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An application to multivariate analysis for GSRTC DATA

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ABSTRACT

Gujarat State Road Transport Corporation (GSRTC) is the chief transportation service provider in Gujarat. Since 1963 GSRTC is doing loss. In terms of economics this devisor of Gujarat state is operated for providing services to the population at least cost and due to that it is doing loss. This research is carried out based on secondary data sets for the year 2005 to 2016 for selected 16 depots of GSRTC. These depots are located at district places. The study is aimed to constructed basic models to estimate the variable affected to the margin money (loss) to GSRTC. It can also help to estimate the future value studies for making fruitful strategies. This research is carried out construction of normality and necessary transformations to derive best conclusions.

1. Introduction

Starting late, observational research in budgetary perspectives has been progressed by the openness of a wealth of new wellsprings of data: cross time. The openness of board data has vivified a quick advancement in both methodological systems and applications starting late. What is all around insinuated as the board data approach to manage fiscal research gives a couple of important central focuses over standard cross-sectional or time-course of action data approaches. This energizes the improvement and testing progressively reasonable social models that couldn't be recognized using only a cross fragments or a lone time-course of action enlightening record. Regardless, the availability of new data sources raises new issues. On the other hand it justifies focusing on that the wealth of two-dimensional data has potential for making better enlistment concerning either time-course of action or cross-portion approaches.

2. Pooled Panel Regression

Board or Panel data examination is a procedure to concentrate on particular subject inside various areas, irregularly observed over a described time length. Inside the sociological, board examination has enabled masters to grasp longitudinal examinations in a wide grouping of fields. In money related issues, board data examination is used to consider the lead of firms and wages of people after some time. For example In political theory, it is used to look at political lead of social affairs and relationship after some time. It is used as a piece of cerebrum look into, human science, and prosperity investigation to consider characteristics of social events of people took after as time goes on. In informational research, pros analyze classes of understudies or graduates after some time.

With reiterated impression of enough cross-portions, board examination enables the researcher to consider the components of advancement with brief time game plan. The mix of time game plan with cross-regions can update the quality and measure of data in manners that would be extraordinary using only a solitary of estimations of model. Board examination can give a rich and extreme examination of a plan of people, in case one will consider both the existence estimation of the data.

The advantages of using board data: In brief the indispensable ideal conditions of board data are as following.

1. More observations are generally available, especially concerning time course of action data.
2. The capacity to recognize and isolate between generous amounts of fighting hypotheses. This takes after from the manner in which that we watch the equivalent fiscal units as time goes on.
3. The capacity to control for vaguely heterogeneity at the dimension of the individual.

We underline that board data bear the expense of the best approach to explore even more totally the possibility of the inert, or subtly, disrupting impact terms in econometric associations. In what tails we will use the word individual in a nonexclusive sense, where the usage of the term particular effect will insinuate the quantifiable effect of the cross-sectional unit of discernment, paying little mind to whether this be a firm, a country, a zone, or a man.

Board data examination favors back slide examination with both a spatial and brief estimation. The spatial estimation identifies with a course of action of cross-sectional units of discernment. These could be countries, states, areas, firms, items, social events of people, or even individuals. The transient estimation identifies with irregular view of a plan of variables depicting this navigate a particular time cross.

A best case of a board data is a gathering of states for which there are similar parameters influences the promoting, for example, deal amid the year, piece of the overall industry secured by firm, piece of the pie for outside items, altruism load of publicizing, normal fleet held, normal fleet worked and absolute income of firm. This pooled informational index, in some cases called time arrangement cross-sectional information, contains an aggregate of 16*12= 192 perceptions.

3. Regular Panel Structure

Board enlightening lists generally join progressive pieces or cross-regions of data, inside all of which carries on a period game plan. An ordinary board enlightening gathering, including states, piece of the pie secured by firm, piece of the pie for outside items, generosity load of publicizing, normal armada held, normal armada worked and all out income of firm and different parameters under investigation. The structure of board structure can be built and introduced pursues.

Beside the variable number, the data structure presents upon the components two estimations. They have a cross-sectional unit of observation, which for this circumstance are states. They have a passing reference for this circumstance the year. The screw up term has two estimations, one for the states and one for the year.

