

APPENDIX

ANALYSES OF THE LINKAGE BETWEEN PAY AND PERFORMANCE:

METHODS FOR STATISTICAL ANALYSES

The body of this report contains results from statistical analyses performed on the objective data pertaining to the Demonstration and Comparison group employees. In this technical appendix, we provide more detail on the statistical analyses from which the results were derived as well as other methodological issues of relevance to the study design. The following information is provided:

- Use of sample versus census data analysis techniques
- Scatterplots displaying the pay-for-performance correlation in the Demonstration Group
- Results of the analysis of covariance (ANCOVA)

Use of Sample Versus Census Data Analysis Techniques

The database of Demonstration Group participants represents the entire universe of Commerce employees who are receiving the human resource interventions as part of this Demonstration Project. By definition this group is a population rather than a sample. The most widely used inferential statistics, and those used as part of this evaluation (Analysis of Covariance), were designed to be applied to sample data. Despite this theoretical hurdle, it has become common practice among researchers to use these inferential statistics in the absence of a better method.

To most accurately describe the population in question, Booz·Allen produced effect size estimates along with significance levels. By producing these additional data, Booz·Allen hopes to mitigate the theoretical concerns of applying data analysis techniques developed for samples on data derived from a population.

Scatterplots Displaying the Pay-For-Performance Correlation in the Demonstration Group

Figure A-1 displays a scatterplot showing the relationship between performance ratings and salary increases (as a percentage of base salary) in the Demonstration Group. Correlational analyses revealed a correlation of $r = .52$. This scatterplot suggests that high performance ratings, to some degree, are associated with higher increase percentages. This plot also suggests that lower performance ratings rarely resulted in higher increases.

Figure A-1. Percent Increase by Performance Rating

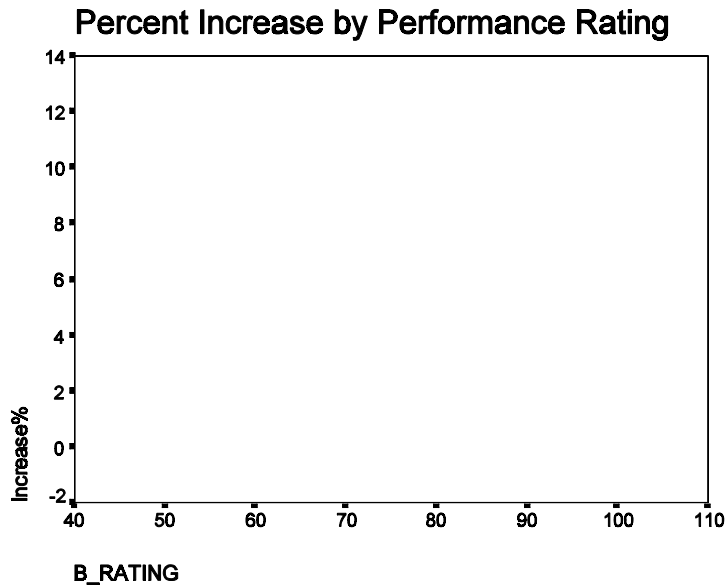
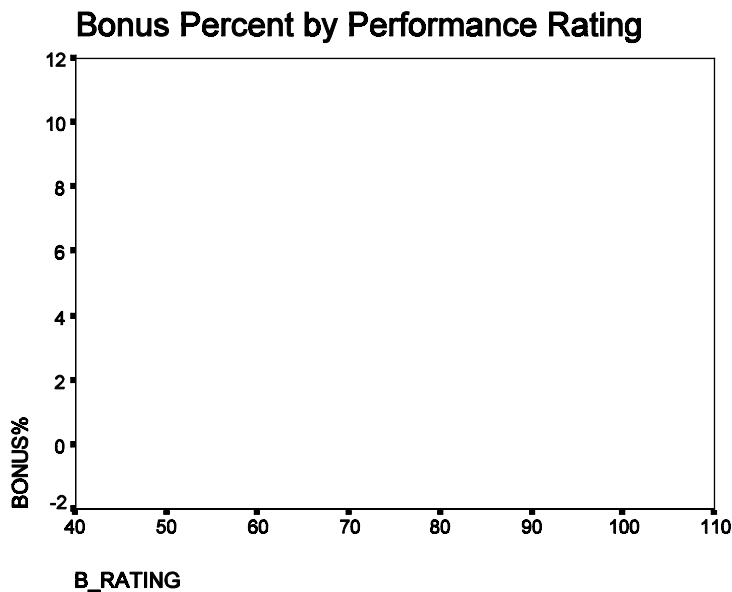


Figure A-2 displays a scatterplot showing the relationship between performance ratings and bonuses (as a percentage of base salary) in the Demonstration Group. Correlational analyses revealed a correlation of $r = .41$. The scatterplot below suggests that the employees receiving low performance ratings were unlikely to receive a large bonus. Additionally, those employees who did receive a large bonus were more likely to have received a high performance rating.

