

# Statistical Analysis of Factors Affecting the Weight of Babies at Birth

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**Abstract:** This research work studied statistically those factors which determine the weight of a baby at birth. The data used in this research work was collected from the Prenatal and Postnatal Register of Ebonyi State University Teaching Hospital Abakaliki, Nigeria. The data covered all births recorded from January 2009 to December 2013. Factors which determine birthweight are numerous but for this work, variables of greater influence were considered which include: Mother's age, Parity, Method of Delivery and the Sex of the baby. By Chi-square Test Statistics, it was observed that the birthweight of a baby depends on the sex of the baby with a calculated value 12.14 and a critical value 7.81 0.5 level of significance. Also the method of delivery of a baby also proved to be a significant factor affecting birthweight with a calculated 50.90 and a critical value 12.6 By Chi-Square Test also, the mother's age and parity shown not to be significant factors affecting birthweight with Chi-Square values 1.90, 1.001 and critical values of 12.6 and 7.81 The Z-Test Statistic was also applied to test for the significance difference between the mean birth weigh of male and female babies and it yielded a calculated value 6.48 and a critical value 1.96 at 0.5 level of significance which indicates that there is a significant difference between the mean birthweights of sex of the babies. Also by Z-Test also, method of delivery proved to be a significant factor affecting birthweight with a calculated value 5.41 and a critical value 1.96. Time Series Analysis was also employed to obtain the seasonal variations between the sex of babies and it was observed that more female babies are born during the third quarter and more male babies are born during the fourth quarter of the year. Also by Least Square Method of Regression Analysis, it was predicted that in the year 2014, the total number of male and female birth will be 140 and also in the year 2015, the total number of male and female birth will be 141.

**Keywords:** Low Birthweight, Parity, Caesarian Section, Chi-Square, Trend Line, Prediction, Seasonal Variations

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## 1. Introduction

This Birthweight is the weight of a baby at its birth. It has a direct link with the gestational age at which the baby was born and can be estimated during pregnancy by measuring the feudal height. The factors affecting birthweight are those factors which determine the weight of a baby at its birth. The study of factors affecting birthweight has been extensively and systematically studied in many parts of the world. A few studies relating to Nigeria merely gave an average weight for children born in the different parts of the world. The knowledge of the factors affecting birthweight in any community is of utmost importance not only to a layman but also to the government for policy making, gynecologist and

pediatricians. Invariably, this study was set out to investigate those factors which appear to have effect on the birthweight of babies born in Ebonyi State University Teaching Hospital Abakaliki Nigeria.

Some of the variables that affect birthweight are:

- a Gestational age (Duration of pregnancy).
- b Number of children born before the last birth (Parity)
- c Age of the mother at the birth of the baby
- d Sex of the baby
- e Method of delivery of the baby
- f Head circumference of the baby
- g Length of the baby
- h Multiple birth
- i Socio-economic status of the parents

j Nutritional state of the mother during pregnancy etc.

Classification of babies by weight and gestational period

- a Low birthweight (LBW) babies are those weighing below 2500g at birth.
- b Extremely Low Birthweight (ELBW) babies are those weighing under 100g at birth
- c Very Low Birthweight (VLBW) babies are those weighing below 500g at birth

