

Statistical and Econometric Methods for Transportation Data Analysis

Example XX.XX
(Analysis of 2018 USNews Engineering Data)

You are given 147 observations from USNews 2018 rankings of graduate engineering schools in the US (based on fiscal year 2016 data). There are 80 variables available (see table starting on the next page).

Your task is to first read carefully the article:

Ghaisi, A., Fountas, G., Anastasopoulos, P., Mannering, F., 2019. Statistical assessment of peer opinions in higher education rankings: The case of engineering graduate programs. Forthcoming in the *Journal of Applied Research in Higher Education*. [https://doi.org/ 10.1108/JARHE-09-2018-0196](https://doi.org/10.1108/JARHE-09-2018-0196).

Then your task is to estimate a regression model similar to the one estimated in that paper:

$$\text{Rank} = \beta\mathbf{X} + \varepsilon$$

Where: Rank = 2018 USNews program rank; \mathbf{X} is a vector of explanatory variables; β is a vector of estimable parameters; and ε is a normally distributed disturbance term. You can consider random parameters with (for each of the “ n ” parameters in the β vector):

$$\beta_n = \beta + \omega_n$$

where ω_n is a randomly distributed term (for example a normally distributed term with mean zero and variance σ^2).

Available distributions:

n = normal; l = lognormal; u = uniform; t = triangular; d = dome; e = Erlang; w = Weibull;
p = exponential; c = nonstochastic (constant)

Variables available for your specification are:

X1		University ID
X2		2018 USNews Engineering ranking of university
X3		Engineering graduate student enrollment
X4		Percent of faculty in the National Academy of Engineering
X5		Number of faculty in the National Academy of Engineering
X6		Average math GRE score
X7		2016 Engineering research expenditures
X8		Percent of graduate applications accepted
X9		Average peer program score (1 to 5)
X10		Number of PhD's graduated in 2016e
X11		Average recruiter program score (1 to 5)
X12		2016 Engineering research expenditures per faculty
X13		Total number of engineering faculty
X14		AAU indicator (1 if university is an American Association of Universities member; 0 otherwise)
X15		Public indicator (1 if university is a public University; 0 otherwise)
X16		10-year average total research *1000 in current dollars (2004-2013)
X17		Total national academy members (1999-2014)
X18		Total Faculty Awards (1999-2014)
X19		Total Doctorates Awarded (1998-2014)
X20		Total Postdoctoral Appointees (1998-2013)
X21		10-year average SAT score (2003-2013)
X22		Total National Merits (1999-2014)
X23		Percent Change in total research fund from 2004 to 2013
X24		Fall 2013 enrollment
X25		Fall 2013 graduate student enrollment
X26		Percent Change in student enrollment from fall 2004 to fall 2013
X27		2013-2014 PhD degrees
X28		Rank_Ln
X29	1st most cited faculty	Citations
X30		h-index
X31		i-10 index
X32		Number of documents
X33		Publishing since
X34	10th most cited faculty	Citations
X35		h-index
X36		i-10 index
X37		Number of documents
X38		Publishing since

X39		Citations
X40	20th most cited faculty	h-index
X41		i-10 index
X42		Number of documents
X43		Publishing since
X44	Number of faculty (in Engineering) with more	10,000 cites
X45	than:	5,000 cites
X46	Number of faculty (entire University) with more	100,000 cites
X47	than:	10,000 cites
X48	Number of citations of the least cited faculty (in Engineering)	Citations
X49		h-index
X50		i-10 index
X51		Number of documents
X52		Publishing since
X53	Number of faculty (entire University) with more	50,000 cites
X54	than:	20,000 cites
X55	Civil	Rank
X56	Engineering	Score
X57	Aerospace	Rank
X58		Score
X59	Biological-	Rank
X60	Agriculture	Score
X61	Chemical	Rank
X62		Score
X63	Biomedical	Rank
X64		Score
X65	Computer	Rank
X66		Score

X67	Electrical	Rank
X68		Score
X69	Environmental	Rank
X70		Score
X71	Industrial	Rank
X72		Score
X73	Materials	Rank
X74		Score
X75	Mechanical	Rank
X76		Score
X77	Nuclear	Rank
X78		Score
X79	Petroleum	Rank
X80		Score

NLOGIT Commands and results:

```

-> reset
-> read;nvar=80;nobs=147;file=C:peer-data.txt$
-> skip
-> regress;lhs=x9;rhs=one,x14,x21,x10,x6,x35, x53,x13,
;rpm;pts=1000;halton
;fcx=x14(n),x53(n);parameters;keep=pred$

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Deleted          8 observations with missing data. N is now      139
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Ordinary      least squares regression .....
LHS=X9       Mean                =          2.89353
              Standard deviation    =          .71962
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              No. of observations   =           139   DegFreedom   Mean square
Regression   Sum of Squares            =          65.2597           7           9.32281
Residual     Sum of Squares            =          6.20449          131           .04736
Total       Sum of Squares            =          71.4642          138           .51786
-----
              Standard error of e   =          .21763   Root MSE           .21127
Fit          R-squared                =          .91318   R-bar squared      .90854
Model test   F[ 7, 131]                    =          196.83945   Prob F > F*       .00000

```

X9	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	
Constant	-3.07001**	1.19371	-2.57	.0101	-5.40965	-.73038
X21	.00109***	.00020	5.58	.0000	.00071	.00147
X10	.00419***	.00074	5.69	.0000	.00275	.00564
X6	.02453***	.00803	3.06	.0022	.00879	.04026
X35	.00348**	.00148	2.35	.0186	.00058	.00638
X13	.00061	.00057	1.08	.2814	-.00050	.00173
X14	.26557***	.05548	4.79	.0000	.15683	.37431
X53	.00654***	.00207	3.15	.0016	.00247	.01060

***, **, * ==> Significance at 1%, 5%, 10% level.
Model was estimated on Jan 10, 2019 at 11:31:46 AM

Iterative procedure has converged
Normal exit: 24 iterations. Status=0, F= -.2434217D+02

Random Coefficients LinearRg Model
Dependent variable X9
Log likelihood function 24.38530
Restricted log likelihood .00000
Chi squared [2](P= .000) 48.77061
Significance level .00000
Estimation based on N = 147, K = 11
Inf.Cr.AIC = -26.8 AIC/N = -.182
Sample is 1 pds and 147 individuals
Simulation based on 1000 Halton draws
Missing data: Skipped 8 individuals.
LINEAR regression model

X9	Coefficient	Standard Error	z	Prob. z >Z*	95% Confidence Interval	
Nonrandom parameters.....						
Constant	-2.19098***	.74925	-2.92	.0035	-3.65949	-.72247
X21	.00098***	.00014	7.01	.0000	.00071	.00125
X10	.00373***	.00063	5.96	.0000	.00251	.00496
X6	.01962***	.00520	3.77	.0002	.00943	.02982
X35	.00297**	.00138	2.14	.0321	.00025	.00568
X13	.00115**	.00049	2.35	.0188	.00019	.00211
Means for random parameters.....						
X14	.27879***	.04560	6.11	.0000	.18941	.36817
X53	.01009***	.00170	5.94	.0000	.00676	.01342
Scale parameters for dists. of random parameters.....						
X14	.20148***	.01906	10.57	.0000	.16412	.23883
X53	.00324**	.00130	2.49	.0129	.00068	.00579
Variance parameter given is sigma.....						
Std.Dev.	.17084***	.00941	18.16	.0000	.15240	.18929

***, **, * ==> Significance at 1%, 5%, 10% level.
Model was estimated on Jan 10, 2019 at 11:32:19 AM