TABLE1 PANEL DATA STRUCTURE

	Effective KM	No. of Passengers	Total EPKM	Total CPKM	Loss
Palanpur 2005	824.56	982.42	964.31	1031.01	549.99
Mahesana	964.59	1408.38	923.92	1111.4	1808.41
Himmatnagar	845.07	1146.57	924.82	1098.4	1466.8
Ahmedabad	884.6	900.37	956.96	1205.98	2202.92
Palanpur 2006	853.2	975.73	995.48	1174.05	1523.25
Mahesana	999.47	1350.92	956.69	1256.7	2998.41
Himmatnagar	868.52	1076.3	965.84	1233.08	2321.06
Ahmedabad	930.89	794.41	981.28	1316.92	3124.36
Palanpur 2007	843.83	885.83	1070.51	1291.85	1864.75
Mahesana	952.81	1027.92	1090.2	1409.36	3041.02
Himmatnagar	838.79	672.89	1130.24	1389.84	2177.61
Ahmedabad	856.61	657.49	1132.07	1518.58	3310.87

(Source: GSRTC Data Book)

In this outline, anticipate that there are three states and three years of time. In spite of the way that time is settled inside the cross-zone in this delineation, Lios Syrs (1988) creates that under a couple of conditions the cross-regions may be settled inside time. If there are no missing regards, the instructive list is known as a balanced board, yet if there are missing regards, the enlightening accumulation is implied as a disproportionate board.

4. Panel Equation

The basic panel model is formed for cross sectional and year base parameters and is presented as:

$$Y_{it} = \varphi_t + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \varepsilon_{it}$$

The study model can be structured on ground of the model can be constructed as:

$$\text{Loss}_{it} = \varphi_t + \beta_1 \text{Effective KM} + \beta_2 \text{No. of Passangers} + \ \ldots\ldots + \varepsilon_{it}$$

here, Loss = margin money, Effective KM = total effective kilometers, total number of passangers travelled and ε_{it} presents total error in the model, the stated equation presents only three variables taken under study. The construction of model presented with support of total 12 variables of which are independent and loss as a dependent variable in productive models is presented for pooled panel analysis. There are a couple of sorts of board data descriptive models. There are enduring coefficients models, settled effects models, and discretionary effects models. Among these sorts of models are dynamic board, solid, and covariance structure models.

Answers for issues of heteroskedasticity and autocorrelation are of eagerness here. We will endeavor to diagram a bit of the obvious pieces of this kind of methodology, yet first we need to consider the data structure. One kind of board show has reliable coefficients, insinuating the two gets and slants. On the off chance that there is neither enormous country nor immense transient effects, we could pool most of the data and run a standard least squares backslide illustrate. Yet as a general rule there is either country or common effects, there are occasions when neither of these is truthfully basic. This model is every so often called the pooled backslide appear. The researchers have created pooled relapse models for gathered data about the GSRTC related information for transportation of 16 depots of Gujarat. The proposed pooled boards demonstrate is developed as pursues for further investigation.

5. GSRTC Panel Model

The GSRTC panel model for selected 12 variables for 16 depots are compiled in form of model is presented as follows:

$$\begin{aligned} \text{Loss} = \varphi + \beta_1 \text{Effective KM} + \beta_2 \text{No. of Passangers} \\ + \beta_3 \text{Total EPKM} + \beta_4 \text{Total CPKM} \\ + \beta_5 \text{Load Factor} + \beta_6 \text{Vehical Utilized per Day} \\ + \beta_7 \text{ Fleet Utilization} + \beta_8 \text{Crew Utilization} \\ + \beta_9 \text{ Diesel KMPL } + \beta_{10} \text{ Engine Oil KMPL} \\ + \beta_{11} \text{ Breakdown} + \beta_{12} \text{ Accidents} \end{aligned}$$

The productive model is examined for the incremental effect of margin money (loss) and virtual variables contributions on loss or margin for Gujarat state for ten years-2005 to 2016. This analysis examines the erection and comparative meaning of the strictures that effect diversities in GSRTC in Gujarat. This research is commenced by pleasing yearly time series data from 2005 to 2016 for 16 districts of Gujarat which asylums advanced improvement in total margin money of GSRTC. An application of pooled panel regression is used for study.

6. Application to GSRTC Data of Gujarat State:

The pooled panel regression model is examining from the exhaustive structure of effect of group responses on inequality of margin money for 16 districts of Gujarat state and the productive exemplary statistics is exist in table 2.

