 0.9337) of the total variation in life expectancy is accounted for by the use of contraceptives (Injectibles, Oral Pills and IUCD) and age with other variables in the stochastic term accounting for the remaining 6.63% of variations in women lifespan.

5. CONCLUSION

The results obtained indicate that the method of contraceptives and age are statistically significant for predicting women life span. The estimated coefficient of determination also revealed that only 93.37% of the total variation in life expectancy was accounted for by the use of contraceptive (injectable, Oral, pills and IUCD) and age with other variables in the expectancy. The Durbin-Watson statistics estimated also showed that the fitted model was not spurious. The study therefore concludes that that the independent variables explain the women lifespan substantially and recommends the need to provide aggressively family planning education, so that people can understand the use, cope with it, take control and develop survival skills.

REFERENCES

[GS83] **Green M. S., Symons M. J.** – *A comparison of the logistic risk function and the proportional hazards model in prospective epidemiologic studies*. Journal of Chronic Disease, 36, 715-721, 1983.

[IK89] **Ingram D. D., Kleinman J. C.** – *Empirical comparisons of proportional hazards and logistic regression models*. Statistics in Medicine. 1989; 8(5):525–538, 1989.

[Kle96] **Kleinbaum D. G.** – *Survival Analysis: A Self-Learning Text*, Springer, New York, 1996.

[KM97] **Klein J. P., Moeschberger M. L.** – *Survival Analysis Techniques for Censored and Truncated Data*, Springer, New York, 1997.

[Ola09] **Olaitan A. S.** – *Contraceptive Use: Implication for Completed Fertility, Parity Progression and Maternal Nutritional Status in Nigeria*. Afr. J. Reprod. Health, 15(4): 60, 2009.

[WHO13] **World Health Organization** – *Fact File about Diabetes*. Retrieved from www.who.int/topics/diabetes/facts/world_figures/en/, 2013.

[***90] ******* – *NDHS, Nigeria Demography Health Survey*, 1990.