

Statistical Analysis of Vehicular Registration in Lagos, Nigeria Based on Ownership and Type

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Abstract

This paper examined the vehicular registration in Lagos state, Nigeria between the years 1998-2015. Time series analysis was employed to analyze the data, to compute the seasonal variation and fluctuations in the number of motor vehicles that was registered between the periods of 16 years in the state. The least square method was also used in forecasting the number of vehicles that will be registered in the next 10years in the state. It was discovered that the number of private, commercial and government registered vehicles will be increased over the years. . Based on the fact of the analysis made, we were able to conclude that the rate at which vehicles were registered in Lagos – State fluctuates over the time.

Keywords: Vehicles; Licensing stations; time series; National Motor Vehicle Administration Agency.

1. Introduction

Vehicle registration in Nigeria began over 100 years ago, the record have been essentially manual, which in turn has not helped to raise efficiency of general or automotive services in recent years [1]. Today computer has been discovered as a very efficient instrument, which has played a very significant role in adequate management of information. Every vehicle kept or used on public roads must be registered and an appropriate vehicle license fee must be paid in respect. This is done by applying for a motor vehicle license. The board of internal revenue which is known to be the revenue division of the ministry of finance is the authority responsible for the insurance of vehicle in the state.

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This board has motor licensing in various local government areas and the licensing offices in the various local government areas gives the monthly report to the state board [2]. The vehicles owner is required to go through several government agencies to completely have a license to ply the vehicle on roads. National agencies such as; National Motor Vehicle Administration Agency (NMVAA), Federal Road Safety Corps (FRSC), and Vehicle Inspection Officers (VIO) [3]. Lagos State Commissioner for Transportation has exempted all private vehicles from obtaining its compulsory number plates before plying the state roads. It announced that private and commercial vehicles in the state would be mandated to use the state's number plates. Number-plates are unified all over the federation. The state never made any pronouncement that vehicles with other states' number plates had been banned from plying Lagos roads, only vehicles operating as commercial public transport will have to obtain the state's number plates before being allowed to operate in and on Lagos roads. This is necessary to enable the government to have adequate information about such vehicles and also to ensure the safety and security of residents [4].

2. Materials and method

Time series can be defined as the recording or measurement of variable over a period of time. It is also described as a qualitative forecasting technique which uses forms of mathematical or statistical analysis on past data arranged in a chorological order. It has been a veritable tool applied in various fields like Agriculture, Engineering, Business and Economics, Geophysics, Medical Science, Quality Control, Statistics and Social Science etc [5].

2.1 Model in time series

Additive Model: This can be written mathematically as;

$$X_t = T_t + S_t + C_t + I_t \quad (1)$$

Then its seasonal variation at time t is;

$$S_t = X_t - T_t \quad (2)$$

Multiplicative Model: This can also be written mathematically as;

$$X_t = T_t \cdot S_t \cdot C_t \cdot I_t \quad (3)$$

And its seasonal variation at time t is; $S_t = X_t / T_t$ Where;

X_t is the original observation

T_t is the trend movement

S_t is the seasonal movement

C_t is the cyclical movement

I_t is the irregular movement

2.2 The least Square Method

The least square estimates a curve that approximately fits a given data point by minimizing the sum of the square errors or deviation from the mean. A linear relationship between the given sets of data points Y_t and some independent variables (t) must be sufficiently established before the least square method can be used to estimate the trend line T [6]. If a linear relationship exists between the time series values, Y_t and time t then the linear method is given as;

$$Y_t = a + bt + e_t \tag{4}$$

$t = 1, 2, 3, \dots$

where;

a = the intercept of the Y axis. b = slope, e_t = error term

The general formula for estimating the trend line is given below;