Table 2: Pooled Panel OLS, using 192 observations Included 176 cross-sectional units, Dependent variable: Loss

	Coeff.	*SE*	*z*	*p-value*	
Const. (a)	3806.39	5212.75	0.7302	0.4653	
Effective KM	1.66520	1.07666	1.547	0.1220	
No of Passengers	0.348032	1.14985	0.3027	0.7621	
Total EPKM	1.57102	0.502093	3.129	0.0018	***
Total CPKM	−0.00083255	0.0616289	−0.01351	0.9892	
Load Factor	15.7447	66.9143	0.2353	0.8140	
Vehicle Utilized per Day	−0.0155573	0.0416458	−0.3736	0.7087	
Fleet Utilization	0.390948	0.364001	1.074	0.2828	
Crew Utilization	−17.5240	2.02454	−8.656	<0.0001	***
Diesel KMPL	−301.033	384.044	−0.7838	0.4331	
Engine Oil KMPL	−0.0189930	0.124516	−0.1525	0.8788	
Break Down	−0.0577827	0.0183904	−3.142	0.0017	***
Accidents	−1.11793	2.55752	−0.4371	0.6620	

Mean dependent var	2322.137	S.D. dependent var	1762.642
Sum squared resid	5.30e+08	S.E. of regression	1720.833
R-squared	0.106759	Adjusted R-squared	0.046877
F(12, 1)	−1.95e+10	P-value(F)	0.00
Log-likelihood	−1696.214	Akaike criterion	3418.428
Schwarz criterion	3460.775	Hannan-Quinn	3435.579
Rho	0.032690	Durbin-Watson	1.926781

The basic of constructed pooled panel regression model on actual data is presented in table 2. The calculation is made based on the 12 independent variables on margin money (loss) as a dependent variable. The model summery shows that the mean of dependent variable is 2322.14 with standard deviation 1762.64 and the R^2 is calculated 0.10, which shows poor correlation among the variables. It shows the explained variation between the variables as 1% ($R^2 = (0.10)^2 = 0.01 =$ 1%) explained variation between the group variables and 100-1% = 99% variation due to other impacted variables or due to errors in model between the variables. The Durbin-Watson (D-W test) value is 1.93, the general significance of Durbin-Watson can be significant if it calculated between -2 and 2. The obtained value of Durbin-Watson test shows 1.93, which shows higher significance and best fit value for model. The standard value of error is found 1720 with least p-value (0.00). The p-value is computed significant, thus the compiled standard error is considered as least value for model. It is necessary to test the normality of residual with reference to testing null hypothesis that error is normally distributed. The p – value for F statistic is very lower (−1.95e+10), lower the value of F-statistics fail to rejects the null hypothesis that the error is normally distributed. The error disturbance in the model is present but rest of the measures can satisfy the criteria. It indicates that the variance between the observations is very high and they highly correlated with independent variable. The high variability between the observations can justify the model.

Table 2 presented the construction of model which is now shows final format of construction of estimated constant (a) = -3806.39, constant or slope values of the formed function and rest latent variables with co-efficient values of each are compiled as follows:

$$\begin{aligned}\text{Loss} = {} & 3806.39 + 1.66\ \text{Effective KM} + 0.35\ \text{No. of Passangers} \\ & + 1.57\ \text{Total EPKM} - 0.0008\ \text{Total CPKM} \\ & + 15.74\ \text{Load Factor} \\ & - 0.016\ \text{Vehical Utilized per Day} \\ & + 0.39\ \text{Fleet Utilization} \\ & - 17.52\ \text{Crew Utilization} \\ & - 301.03\ \text{Diesel KMPL} \\ & - 0.019\ \text{Engine Oil KMPL} - 0.058\ \text{Breakdown} \\ & - 1.12\ \text{Accidents}\end{aligned}$$

The model runs for testing the sigma value and error value in accordance to all selected twelve parameters. The final model is presented as above. The result of regression model shows that the effective KM, total number of passengers, total earning per kilometer, total load factor and total fleet utilization have highly positive impact on margin money (loss) of GSRTC. The total cost per kilometer, vehicle utilized per day, crew utilization, diesel used per kilometer, engine oil used per kilometer, break down and total number of accidents have highly negative impact on margin money (loss). The positive impact of variables on negative slope shows cross relation to the model and negative values of the parameters have positive relation to the model.