Figure A-2. Bonus Percent by Performance Rating



Results of the Analysis of Covariance (ANCOVA)

Analysis of variance (ANOVA) involves determining whether the difference between two or more means is statistically significant. Analysis of covariance (ANCOVA, also referred to as ANACOVA) builds one more level of complexity. With ANCOVA, those differences between the means are examined while also *controlling* for the effects that another variable or variables may have on the relationship. That is, the question becomes "what is the effect of something when we take into account something else?" (Will G. Hopkins, *A New View of Statistics*).

When performing ANCOVAs, the output produces means that account for the presence of other specified variables. These means are known as "adjusted" means; they allow closer examination of the relationship between two variables of interest while removing the impact that other variables may have on the relationship.

Using a standard statistical software, Statistical Package for the Social Sciences (SPSS), Booz•Allen ran ANCOVA analyses to assess any differences in pay outcomes for EEO groups and veterans within the Demonstration Project. Separate ANCOVA analyses were run for each protected subgroup (i.e., minorities, women, and veterans) to test whether they were adversely affected by the new pay for performance system. In essence, the ANCOVA analyses indicate whether differences for subgroups in average pay increases or bonuses were significant during the second cycle of the pay for performance system. We examined, for example, differences in average pay increases for females and males. In this example we sought to determine whether 1) there was a statistically significant difference in average pay increases between females and males and 2) whether the size of the effect of gender on average pay increases was large enough to be meaningful.

Separate ANCOVAs were run for several independent variables whose categories were:

1. Minority/non-minority
2. Female/male
3. Veteran/non-veteran

Separate ANCOVAs for each of these subgroups were performed for each of the two dependent variables of interest:

1. Percent Increase in Salary (amount of salary increase expressed as a percent of salary at the beginning of Year Two of the Demonstration Project)
2. Percent Bonus (bonus amount expressed as a percent of salary at the beginning of Year Two of the Demonstration Project)

We calculated the ANCOVAs using three covariates: Performance Rating, Career Path, and Time in Service. The ANCOVA analyses were used to address the question of how much impact gender, for example, had on differences in Percent Increase in Salary once the effects of Performance Rating, Career Path, and Time in Service were statistically accounted for.

In these analyses, values less than .01 in the column labeled “Significance” were considered significant. Due to the large number of cases in the data set, it was not unexpected to find that many relationships were statistically significant. Because so many of these relationships were statistically significant, it is important to also consider the Eta squared value.

The column labeled “Eta Squared” is the estimate of the size of the effect that each independent variable had on the dependent variable of interest (Percent Increase in Salary or Percent Bonus). For these data, values greater than .05 were considered to be of interest. However, none of the EEO group variables in any of the analyses reached this level.

For each ANCOVA analysis, raw and estimated marginal means are presented. The raw measures are labeled “Unadjusted Means.” The estimated marginal means are means that have been adjusted for the covariates and are labeled “Adjusted Means.”

In summary, the findings presented below indicate that while many relationships between the independent variables and the dependent variables were statistically significant (due to the large sample size), none had an effect on the distribution of pay increases or bonuses large enough to be meaningful.

DEMONSTRATION GROUP DATA

Dependent Variable = Percent Increase in Salary Independent Variable Categories = Minority/Non-Minority			DEMO GROUP
Group	Unadjusted Means	Standard Deviation	N
Minority	2.8%	1.9	403
Non-Minority	2.9%	1.9	1875
ANCOVA Results	Significance	Eta Squared	
Career Path	.000	.018	
Performance Rating	.000	.426	
Time in Service	.000	.334	
Minority/Non-Minority	.006	.003	
Group	Adjusted Means	Standard Error	
Minority	2.7%	.067	
Non-Minority	2.9%	.031	

Dependent Variable = Percent Increase in Salary Independent Variable Categories = Female/Male			DEMO GROUP
Group	Unadjusted Means	Standard Deviation	N
Female	3.1%	1.9	875
Male	2.7%	1.9	1403
ANCOVA Results	Significance	Eta Squared	
Career Path	.000	.018	
Performance Rating	.000	.428	
Time in Service	.000	.330	
Female/Male	.001	.005	
Group	Adjusted Means	Standard Error	
Female	2.7%	.046	
Male	2.9%	.036	

Dependent Variable = Percent Increase in Salary Independent Variable Categories = Veteran/Non-Veteran			DEMO GROUP
Group	Unadjusted Means	Standard Deviation	N
Veteran	2.5%	1.8	222
Non-Veteran	2.9%	1.9	2056
ANCOVA Results	Significance	Eta Squared	
Career Path	.000	.019	
Performance Rating	.000	.424	
Time in Service	.000	.332	
Veteran/Non-Veteran	.574	.000	
Group	Adjusted Means	Standard Error	
Veteran	2.8%	.089	
Non-Veteran	2.9%	.029	

