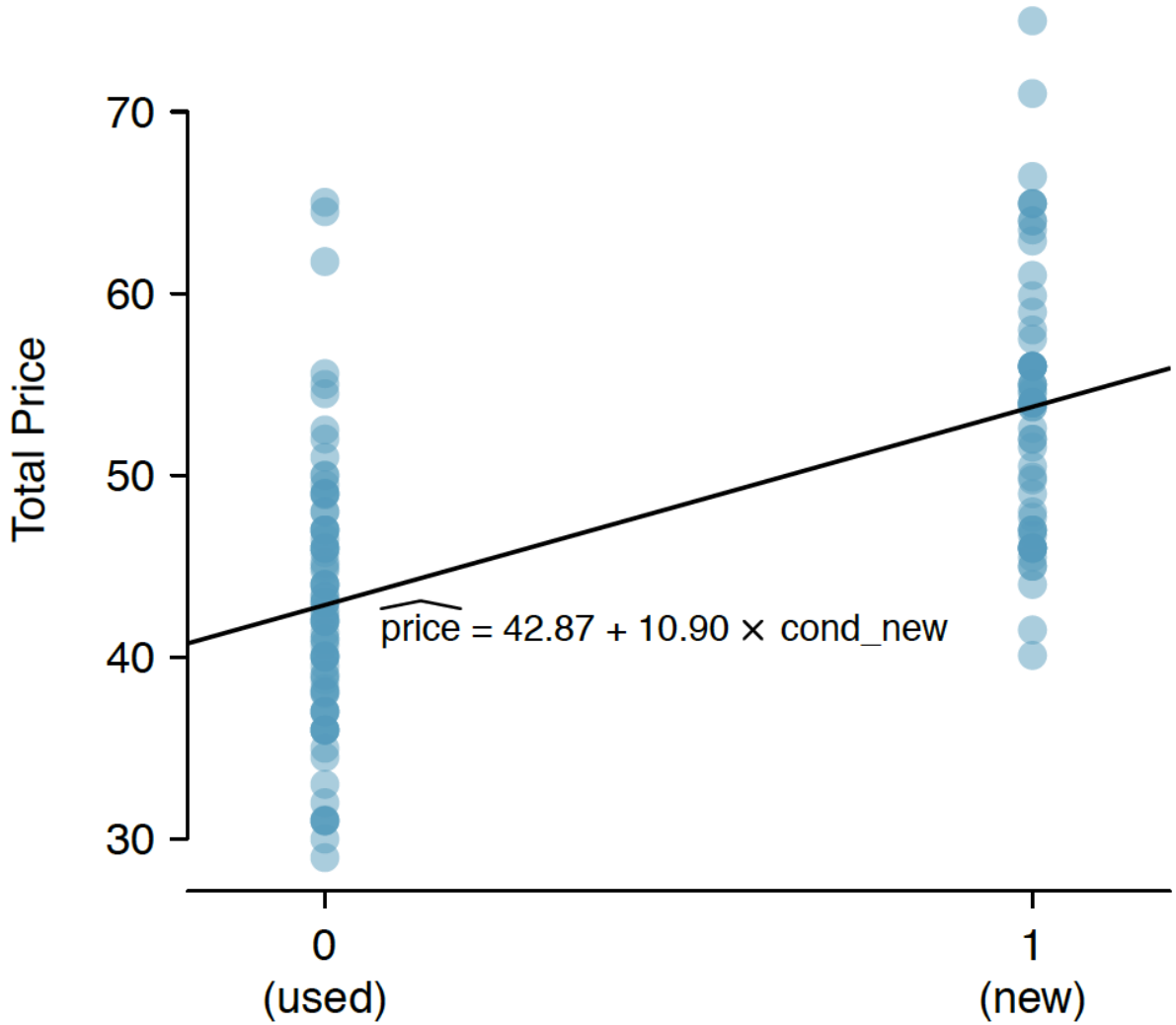
Lecture 26: Multiple Regression

Chapter 8.1

Categorical Predictor x With Two Levels



Questions for Today

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- `stock_photo`: is there a stock photo?
- `duration`: length of the auction in days (1 to 10)
- `wheels`: number of Wii wheels included

Questions for Today

How do we simultaneously incorporate all four predictors to model the eBay auction `price`?