It is concluded that negatively affected parameters should be improved to take out the GSRTC from the higher loss. The positive impact variables are supporting GSRTC for betterment. The unit has to try to manage the proportion of their sharing or it must be balanced for long lasting improvement. The results of model statistics are also justify the best fit results to the model. The values of testing the model are Log-likelihood, Schwarz criterion (BIC), Akaike criterion (AIC) and Hannan-Quinn.

Statistically, when the restricted variables have major impact on model it or they should be removed from the process to estimate the best fit model for the results. On other hand practically it is not possible to remove the effect of the parameters from the actual study. The pooled panel models presented above is presented the impact of all 12 variables. The first constructed model shows that majority of parameters having negative impact on margin money of GSRTC. The effected parameters should be removed from the process for better results. But practically, the variables cannot be removed from the process. The insignificant values of variable may cause due to any other statistical error. Thus, it is required to check the available information with normality of data. The nature of data should be follows to the conditions of normality, and if it is not normally behaved than applications of transformations are required to test. The next section of study is discussed with transformations of the collected information in terms of natural logarithm, square root and taking proportion of the data to one.

7. Transformation

Suitable alteration to improve the inconsistency can be used with methodical acquaintance or nominated for data taken under study. Three alterations that are often effective for leveling the normality through the data of the conjecturer parameters the supportive alterations or transformations is data to proportion to one (1/Y).

Other alterations can be measured, but in a wider range of studies these three alterations produced best fit results for pooled panel data. The said transformation is computed and tested to conclude the results for pooled panel data structure and its impact on model to check it for best fit on margin money (loss) for selected 16 depots of GSRTC.

A nonlinear alteration changes linear relations between variables and have modifications to the values of correlation among parameters. These methods need to be tested on total margin money and can be seen in the model that increases rather than reduction the linearity of the affiliation between the variables. Testing the effect of a transformation method involves looking at amount of grit. It is highly required to test the outline for errors for model to recognize their impact on model. The transformations are tested for dependent variable margin money for 12 expounding variables in terms of proportion to one. The compiled results are presented as follows:

7.1 TRANSFORMATION – (1 / Y)

The transformation is taken for observation is proportion of the values towards one. The results after transforming the pooled panel data are presented in table 3 as follows:

Table 3 Pooled Ordinary Least Square, using 192 observations Included 176 cross-sectional units, Dependent variable: Loss

	Coeff.	*Std. Error*	*z*	*p-value*	
Const (a)	0.302	0.0208	14.47	<0.0001	***
Effective KM	0.73	0.448	1.616	0.1061	
No. of Passengers	0.028	0.185	0.1529	0.8785	
Total EPKM	0.29	0.283	1.019	0.3081	
Total CPKM	0.55	0.593	0.9223	0.3564	
Load Factor	0.32	0.430	0.7385	0.4602	
Vehicle Utilized per Day	−0.11	0.189	−0.5993	0.5490	
Fleet Utilization	−0.079	0.151	−0.5248	0.5997	
Crew Utilization	−0.76	0.209	−3.646	0.0003	***
Diesel KMPL	−0.17	0.0667	−2.570	0.0102	**
Engine Oil KMPL	0.068	0.0998	0.6821	0.4952	
Break Down	−0.12	0.0154	−7.770	<0.0001	***
Accidents	−0.089	0.103	−0.8629	0.3882	

Mean dependent var	0.304244	S.D. dependent var	0.021936
Sum squared resid	0.049761	S.E. of regression	0.016673
R-squared	0.458581	Adjusted R-squared	0.422285
F(12, 1)	0.013532	P-value(F)	0.009
Log-likelihood	520.3330	Akaike criterion	−1014.666
Schwarz criterion	−972.3186	Hannan-Quinn	−997.5150
rho	0.230759	Durbin-Watson	1.469391