The study of birth weight measurement has been with us for many decades, numerous studies have been carried out to find the relationship between birth weight and other variables such as the maternal age, birth order or parity, socio-economic status of parents and so on. The consensus has been that infants with low birth weight were generally gestational premature and Low birthweight (LBW) has been defined by WHO as weight at birth of less than 2.5 kg. The World Health Organization also recommended the use of birthweight as a measure of prematurity in babies. [1-2]. A study of Impact of maternal nutrition on birth weight of babies has revealed the influence of maternal nutritional status on newborn birthweight and particularly low birth weight (LBW) and has shown that maternal nutritional status impacted significantly on newborn birthweight as poorly nourished mothers were observed to produce a higher percentage of LBW babies in comparison to those who were better nourished [3]. Also a study on Risk Factors Associated with Low Birth Weight Babies in Eastern Nepal revealed that maternal height, time of first antenatal care (ANC) visit, number of ANC visits, iron supplementation, calcium supplementation, maternal education, any illness during pregnancy, and hypertension were found as the significant predictors of LBW [4]. A study on maternal Determinants of birthweight has shown that pre-pregnancy body mass index and weight gain during pregnancy influence birthweight. Therefore, emphasis should be placed on counseling and assisting pregnant women to stay within the recommended weight gain ranges [5]. The prenatal period is an important one for both mother and the fetus. The child's endowments at birth depends wholly on the genetic make-ups of the mother and other factors like the birth process, medical interventions, social, emotional and physical factors of the environment. Some of the causes of prematurity in babies includes: multiple pregnancies, fetal abnormalities, maternal malnutrition, drugs taken by the mother (including nicotine and alcohol) during pregnancy, placental abnormalities, infection, maternal disease such as hypertension and structural or endocrine abnormalities in the mother [6-7]. A study on Maternal Dietary Patterns and Practices and Birth Weight in Northern Ghana has shown that Mothers who practiced good nutrition such as consuming foods across and within the various food groups were less likely to have low birth weight babies. Their findings buttress the importance of optimal nutrition during pregnancy [8]. A recent study on Air pollution, neighbourhood and maternal-level factors modify the effect of smoking on birth weight in British Columbia, Canada has also proved that Maternal smoking during pregnancy negatively impacts fetal growth [9].

Since birthweight is an index of growth of the fetus in the

uterus, it will help the obstetricians and pediatricians to plan on how the next pregnancy should be handled. It will also help to determine the fate of the mother in the subsequent pregnancies as it can decide whether the mother will deliver through a caesarian section or not.

References can also be made to the following papers who have worked in this area in the same regards: Khader YS, and Fa AN Q. (200) [10], Hold Chris and Mac Donald Anita(2007) [11], Shino et al (2006) [12], Queenan(1999) [13], Dalby (1978) [14], Robertson(1999) [15] etc.

Motivation of study

Birthweight is one of the most important variable of concern to many governments in developing countries as it contributes to infant mortality rate. Factors affecting birthweight should be of interest to all as its knowledge will help to reduce child-mother mortality rate in the world.

Five variables collected for the analysis include:

- a Weight of baby at birth
- b Sex of the baby
- c Age of the mother
- d Parity
- e Method of delivery
- f This study seeks to achieve the following objectives:
- g Determine if the sex of the child has an effect on the child's birthweight.
- h If the mother's parity has an effect on the child's birthweight.
- i If the mother's age has an effect on the child's birthweight.
- j If the method of delivery of the child has an effect on the child's birthweight.

Hypothesis of Interest

1.  $H_0$ : There is no association between birthweight and the mother's parity.
2.  $H_0$ : There is no association between birthweight and the mother's age.
3.  $H_0$ : There is no association between birthweight and the method of delivery.
4.  $H_0$ : There is no association between birthweight and the sex of the child

## 2. Research Methodology

### 2.1. Chi-Square Test Statistic

The Chi-Square Test Statistic is to be employed in this analysis to test the null hypothesis of the association/independence between birthweight and the sex of baby, mother's age, method of delivery and parity.

$$\chi^2_{cal} = \sum_{i=1}^r \sum_{j=1}^c \frac{(n_{ij} - E_{ij})^2}{E_{ij}} \quad (1)$$

with (r-1)(c-1) degrees of freedom

Where

$n_{ij}$  = The observed frequency in the  $i$ th row and  $j$ th column.

$E_{ij}$  = The expected frequency in the  $i$ th row and  $j$ th column.  
 $r$  = Number of rows.  
 $c$  = Number of rows and  
 If the calculated value  $\chi^2_{cal}$  is greater than the table value  $\chi^2_{(r-1)(c-1)}$ , the null hypothesis of independence is rejected at some level of significance  $\alpha$  or otherwise accepted.