Dependent Variable = Percent Bonus Independent Variable Categories = Minority/Non-Minority			DEMO GROUP
Group	Unadjusted Means	Standard Deviation	N
Minority	1.5%	1.4	415
Non-Minority	1.6%	1.4	1906
ANCOVA Results		Significance	Eta Squared
Career Path		.000	.019
Performance Rating		.000	.181
Time in Service		.000	.006
Minority/Non-Minority		.041	.002
Group	Adjusted Means	Standard Error	
Minority	1.5%	.063	
Non-Minority	1.6%	.029	

Dependent Variable = Percent Bonus Independent Variable Categories = Female/Male			DEMO GROUP
Group	Unadjusted Means	Standard Deviation	N
Female	1.8%	1.6	886
Male	1.5%	1.2	1435
ANCOVA Results		Significance	Eta Squared
Career Path		.000	.016
Performance Rating		.000	.173
Time in Service		.038	.002
Female/Male		.000	.009
Group	Adjusted Means	Standard Error	
Female	1.8%	.043	
Male	1.5%	.034	

Dependent Variable = Percent Bonus Independent Variable Categories = Veteran/Non-Veteran			DEMO GROUP
Group	Unadjusted Means	Standard Deviation	N
Veteran	1.4%	1.1	225
Non-Veteran	1.6%	1.4	2096
ANCOVA Results		Significance	Eta Squared
Career Path		.000	.019
Performance Rating		.000	.179
Time in Service		.001	.005
Veteran/Non-Veteran		.083	.001
Group	Adjusted Means	Standard Error	
Veteran	1.5%	.085	
Non-Veteran	1.6%	.028	

COMPARISON GROUP DATA

Dependent Variable = Percent Increase in Salary Independent Variable Categories = Minority/Non-Minority			COMPARISON
Group	Unadjusted Means	Standard Deviation	N
Minority	2.6%	3.7	178
Non-Minority	2.5%	3.6	1360
ANCOVA Results	Significance	Eta Squared	
Career Path	.014	.004	
Performance Rating	.	.000	
Time in Service	.000	.034	
Minority/Non-Minority	.922	.000	
Group	Adjusted Means	Standard Error	
Minority	2.5%	.266	
Non-Minority	2.5%	.096	

Dependent Variable = Percent Increase in Salary Independent Variable Categories = Female/Male			COMPARISON
Group	Unadjusted Means	Standard Deviation	N
Female	3.0%	4.2	522
Male	2.2%	3.3	1016
ANCOVA Results	Significance	Eta Squared	
Career Path	.014	.004	
Performance Rating	.	.000	
Time in Service	.000	.027	
Female/Male	.017	.004	
Group	Adjusted Means	Standard Error	
Female	2.8%	.158	
Male	2.3%	.112	

Dependent Variable = Percent Increase in Salary Independent Variable Categories = Veteran/Non-Veteran			COMPARISON
Group	Unadjusted Means	Standard Deviation	N
Veteran	2.3%	3.7	130
Non-Veteran	2.5%	3.6	1408
ANCOVA Results	Significance	Eta Squared	
Career Path	.016	.004	
Performance Rating	.	.000	
Time in Service	.000	.034	
Veteran/Non-Veteran	.494	.000	
Group	Adjusted Means	Standard Error	
Veteran	2.3%	.312	
Non-Veteran	2.5%	.094	

Dependent Variable = Percent Bonus Independent Variable Categories = Minority/Non-Minority			COMPARISON
Group	Unadjusted Means	Standard Deviation	N
Minority	1.2%	1.6	178
Non-Minority	1.3%	1.5	1360
ANCOVA Results		Significance	Eta Squared
Career Path		.280	.001
Performance Rating		.	.000
Time in Service		.085	.002
Minority/Non-Minority		.815	.000
Group	Adjusted Means	Standard Error	
Minority	1.2%	.113	
Non-Minority	1.3%	.041	

Dependent Variable = Percent Bonus Independent Variable Categories = Female/Male			COMPARISON
Group	Unadjusted Means	Standard Deviation	N
Female	1.4%	1.7	522
Male	1.2%	1.4	1016
ANCOVA Results		Significance	Eta Squared
Career Path		.282	.001
Performance Rating		.	.000
Time in Service		.009	.004
Female/Male		.000	.008
Group	Adjusted Means	Standard Error	
Female	1.5%	.067	
Male	1.2%	.048	

Dependent Variable = Percent Bonus Independent Variable Categories = Veteran/Non-Veteran			COMPARISON
Group	Unadjusted Means	Standard Deviation	N
Veteran	0.9%	1.3	130
Non-Veteran	1.3%	1.5	1408
ANCOVA Results		Significance	Eta Squared
Career Path		.376	.001
Performance Rating		.	.000
Time in Service		.084	.002
Veteran/Non-Veteran		.010	.004
Group	Adjusted Means	Standard Error	
Veteran	0.9%	.132	
Non-Veteran	1.3%	.040	