

Analysis of a Completely Randomized Design with a Threeway Treatment Structure

A marketing research consultant evaluated the effects of *fee schedule*, *scope of work*, and *type of supervisory control* on the quality of work performed (index) under contract by independent marketing research agencies. The factor levels in the study were as follows:

Factor	Factor Levels

Fee level	i = 1: High i = 2: Average i = 3: Low
Scope	j = 1: All performed in house j = 2: Some work subcontracted out
Supervisor	k = 1: Local supervisors k = 2: Traveling supervisors only

Fee Level	Supervision			
	1		2	
	Scope 1	Scope 2	Scope 1	Scope 2
1	124.3	115.1	112.7	88.2
	120.6	119.9	110.2	96.0
	120.7	115.4	113.5	96.4
	122.6	117.3	108.6	90.1
2	119.3	117.2	113.6	92.7
	118.9	114.4	109.1	91.1
	125.3	113.4	108.9	90.7
	121.4	120.0	112.3	87.9
3	90.9	89.9	78.6	58.6
	95.3	83.0	80.6	63.5
	88.8	86.5	83.5	59.8
	92.0	82.7	77.1	62.3

SAS Code

```
options pageno=1;
title 'Marketing Research Agencies Quality of Service';
title2 'Analysis of a Three-way Treatment Structure';
title3 'in a Completely Randomized Design Structure';
data one;
input fee $ scope $ supervis $ quality @@;
cards;
High In_house Local 124.3 High In_house Local 120.6
High In_house Local 120.7 High In_house Local 122.6
High In_house Travel 112.7 High In_house Travel 110.2
High In_house Travel 113.5 High In_house Travel 108.6
High Subcontracted Local 115.1 High Subcontracted Local 119.9
High Subcontracted Local 115.4 High Subcontracted Local 117.3
High Subcontracted Travel 88.2 High Subcontracted Travel 96.0
High Subcontracted Travel 96.4 High Subcontracted Travel 90.1
Average In_house Local 119.3 Average In_house Local 118.9
Average In_house Local 125.3 Average In_house Local 121.4
Average In_house Travel 113.6 Average In_house Travel 109.1
Average In_house Travel 108.9 Average In_house Travel 112.3
Average Subcontracted Local 117.2 Average Subcontracted Local 114.4
Average Subcontracted Local 113.4 Average Subcontracted Local 120.0
Average Subcontracted Travel 92.7 Average Subcontracted Travel 91.1
Average Subcontracted Travel 90.7 Average Subcontracted Travel 87.9
Low In_house Local 90.9 Low In_house Local 95.3
Low In_house Local 88.8 Low In_house Local 92.0
Low In_house Travel 78.6 Low In_house Travel 80.6
Low In_house Travel 83.5 Low In_house Travel 77.1
Low Subcontracted Local 89.9 Low Subcontracted Local 83.0
Low Subcontracted Local 86.5 Low Subcontracted Local 82.7
Low Subcontracted Travel 58.6 Low Subcontracted Travel 63.5
Low Subcontracted Travel 59.8 Low Subcontracted Travel 62.3
;
proc print;
proc glm data = one;
class fee scope supervis;
model quality = fee|scope|supervis;
means fee scope supervis / lines lsd;
lsmeans scope*supervis fee*scope*supervis / pdiff stderr;
run;
```