**2.2. Test of Significant Differences Using the Z-Test Statistic**

The Z-Test statistic will be used here to test if there is any significant difference between the hypotheses drawn. And if there is, at what level of significant does it differ. The modernized Z-Test that will be used for this analysis is:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} \tag{2}$$

Which after will be compared with the Z- tabulated at  $Z_{\alpha/2}$  degrees of freedom.

**2.3. Method of Time Series**

Time series is a set of statistical data which is observed, recorded or collected at uniform intervals of time. It has the model:

$$Y_t = T_t + S_t + C_t + I_t \text{ (Additive Model)} \tag{3}$$

Where  
 $T_t$  is the trend.  
 $S_t$  is the seasonal variation.  
 $C_t$  is the cyclical variation.  
 $I_t$  is the irregular variation.

**2.4. Least Square Method of Regression Analysis (Matrix Approach)**

Using the least square method to estimate the trend line, we have that

$$Y_i = \alpha + \beta_i + e_i \quad i = 1, 2, \dots, n \tag{4}$$

Using the matrix approach of solving least square equation, we have that;

$$\begin{pmatrix} \alpha \\ \beta \end{pmatrix} = \begin{pmatrix} n & \sum t \\ \sum t & \sum t^2 \end{pmatrix}^{-1} \begin{pmatrix} \sum Y_i \\ \sum tY_i \end{pmatrix} \tag{5}$$

Where  
 $n$  = Number of period  
 $t$  = Time Unit  
 $Y_t$  = Estimated tend value for a given time period  
 $\alpha$  = The trend line value  $t = 0$   
 $\beta$  = The slope of the trend line i. e the change in  $Y_t$  per unit

of time

**3. Result**

**3.1. Chi-Square Analysis**

*Table 1. Group weight of babies at birth by sex.*

Birthweight	Sex		Total
	Male	Female	
0.65-1.54	55(39.97)	91(106.03)	146
1.55-2.44	47(44.90)	17(119.10)	164
2.45-3.34	71(83.23)	233(220.77)	304
3.35-4.24	14(18.89)	55(50.11)	69
Total	187	496	683

The expected frequencies are those enclosed in brackets  
 $H_0$ : There is no association between birth weight and sex of babies.

$H_1$ : There is an association between the birth weight and sex of babies

$$\chi^2_{cal} = 12.14$$

At  $\alpha=0.05$ ,  $\chi^2_{(4-1)(2-1)} = \chi^2_{(3,0.05)} = 7.81$

Decision: Since the  $\chi^2_{cal} = 12.14 > \chi^2_{(3,0.05)} = 7.81$ , the null hypothesis is rejected which implies that there is an association between the birth weight sex of babies.

*Table 2. Group weight of babies at birth my mother's parity.*

Birthweight	Parity		Total
	1-4	5 & above	
0.65-1.54	134(133.48)	14(14.51)	148
1.55-2.44	148(145.21)	13(15.79)	161
2.45-3.34	274(275.98)	32(30.02)	306
3.35-4.24	60(61.33)	8(6.68)	68
Total	618	67	683

$H_0$ : There is no association between birth weight and mother's parity.

$H_1$ : There is an association between the birth weight and mother's parity

$$\chi^2_{cal} = 1.001$$

At  $\alpha=0.05$ , the table value  $\chi^2_{(4-1)(2-1)} = \chi^2_{(3,0.05)} = 7.81$

Decision: Since the  $\chi^2_{cal} = 12.14 < \chi^2_{(3,0.05)} = 7.81$ , the null hypothesis is accepted which implies that there is no association between the birth weight and mother's parity.

*Table 3. Group weight of babies at birth by mother's age.*

Birthweight	Age			Total
	10-20	21-30	31 & Above	
0.65-1.54	25(18.51)	77(81.57)	45(46.91)	147
1.55-2.44	23(20.40)	98(89.89)	41(51.72)	162
2.45-3.34	28(38.40)	171(169.25)	106(97.35)	305
3.35-4.24	10(8.69)	33(38.29)	26(22.02)	69
Total	86	379	218	683

H<sub>0</sub>: There is no association between birth weight and mother's age.