$$b = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2} \tag{5}$$

3. Results

3.1 Based on Ownership

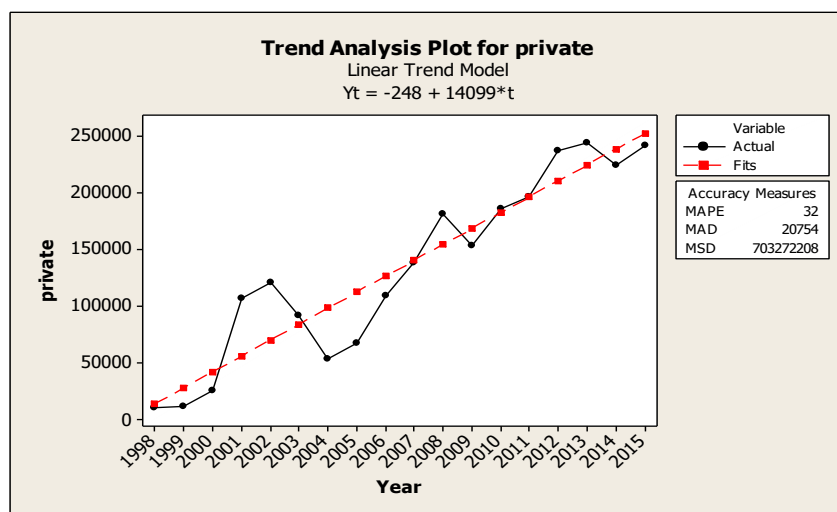


Figure 1: Graph of private owned vehicles

Interpretation: the number of private registered vehicles increases by 14099 except for a very sharp decrease in 2005.

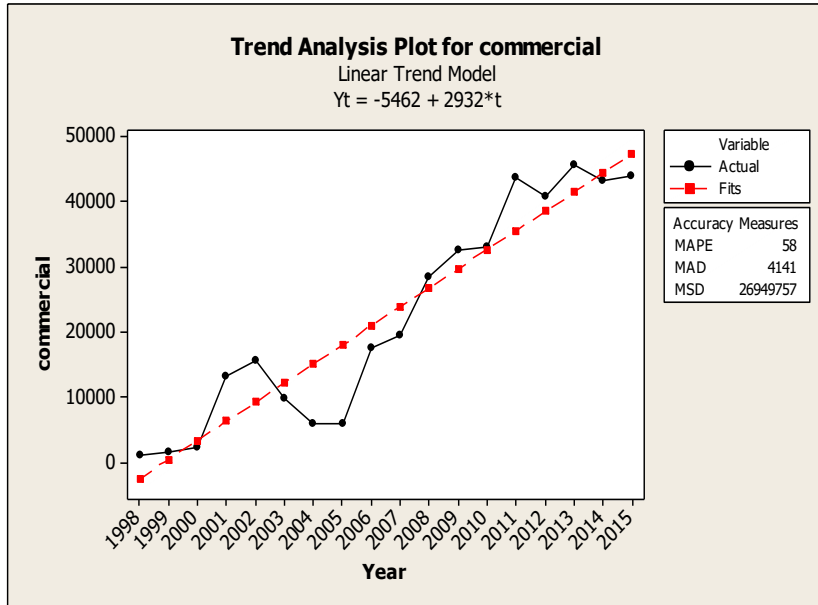


Figure 2: Graph of commercial owned vehicles

Interpretation: the number of commercial registered vehicles increases by 2932 except for a very sharp fall in 2003 and 2004.

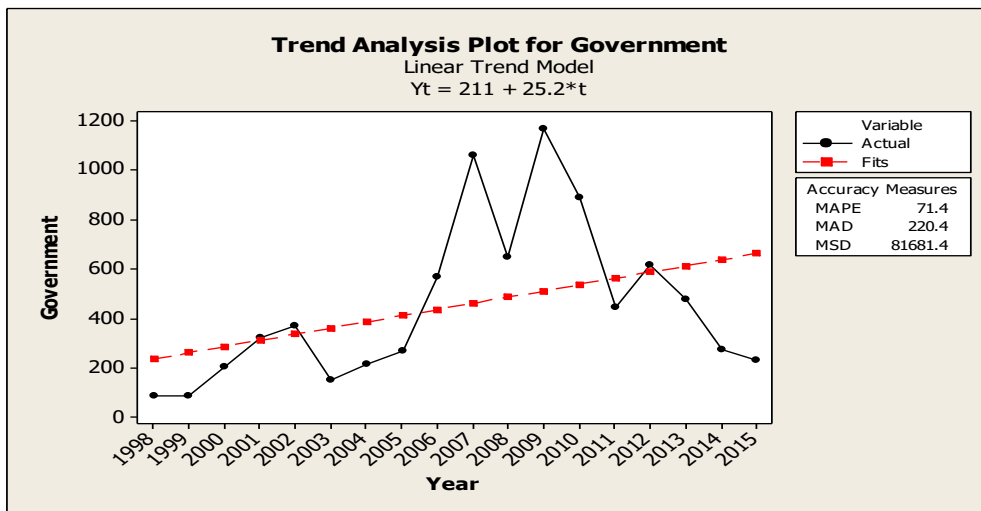


Figure 3: Graph of Government owned vehicles

Interpretation: the number of government registered vehicles increases by 25.2 and decreases in year 2013, 2014 and 2015.