The basic of constructed pooled panel regression model on proportion of one to all listed data is presented in table 3. The calculation is made based on the 12 independent variables on margin money as a dependent variable. The model summery shows that the mean of dependent variable is 0.3041 with standard deviation 0.0219. The R^2 is 0.45, which shows good correlation among the variables. It shows the explained variation between the variables as 20.25% ($R^2 = (0.45)^2 = 0.2025 = 20.25\%$) explained variation between the group variables and 100 - 20.25% = 79.75% variation due to other impacted variables or due to errors in model between the variables. The Durbin-Watson value is 1.46. The Durbin-Watson can be significant if it calculated between -2 and 2. The obtained value of Durbin-Watson test shows 1.46, which shows higher significance and best fit value for model. The standard value of error is found 0.017 with least p-value (0.009). The p-value is computed significant, thus the compiled standard error is considered as least value for model. It is necessary to test the normality of residual with reference to testing null hypothesis that error is normally distributed. The p – value for F statistic is very high (0.01353), higher the value of F-statistics rejects the null hypothesis that the error is normally distributed. The error disturbance model is present but rest of the measures can satisfy the criteria. It indicates that the variance between the observations is very high and they highly correlated with independent variable. The high variability between the observations can justify the model.

Table 3 presented the construction of model which is now shows final format of construction of estimated a = 0.302, constant or slope values of the formed function and rest latent variables with co-efficient values of each are compiled as follows:

$$\begin{aligned}\text{Loss} = \ & 0.302 + 0.73\ \text{Effective KM} + 0.028\ \text{No. of Passangers} \\ & + 0.29\ \text{Total EPKM} + 0.55\ \text{Total CPKM} \\ & + 0.32\ \text{Load Factor} \\ & - 0.11\ \text{Vehical Utilized per Day} \\ & - 0.079\ \text{Fleet Utilization} \\ & - 0.079\ \text{Crew Utilization} - 0.17\ \text{Diesel KMPL} \\ & + 0.068\ \text{Engine Oil KMPL} - 0.12\ \text{Breakdown} \\ & - 0.089\ \text{Accidents}\end{aligned}$$

The model runs for testing the sigma value and error value in accordance to all selected twelve parameters. The final model is presented as above. The result of regression model shows that the total cost per kilometer is improved. It shows that improvement in operating cost can increase the margin value of GSRTC. Majority of the parameters are improved with effect to the GSRTC model. The normality compare to the actual data is fluctuating.

The results of model statistics are also justify the best fit results to the model. The values of testing the model are Log-likelihood, Schwarz Criterion (BIC), Akaike Criterion (AIC) and Hannan - Quinn is taken for comparison for best fit of the model.

8. Comparison

This study evaluates basic understanding of panel structure model and necessary transformations for the constructed data. Each of the models is constructed as per their statistical significance. The pooled panel model is run with actual data framed, thus it has higher variation in colliniarity and basic statistics. After comparison with help of the model comparisons tools it is possible to state the real ideal of best fit of the model. Table 3 presented the particulars of comparison tools. AIC, BIC, Hannan-Quinn and log-likelihood are the parameters taken for comparing the derived models. The other model statistics are also checked for testing the best fit criteria for the listed models.

Table 4 Comparison of Models

Model	SE	AIC	Hannan-Quinn	BIC
Panel Based Model	1720.83	3418.43	3435.5	3460.7
1/y	0.017	-1014.6	-997.5	-972.5

9. Conclusion

It is observed from table 4 that Panel and1/Y are tested for SE of the model. The Panel model is defined with 1720.83 of SE, similarly, transformation in proportion of one is found 0.017 The least value is computed as 0.017 for transformation in proportion of one thus according to the criteria of best model fit the transformation of one to data is consider as the best fit model.

The second criteria for testing best fit of model are AIC. The values of AIC are computed as 3418.43 and -1014.6 respectively. Lower the values of AIC justify the best fit model. According to this testing the value of transformation one is to data is found most little. Thus, it is defined as best fit model to the data.

The third criterion for model comparison is taken as Hannan-Quinn test result. The tested results are compiled as 3435.5 and -997.5. The criteria is justify the transformation of one is to the data for least value compare to other values of Hannan-Quinn. Thus, according to this test again the transformation of one is to the data is the best fit to the data.

The fourth parameter is taken for testing best fit of model as BIC. As presented in table 4 the values of BIC for each of the models is computed as 3460.7 and -972.5 respectively. Again the least value is computed for transformation of one is to the data and this test also present the best fit of model.

All the four criteria for testing of best fit model fingering to the transformation of one are to the data. Thus, out of four tested model it is considered as best fit model to the GSRTC data for last decade.

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