H<sub>1</sub>: There is an association between the birth weight and mother's age

$$\chi^2_{cal} = 11.15$$

At a=0.05,  $\chi^2_{cal} = 11.15 < \chi^2_{(6,0.05)} = 12.6$ ,

Decision: Since the  $\chi^2_{cal} = 11.15 < \chi^2_{(6,0.05)} = 12.6$ , the null hypothesis is accepted meaning that there is no association between birth weight and mother's age.

Table 4. Group weight of babies at birth by method of delivery.

Birthweight \ Mtd of Delivery	Normal delivery	Caesarian section	Multipl & other Mtds of delivery	Total
0.65-1.54	79(108.04)	45(23.24)	23(15.72)	147
1.55-2.44	117(120.54)	27(25.93)	20(17.53)	164
2.45-3.34	256(222.70)	25(47.91)	22(31.49)	303
3.35-4.24	50(50.71)	11(10.91)	8(7.37)	69
Total	502	108	73	683

H<sub>0</sub>: There is no association between birth weight and method of delivery.

H<sub>1</sub>: There is an association between the birth weight and method of delivery

$$\chi^2_{cal} = 50.90$$

At a=0.05,  $\chi^2_{(6,0.05)} = 12.6$

Decision: Since the  $\chi^2_{cal} = 50.90 > \chi^2_{(6,0.05)} = 12.6$ , the null hypothesis is rejected which implies that there is an association between the birthweight and method of delivery of a child.

3.2. Z-Test of Significant Difference Between the Mean-Birthweight of Sex of Baby

H<sub>0</sub>: There is no significant difference between the mean-birthweight of sex of babies i.e ( $\mu_1 = \mu_2$ )

H<sub>1</sub>: There is a significant difference between the mean-birthweight of sex of babies i.e ( $\mu_1 \neq \mu_2$ )

Table 5. Z-Test for birthweight against the sex of babies.

SEX	N	Mean	Variance
MALE	187	2.21	0.74
FEMALE	496	2.45	0.68

$$Z = \frac{2.45 - 2.21}{\sqrt{\frac{0.74}{187} + \frac{0.68}{496}}} = \frac{0.24}{\sqrt{0.005328186993}} = \frac{0.24}{0.0370} = 6.48$$

Decision: Since  $Z_{cal} = 6.48 > 1.96$ , Hence the null hypothesis is rejected which implies that there is a significant difference

between the mean birth weights of sex of the babies.

Table 6. Z-Test for weight against the method of delivery.

Method of delivery	N	Mean	Variance
Normal	502	2.49	0.62
Caesarian	108	2.01	0.85

H<sub>0</sub>: There is no significant difference between the meant weight of babies born through normal delivery and those borne through Caesarian method of delivery.

H<sub>1</sub>: There is a significant difference between the meant weight of babies born through normal delivery and those borne through Caesarian method of delivery

$$Z = \frac{2.49 - 2.01 - 0}{\sqrt{\frac{0.62}{502} + \frac{0.85}{108}}} = \frac{0.48}{\sqrt{0.001235 + 0.00787}} = \frac{0.48}{\sqrt{0.00910543}} = \frac{0.48}{0.0887} = 5.41$$

At  $\alpha = 0.05$ ,  $Z_{0.025} = 1.96$

Decision: Since  $Z_{cal} = 5.41$  is greater ( $>$ )  $Z_{\alpha/2} = 1.96$ , hence, the null hypothesis is rejected which implies that there is a significant difference between the mean weight of babies born through normal delivery and those borne through Caesarian method of delivery.

3.3. Time Series Analysis

Table 7. Number of male birth between the years 2009 to 2013.

