**Research Methods**

### Research Methods

**Reading Computer Printouts**

#### TABLE 1

<table>
<thead>
<tr>
<th>Source</th>
<th>Model</th>
<th>DF</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>Root MSE (σ-hat)</th>
<th>R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>1 (8 of explanatory variables)</td>
<td>1</td>
<td>145097 (TSS-SSE; numerator of r^2)</td>
<td>145097</td>
<td>19.473 (Ω = estimated standard deviation, estimated variability of Y values)</td>
<td>.8 (r^2 = coefficient of determination, because .8 is close to 1, Y-hat is a good predictor of correlation, strong + association)</td>
</tr>
<tr>
<td>Error (cond. distrib.)</td>
<td>91 (n-k+1)</td>
<td>91</td>
<td>34508 (SSE)</td>
<td>379</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (marginal dist.)</td>
<td>92 (model + error df)</td>
<td>34508 (SSE)</td>
<td>179605 (TSS)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1:** This table summarizes the results of an analysis of variance (ANOVA) for a multiple regression model. The model includes 8 explanatory variables and is used to predict the dependent variable Y. The table provides the sum of squares, mean square, root mean square error (RMSE), and R-squared for the model. The model is significant at the 0.0003 level, indicating that it explains a substantial amount of the variance in the dependent variable.

#### Reading Computer Printouts

**Multiple Regression**

**Regression Toward the Mean**

Every 1 unit increase in the explanatory variable has an increase in b (units).

**Interpreting Regression Coefficients**

1. **Model Sum of Squares:** TSS-SSE
2. **R^2:** Proportion of the total variation in Y explained by the multiple regression model now called “coefficient of mult. determination.”
3. **r:** Multiple correlation coefficient = square root of R squared
4. **sY:** Standard deviation of the marginal distribution of Y (σ_Y)
5. **sx:** Standard deviation of the marginal distribution of X (σ_X)
6. **n:** Sample size (Intercept (a) or a)
7. **T** for Ho: Parameter = 0
8. **Prob > |T|**

**Analysis of Variance (ANOVA)**

**Table 2:** This table presents the results of an analysis of variance (ANOVA) for a multiple regression model. The table includes the sum of squares, mean square, F-value, degrees of freedom (DF), and p-value for each variable in the model. The table also provides the F-value for the overall model and the p-value for testing the null hypothesis that all regression coefficients are zero. The model is significant at the 0.0003 level, indicating that it explains a substantial amount of the variance in the dependent variable.

**Multiple Regression Equation**

Regression equation: Y-hat = -498.7 + 32.6(X1) + 9.1(X2)

**Regression Function**

The regression function E(Y-bar) = b(X-bar) & Y-hat = -498.7 + 32.6(X1) + 9.1(X2); Y = crime (deaths/100,000); X1=poverty rate; X2=crime rate (deaths/100,000)

**Standard Error**

Standard error = sY or σ_Y

**T Value**

T value = (b-β)/SE

**F Value**

F value = (TSS-SSE)/SS

**Prob > F**

Prob > F = .0003 (very low, reject the null hypothesis)

**Null Hypothesis**

Ho: Parameter = 0

**Alternative Hypothesis**

Ha: Parameter ≠ 0

**Significance Level**

α = .05

**Confidence Level**

1 - α = 95%

**t-Statistic**

t statistic = (b-β)/SE

**Critical t-value**

t = 2.576

**Sample Size**

n = 10

**Significance Level**

α = .02

**Critical t-value**

t = 2.576

**Standard Error of Mean**

SE = sY/√n

**Standard Error of Regression**

SE = sY/√(n-k)

**Standard Error of Coefficient**

SE = sY/√(n-k-1)

**t-Statistic**

t statistic = (b-β)/SE

**Critical t-value**

t = 2.576

**Significance Level**

α = .02

**Critical t-value**

t = 2.576

**Confidence Interval**

CI = b ± (t)(SE)

**P-value**

P-value = Prob(|t| > t)|t| from the t-distribution and df = n-k

**Critical t-value**

t = 2.576

**Significance Level**

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