Impact of Research on Univerisity Rankings

Thomas Billington, Steven Bottone, Nart Hakij, and Joe Manley

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Introduction:

- Many schools either brand themselves as teaching, professional, or research focused universities.

- By measuring the trends of institutions across the globe we can determine if their ability to conduct meaningful research correlate to its statute.

- Goal: Does a university's research efforts have an effect on its global ranking?

- Response variable: Global ranking

- Explanatory variable: Research score (out of 100)

- Observations: 1695 universities

Analysis:

To better understand the relationship, a thorough statistical analysis was conducted.

University Rank vs Research Score
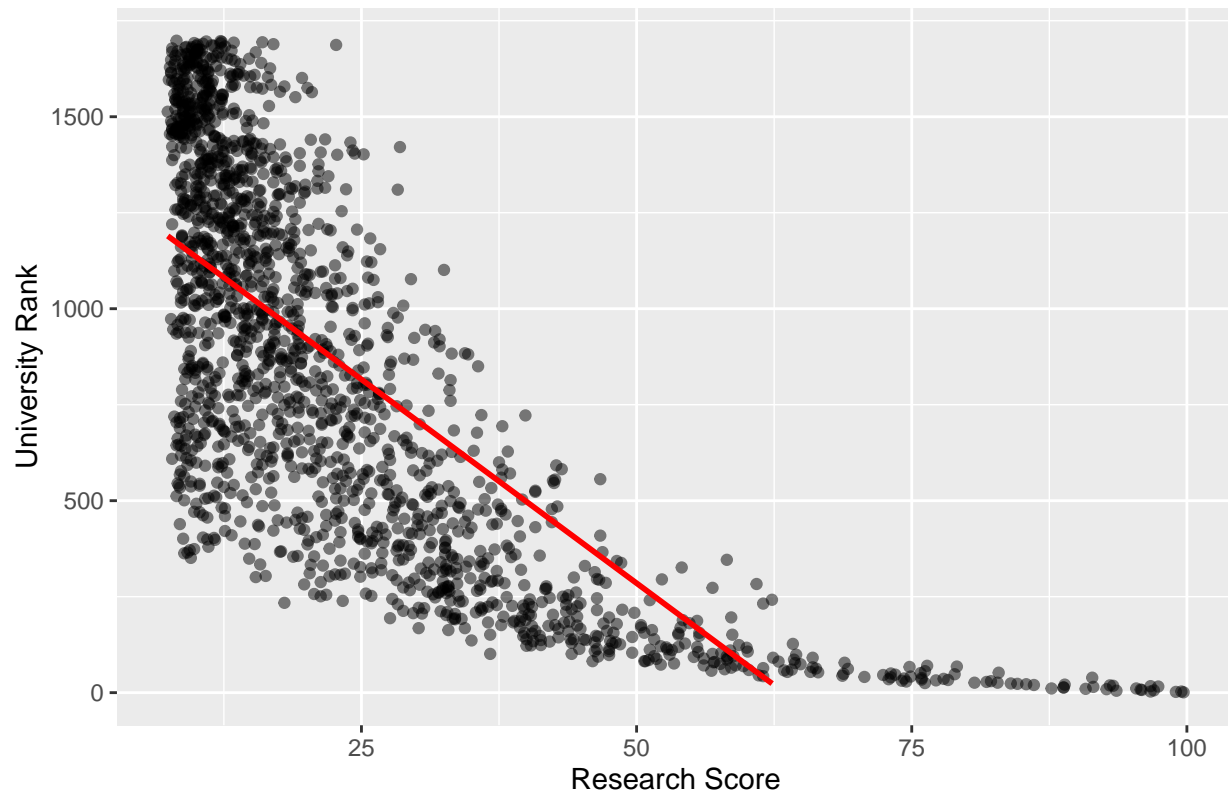
From the graph we can assume a strong negative linear relationship between research score and university ranking. We see that as research score increases, rank decreases(goes towards better rank).

More information can be observed from better understanding the linear model:

```
Call:
lm(formula = University.Rank ~ Research.Score, data = data)

Residuals:
   Min     1Q Median     3Q    Max
-794.7 -261.5  -14.9  269.9  822.3

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)    1346.6788    13.7041   98.27   <2e-16 ***
Research.Score  -21.2322     0.4738  -44.81   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 331.8 on 1695 degrees of freedom
Multiple R-squared:  0.5422,    Adjusted R-squared:  0.542
F-statistic:  2008 on 1 and 1695 DF,  p-value: < 2.2e-16
```

From this summary output we can note a few key details about the model.

- $\hat{Y}$ = 1346.679 + (-21.23218)*X
- $\hat{Y}$ is university ranking
- X is research score of university

Statistical Tests and Inference:

Hypothesis Testing:

- H0: There is no association between university ranking and research score

- H1: There is an association between university ranking and research score

The p-value was $2.2e\hat{\,}\text{-}16$ which is much lower than the significance level of 0.05. Therefore, we can reject the null hypothesis, indicating that there is a strong statistical evidence that when university ranking decreases or gets closer to rank 1, research score increases.

Confidence stuff

```r
confidence_interval <- confint(model, level = 0.95)
confidence_interval
```

```
##                    2.5 %     97.5 %
## (Intercept)     1319.80011 1373.5575
## Research.Score   -22.16156  -20.3028
```

Prediction stuff

```r
new_data <- data.frame(Research.Score = 60)
pred_int <- predict(model, newdata = new_data, interval = "prediction", level = 0.95)
pred_int
```

```
##        fit       lwr      upr
## 1 72.74794 -579.0791 724.575
```

```r
lower_bounds <- pred_int[, 1]
upper_bounds <- pred_int[, 2]

# Set negative lower bounds to 0
lower_bounds <- pmax(lower_bounds, 0)

# Set negative upper bounds to 0
upper_bounds <- pmax(upper_bounds, 0)

# Combine the modified lower and upper bounds into a matrix
pred_int <- cbind(lower_bounds, upper_bounds)
pred_int
```

```
##      lower_bounds upper_bounds
## [1,]     72.74794            0
```