MONTHS	2009	2010	2011	2013	2013
JAN	3	2	3	3	4
FEB	3	2	3	3	5
MARCH	3	4	3	5	4
APRIL	4	2	2	2	3
MAY	1	2	4	3	3
JUNE	4	2	4	3	3
JULY	2	4	3	3	3
AUG.	4	3	3	3	4
SEPT.	3	2	2	3	4
OCT.	2	2	4	3	4
NOV.	4	3	3	3	5
DEC.	2	2	1	3	5
TOTAL	35	30	35	39	48

**Table 8.** Number of female birth between the years 2009 to 2013.

MONTHS	2009	2010	2011	2012	2013
JAN	7	9	8	6	9
FEB	8	7	6	5	8
MARCH	10	7	10	6	10
APRIL	7	8	11	6	10
MAY	12	11	10	6	11
JUNE	8	7	7	5	9
JULY	8	9	7	8	7
AUG.	7	9	8	6	9
SEPT.	8	10	7	6	7
OCT.	11	9	10	7	7
NOV.	9	9	8	8	10
DEC.	10	10	10	8	10
TOTAL	105	105	102	77	107

**Table 9.** Computation of Seasonal Variation of male birth from the year 2009 to 2013 using the Ratio-to-Moving Average Method.

Years	QTRS	Acute value	4-Qtr moving total	8-Qtr. Moving total	Centered 8-Qtr M. A (trend)	Seasonal variation
2009	1 <sup>st</sup> Qtr	9	-	-	-	-
	2 <sup>nd</sup> Qtr	9	35	-	-	-
	3 <sup>rd</sup> Qtr	9	34	69	8.63	104.29
	4 <sup>th</sup> Qtr	8	31	65	8.13	98.40
2010	1 <sup>st</sup> Qtr	8	31	62	7.75	103.23
	2 <sup>nd</sup> Qtr	6	30	62	7.75	77.42
	3 <sup>rd</sup> Qtr	9	31	62	7.75	116.13
	4 <sup>th</sup> Qtr	7	35	66	8.25	84.85
2011	1 <sup>st</sup> Qtr	9	34	69	8.63	104.29
	2 <sup>nd</sup> Qtr	10	35	69	8.63	115.87
	3 <sup>rd</sup> Qtr	8	37	72	9.00	88.89
	4 <sup>th</sup> Qtr	8	35	74	9.25	86.49
2012	1 <sup>st</sup> Qtr	11	37	74	9.25	118.92
	2 <sup>nd</sup> Qtr	8	39	76	9.50	84.21
	3 <sup>rd</sup> Qtr	10	41	80	10.00	100.00
	4 <sup>th</sup> Qtr	10	42	83	10.38	96.34
2013	1 <sup>st</sup> Qtr	13	44	85	10.63	122.30
	2 <sup>nd</sup> Qtr	9	48	91	11.38	79.09
	3 <sup>rd</sup> Qtr	12	-	-	-	-
	4 <sup>th</sup> Qtr	14	-	-	-	-

Computation of seasonal index

N/B: We eliminate the irregular variations in order to obtain the seasonal index. This is done by averaging the seasonal variations for each quarter.

**Table 10.** Computed Seasonal Index.

Year	Quarters				Total
	1	2	3	4	
2009	-	-	104.29	98.40	-
2010	103.23	77.42	116.13	84.85	-
2011	104.23	115.87	88.89	86.49	-
2012	118.92	84.21	100	96.34	-
2013	122.30	79.09	-	96.34	-
Total	448.68	356.59	409.31	366.08	-
Quarterly Average	112.17	98.15	102.33	91.52	404.17

To adjust the seasonal index  $x$  to total 400, we introduce a constant  $K$  by multiplying each quarterly average by  $K$

$$\text{Where } K = \frac{400}{\text{Total quarterly average}} = \frac{0.99}{404.17}$$

For Qtr 1, the adjusted seasonal index =  $112.19 \times 0.99 = 111.01$

For Qtr 2, the adjusted seasonal index =  $98.15 \times 0.99 = 97.17$

For Qtr 3, the adjusted seasonal index =  $102.33 \times 0.99 = 101.31$

For Qtr 4, the adjusted seasonal index =  $91.52 \times 0.99 = 90.60$

**Table 11.** Adjusted Seasonal Index for male birth.

Adjusted seasonal index	Quarters				Total
	111.01	97.17	101.31	90.60	
Adjusted seasonal index	111.01	97.17	101.31	90.60	400.00

From the result above, the quarter that has the highest seasonal variation is the 1<sup>st</sup> quarter with a seasonal index of 113.56. This means that more male babies were born in the months of January, February and March. Also the 2<sup>nd</sup> quarter has the least seasonal variation with 90.24, which implies that less male babies were born in the months of April, May and June.