3.2 By Type

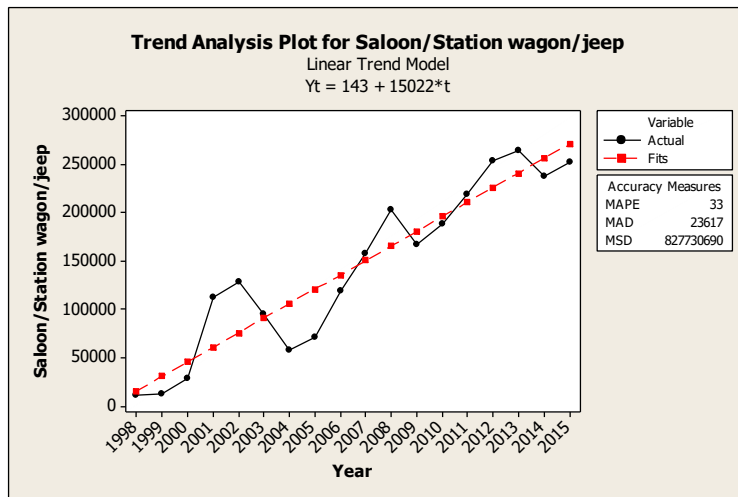


Figure 4: Graph of saloon, station wagon and jeep type of vehicle

Interpretation: the cumulative of saloon, station wagon and jeep type of vehicles increases by 15022 except for a very sharp fall in 2003 and 2004.

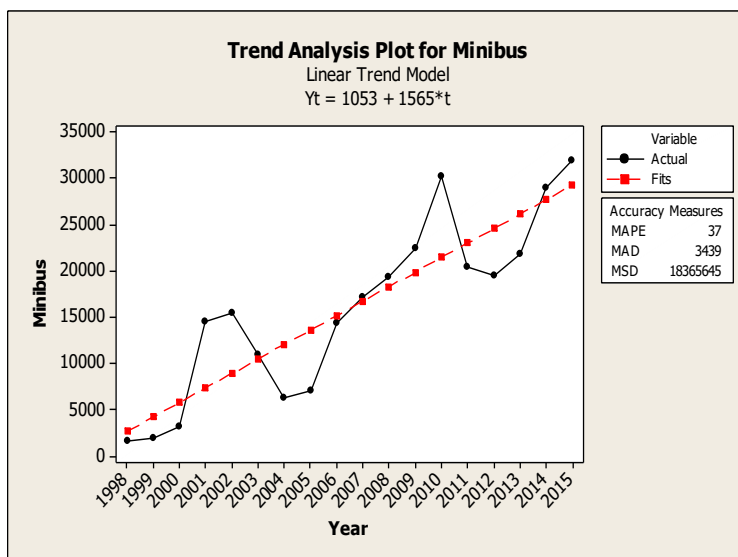


Figure 5: Graph of Minibus vehicles

Interpretation: the number of Minibus type of vehicle increase by 1565 except for a very sharp fall in 2004 and 2011.

3.3 Trend Table

$$T_t = a + bt$$

Seasonal Variation

$$S_t = X_t - T_t \text{ (Additive Model)}$$

Forecast, Forecasting = $a + bt$

Table 1: Table for private owned vehicles

Year	Private(Y_t)	T	Trend(T_t)	Seasonal(S_t)
1998	10073	1	13851	-3778
1999	11260	2	27950	-16690
2000	25944	3	42049	-16105
2001	107555	4	56148	51407
2002	121646	5	70247	51399
2003	91669	6	84346	7323
2004	53322	7	98445	-45123
2005	67246	8	112544	-45298
2006	109436	9	126643	-17207
2007	138592	10	140742	-2150
2008	181632	11	154841	26791
2009	153781	12	168940	-15159
2010	186429	13	183039	3390
2011	196987	14	197138	-151
2012	237697	15	211237	26460
2013	245332	16	225336	19996
2014	225361	17	239435	-14074
2015	242,456	18	253534	-11078

Table 2: Commercial

T	Year	commercial(Y_t)	Trend(T_t)	Seasonal(S_t)
1	1998	1057	-2530	3587
2	1999	1544	402	1142
3	2000	2270	3334	-1064
4	2001	13078	6266	6812
5	2002	15651	9198	6453
6	2003	9700	12130	-2430
7	2004	5879	15062	-9183
8	2005	5766	17994	-12228
9	2006	17446	20926	-3480
10	2007	19484	23858	-4374
11	2008	28425	26790	1635
12	2009	32490	29722	2768
13	2010	32978	32654	324
14	2011	43641	35586	8055
15	2012	40758	38518	2240
16	2013	45668	41450	4218
17	2014	43198	44382	-1184
18	2015	43,965	47314	-3349