**Table 12.** Computation of Seasonal Variation of Female birth from the year 2009 to 2013 using the Ratio-to-Moving Average Method.

Years	QTRS	Acute value	4-Qtr moving total	8-Qtr. Moving total	Centered 8-Qtr M. A (trend)	Seasonal variation
2009	1 <sup>st</sup> Qtr	25	-	-	-	-
	2 <sup>nd</sup> Qtr	27	105	-	-	-
	3 <sup>rd</sup> Qtr	23	103	208	26.00	88.46
	4 <sup>th</sup> Qtr	30	102	205	25.63	117.05
2010	1 <sup>st</sup> Qtr	23	107	209	26.13	88.02
	2 <sup>nd</sup> Qtr	26	105	212	26.5	98.11
	3 <sup>rd</sup> Qtr	28	106	211	26.38	106.14
	4 <sup>th</sup> Qtr	28	108	214	26.75	104.67
2011	1 <sup>st</sup> Qtr	24	102	210	26.25	91.43
	2 <sup>nd</sup> Qtr	28	102	204	25.5	109.80
	3 <sup>rd</sup> Qtr	22	95	197	24.63	89.32
	4 <sup>th</sup> Qtr	28	84	179	22.38	125.11
2012	1 <sup>st</sup> Qtr	17	82	166	20.75	81.93
	2 <sup>nd</sup> Qtr	17	77	159	19.88	85.51
	3 <sup>rd</sup> Qtr	20	87	164	20.5	97.56
	4 <sup>th</sup> Qtr	23	100	187	23.38	98.37
2013	1 <sup>st</sup> Qtr	27	103	203	25.38	106.38
	2 <sup>nd</sup> Qtr	30	107	210	25.38	115.92
	3 <sup>rd</sup> Qtr	23	-	-	-	-
	4 <sup>th</sup> Qtr	27	-	-	-	-

Computation of seasonal index

The irregular and cyclic variations are eliminated by averaging the seasonal variations for each quarter in order to obtain the seasonal index.

**Table 13.** Computed Seasonal Index.

Year	1 <sup>st</sup> Qtr	2 <sup>nd</sup> Qtr	3 <sup>rd</sup> Qtr	4 <sup>th</sup> Qtr	Total
2009	-	-	88.46	117.05	-
2010	88.02	98.11	106.14	104.67	-
2011	91.43	109.80	89.32	125.11	-
2012	81.93	85.51	97.56	98.37	-
2013	106.38	115.92	-	-	-
Total	367.76	409.34	381.48	445.2	-
Quarterly Average	91.99	102.34	95.37	111.3	401

To adjust the seasonal index, we introduce  $K$

Where  $K = \frac{400}{\text{Total quarterly average}} = \frac{400}{401} = 0.9975$

For Qtr 1, the adjusted seasonal index =  $91.99 \times 0.9975 = 91.76$

For Qtr 2, the adjusted seasonal index =  $102.34 \times 0.9975 = 102.08$

For Qtr 3, the adjusted seasonal index =  $95.37 \times 0.9975 = 95.13$

For Qtr 4, the adjusted seasonal index =  $111.33 \times 0.9975 = 111.02$

Table 14. Adjusted Seasonal Index for female birth,

	Quarters				Total
Adjusted seasonal Index	91.76	102.08	95.13	111.02	399.99

Here, the adjusted seasonal index is 399.99, which is approximately 400.

From the table above, the 4<sup>th</sup> quarter has the highest seasonal effect with 111.02 seasonal index which implies that more female babies were born in the months of October, November and December. Also the 1<sup>st</sup> quarter has the least seasonal effect with 91.76 seasonal index, which implies that less female babies were born in the month of January, February and March.

### 3.4. Estimation of Trend Line Using the Least Square Method of Regression Analysis

Table 15. Total number of male and female birth between the years 2009 to 2013.

Year	Total birth
2009	140
2010	135
2011	137
2012	116
2013	155
Total	683

Table 16. Estimated Trend Values.

Year	t	Y <sub>t</sub>	t Y <sub>t</sub>	t <sup>2</sup>	Y <sub>t</sub> <sup>2</sup>	Trend
2009	1	140	140	1	19600	134.4
2010	2	135	270	4	18225	135.5
2011	3	137	411	9	18769	136.6
2012	4	116	464	16	13456	137.7
2013	5	155	775	25	24025	138.8
Total	15	683	2060	55	94075	

$$\begin{pmatrix} \alpha \\ \beta \end{pmatrix} = \begin{pmatrix} 5 & 15 \\ 15 & 55 \end{pmatrix}^{-1} \begin{pmatrix} 683 \\ 2060 \end{pmatrix}$$

$$\alpha = \frac{37565 - 30900}{50} = \frac{666.5}{50} = 133.3$$

$$\beta = \frac{10300 - 10245}{50} = \frac{55}{50} = 1.1$$

The predicted line  $Y_t = 133.3 + 1.1(t)$

For t = 1

$$Y_t = 133.3 + 1.1(1) = 134.4$$

For t = 2

$$Y_t = 133.3 + 1.1(2) = 135.5$$

For t = 3

$$Y_t = 133.3 + 1.1(3) = 136.6$$

For t = 4

$$Y_t = 133.3 + 1.1(4) = 137.7$$

For t = 5

$$Y_t = 133.3 + 1.1(5) = 138.8$$

For t = 6

$$Y_t = 133.3 + 1.1(6) = 139.9$$

Also

For t = 7

$$Y_t = 133.3 + 1.1(7) = 140$$

This implies that in the year 2014, the total number of male and female birth will be 139.9 which is approximately 140 and also in the year 2015, the total number of male and female birth will be 141.

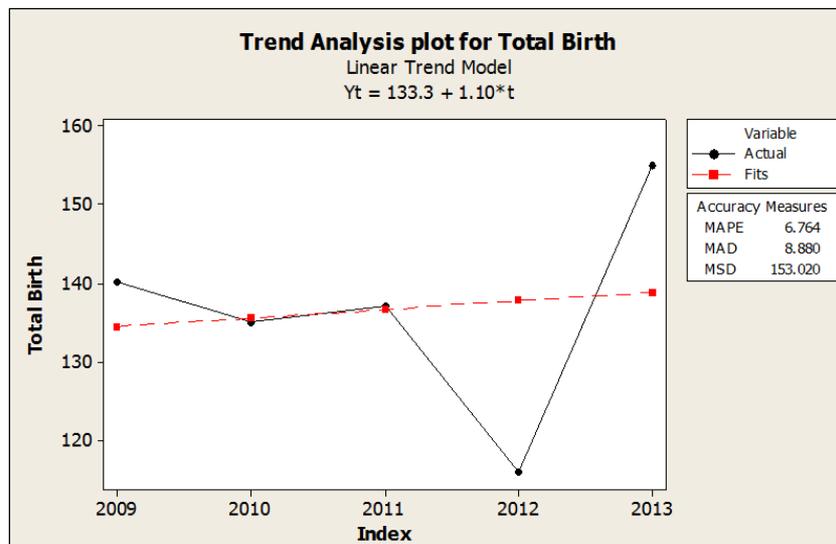


Figure 1. Original time series and trend line fitted by the method of least square.