Table 3: Government

T	Year	Government(Y_t)	Trend(T_t)	Seasonal(S_t)
1	1998	87	236.2	-149.2
2	1999	86	261.4	-175.4
3	2000	204	286.6	-82.6
4	2001	320	311.8	8.2
5	2002	373	337	36
6	2003	148	362.2	-214.2
7	2004	216	387.4	-171.4
8	2005	268	412.6	-144.6
9	2006	571	437.8	133.2
10	2007	1061	463	598
11	2008	651	488.2	162.8
12	2009	1170	513.4	656.6
13	2010	892	538.6	353.4
14	2011	445	563.8	-118.8
15	2012	618	589	29
16	2013	478	614.2	-136.2
17	2014	274	639.4	-365.4
18	2015	231	664.6	-433.6

Analysis by type

Table 4: Saloon/Station Wagon/Jeep

T	Year	Saloon/Station wagon/jeep(Y_t)	Trend(T_t)	Seasonal(S_t)
1	1998	10529	15165	-4636
2	1999	12104	30187	-18083
3	2000	27729	45209	-17480
4	2001	112600	60231	52369
5	2002	127446	75253	52193
6	2003	95326	90275	5051
7	2004	57826	105297	-47471
8	2005	70496	120319	-49823
9	2006	118099	135341	-17242
10	2007	156858	150363	6495
11	2008	202042	165385	36657
12	2009	166207	180407	-14200
13	2010	188515	195429	-6914
14	2011	218528	210451	8077
15	2012	253404	225473	27931
16	2013	264286	240495	23791
17	2014	236873	255517	-18644
18	2015	252,497	270539	-18042

Table 5: Table for Minibus

T	Year	Minibus(Y_t)	Trend(T_t)	Seasonal(S_t)
1	1998	1573	2618	-1045
2	1999	1920	4183	-2263
3	2000	3175	5748	-2573
4	2001	14529	7313	7216
5	2002	15469	8878	6591
6	2003	10897	10443	454
7	2004	6292	12008	-5716
8	2005	6988	13573	-6585
9	2006	14290	15138	-848
10	2007	17124	16703	421
11	2008	19244	18268	976
12	2009	22351	19833	2518
13	2010	30232	21398	8834
14	2011	20420	22963	-2543
15	2012	19424	24528	-5104
16	2013	21807	26093	-4286
17	2014	28859	27658	1201
18	2015	31,950	29223	2727

From the estimation of the time series components, trend was used to normalize the trend which gives a varying or different regression equation over the categories of vehicles registered over the period e.g. Private owned vehicles has a trend of $T_t = -248 + 14099(t)$ which shows that the number of private owned vehicles registered in Lagos State over the period increased by 14099 while that of commercial increased by 2932 and that of government by 25.2. And this makes private registered vehicles the most registered vehicle under vehicles registered by ownership. The trend analysis was obtained and the graph shows an irregular variation also, the prediction shows fluctuations in the future occurrence. From the estimation of the time series components, trend was used to normalize the trend which gives a varying or different regression equation over the categories of vehicles registered over the period e.g. Private owned vehicles has a trend of $T_t = -248 + 14099(t)$ which shows that the number of private owned vehicles registered in Lagos State over the period increased by 14099 while that of commercial increased by 2932 and that of government by 25.2. And this makes private registered vehicles the most registered vehicle under vehicles registered by ownership. The trend analysis was obtained and the graph shows an irregular variation also, the prediction shows fluctuations in the future occurrence.

4. Conclusion and Recommendations

From the time series analysis that was carried out, we can see that time series is a good statistic for analysing

vehicular registration data. Relevant predictions can be made which serves as a link to the future and the influence of statistics have been spread to all areas of life because of its usefulness and refuge in its operations.

Furthermore, we could see that the use of trend to forecast is an example of what statisticians could call adaptive forecast prediction. The Lagos state government should employ competent hands in the registration exercise so as to avoid fraudulent act and also enhance their registration data base for more accurate and precise estimate of registered vehicles. The Government should also use the data on the estimate of vehicles registered to improve the state roads and also strikes balance between ratios of good road networks to registered vehicles and vehicles in use in the country so as to reduce traffic on the state roads. And there should be an improved scheme whereby the Government provides a suitable, comfortable and conducive public transportation to reduce the number of private owned vehicles plying her roads to reduce traffic congestions and can also serve as source revenue for the country.

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