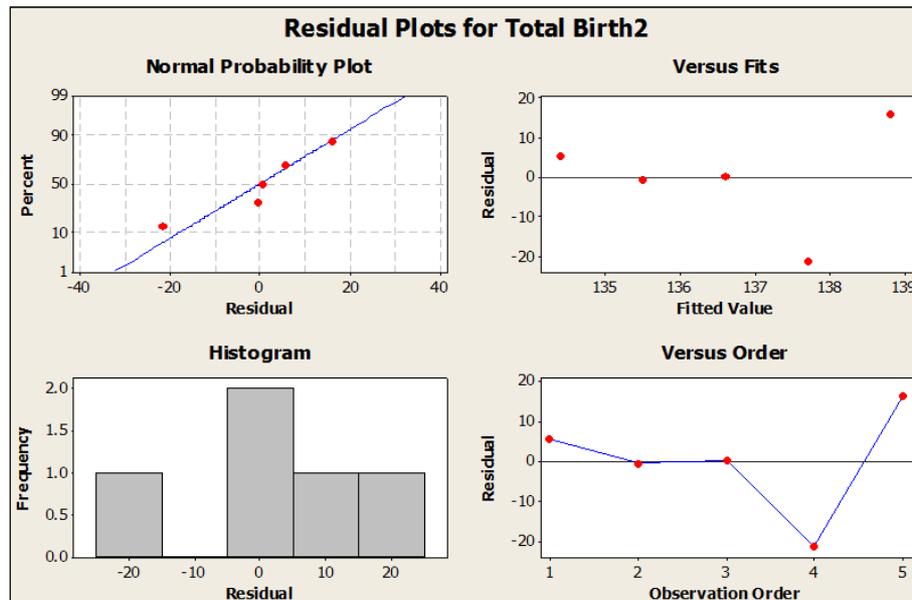


Figure 2. Residual plots of the observed and fitted values.

## 4. Discussion

The essence of this research work is to satisfactorily analyze the factors affecting birthweight at Ebonyi state university teaching hospital Abakaliki Nigeria. There is a clear indication that the number of female babies born in this hospital is far more than their male counterpart within the researcher's scope of year. From the hypothesis, we concluded that the null hypothesis is significant 0.05 levels, which means that the baby's birthweight is dependent upon their sexes. When the data were classified by the age of the mother, the highest birthweight was recorded for children born to women aged 21-30 years, from this peak the birthweight decreased progressively on both sides of the age scale. From the hypothesis the null hypothesis is not significant meaning that there is no association between birthweights and age of the mothers. From the result obtained in the analysis of birthweight and parity, the highest weight was recorded for the length interval 1-4. From this peak, the weight of babies at birth decreased signifying that the number of births delivered previously by mother determines the weight of subsequent births, from the hypothesis tested we concluded that the null hypotheses was significant at 0.05 level which means that there is no association or relationship between birth weight and parity and that the birth weight of a baby is not dependent upon the mother's parity.

Finally, there is an indication that method of delivery has an effect on the birthweight of babies. Though the number of children born through spontaneous vertex delivery that is through (normal process) is higher than babies delivered through caesarean section (C/S), multiple and other methods of delivery but from the hypothesis drawn, we concluded that the null hypothesis is not significant, that is, the method of delivery of a child depends on the weight of baby.

## 5. Conclusion

The analysis of some of the factors affecting birthweight at EBSUTH Abakaliki Nigeria has been presented in the tables above.

In absolute terms, it was found in this work that the mean weight of male babies is less than that of the female babies.

However, when this difference in weights were subjected to a statistical test, it was found that there is a significant difference between the mean birthweight of male and female babies born in EBSUTH Abakaliki between the year 2009 to 2013. Sex was found to be a major significant factor affecting the birthweight of babies which was also discovered by Yokoyama et al (2005) in an analysis of factors affecting birthweight of babies. Also It was found in this work that the method of delivery was also a significant factor affecting the birthweight of babies because there is a significant difference between the mean birthweight of babies delivered normally and those delivered through caesarian section. It was discovered from this study that, sex of babies, method of delivery are the factors affecting the birthweight of babies born in EBSUTH Abakaliki by the use of chi-square.

Finally, it was observed in this work by times series analysis that more male babies are born in the months of January, February and march i.e the first quarter and less male babies are born in the months of April, may and June i.e second quater. Also more male babies were born in the months of October, November and December i.e third quater and that less female babies were born in the months of January, February and March which imply that season has a greater effect on the sex of babies born EBSUTH Abakaliki Nigeria. Also by Least Square Method of Regression Analysis, it was predicted that in the year 2014, the total number of male and female birth will be 140 and also in the year 2015, the total number of male and female birth will be 141.

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