Multiple Regression

Point Estimates, Fitted Values, and Residuals

Multiple Regression Results Table

On page 357:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	36.21	1.51	23.92	0.00
`cond_new`	5.13	1.05	4.88	0.00
`stock_photo`	1.08	1.06	1.02	0.31
`duration`	-0.03	0.19	-0.14	0.89
`wheels`	7.29	0.55	13.13	0.00
				$df = 136$

where $df = n - k - 1 = 141 - 4 - 1 = 136$

Comparison of Results

For simple linear regression:

	Estimate	Std. Error	t value	Pr(>|t|)
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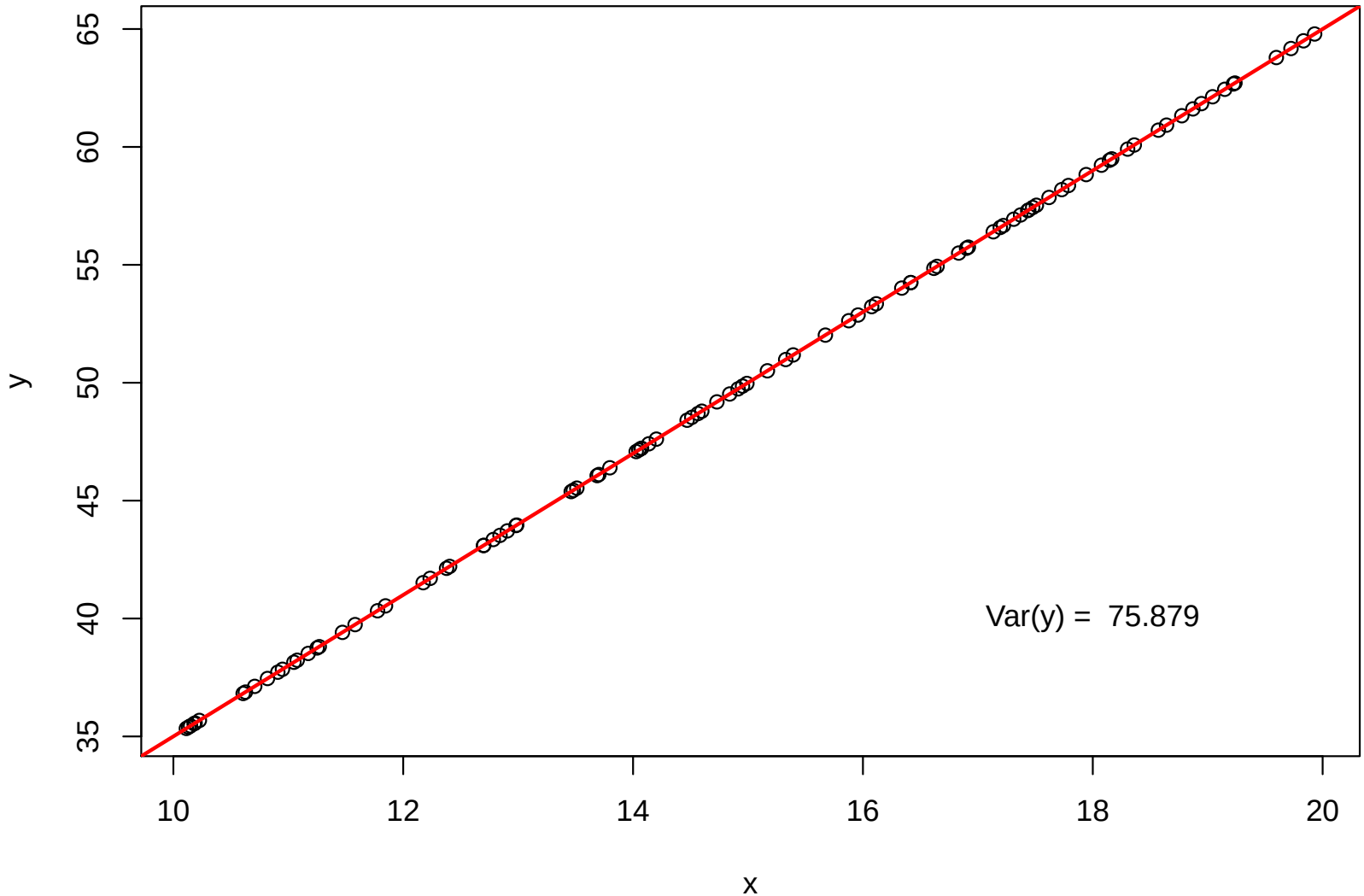
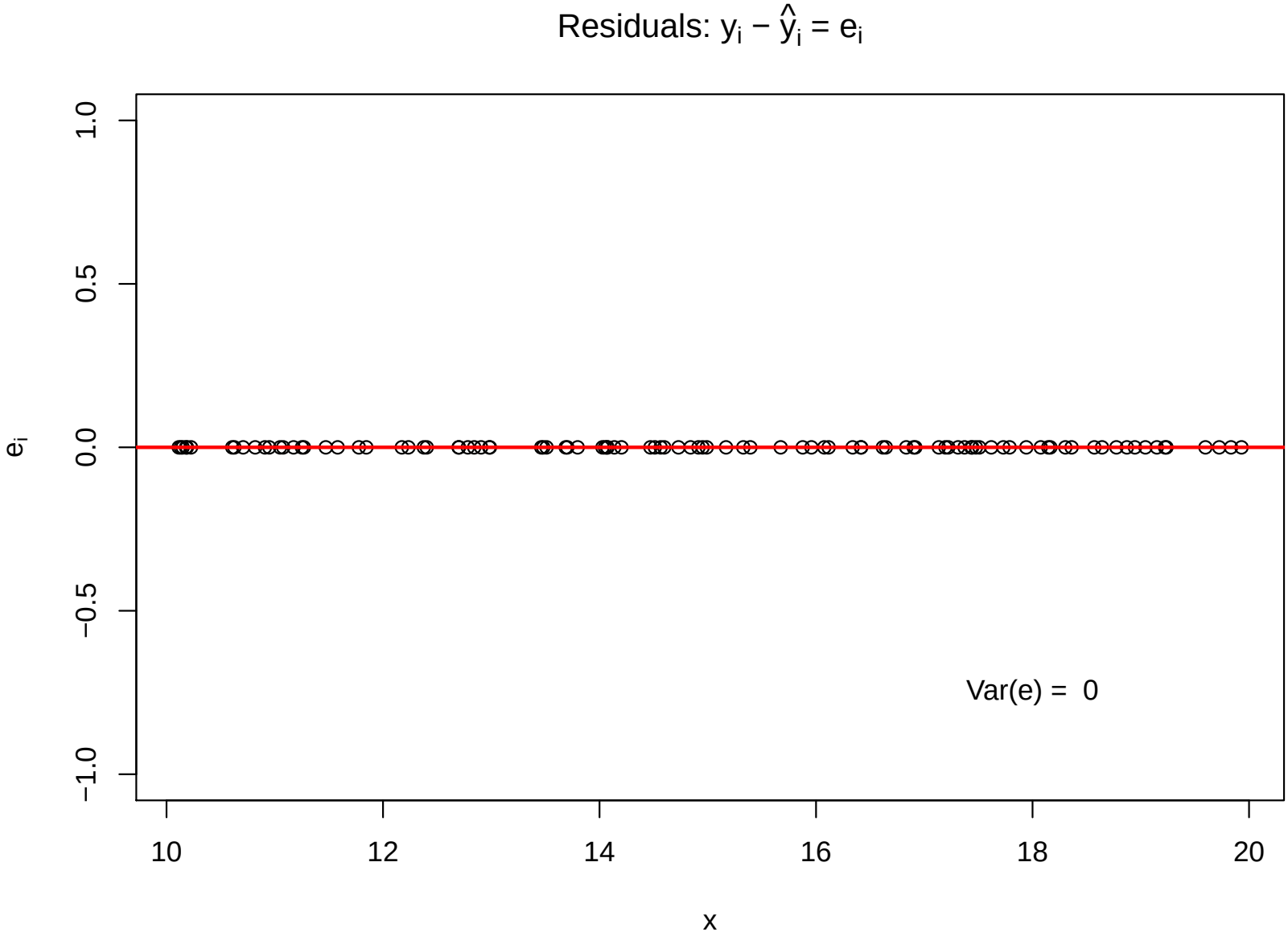
...	...	...	...	...

R^2 to Describe the Strength of Fit

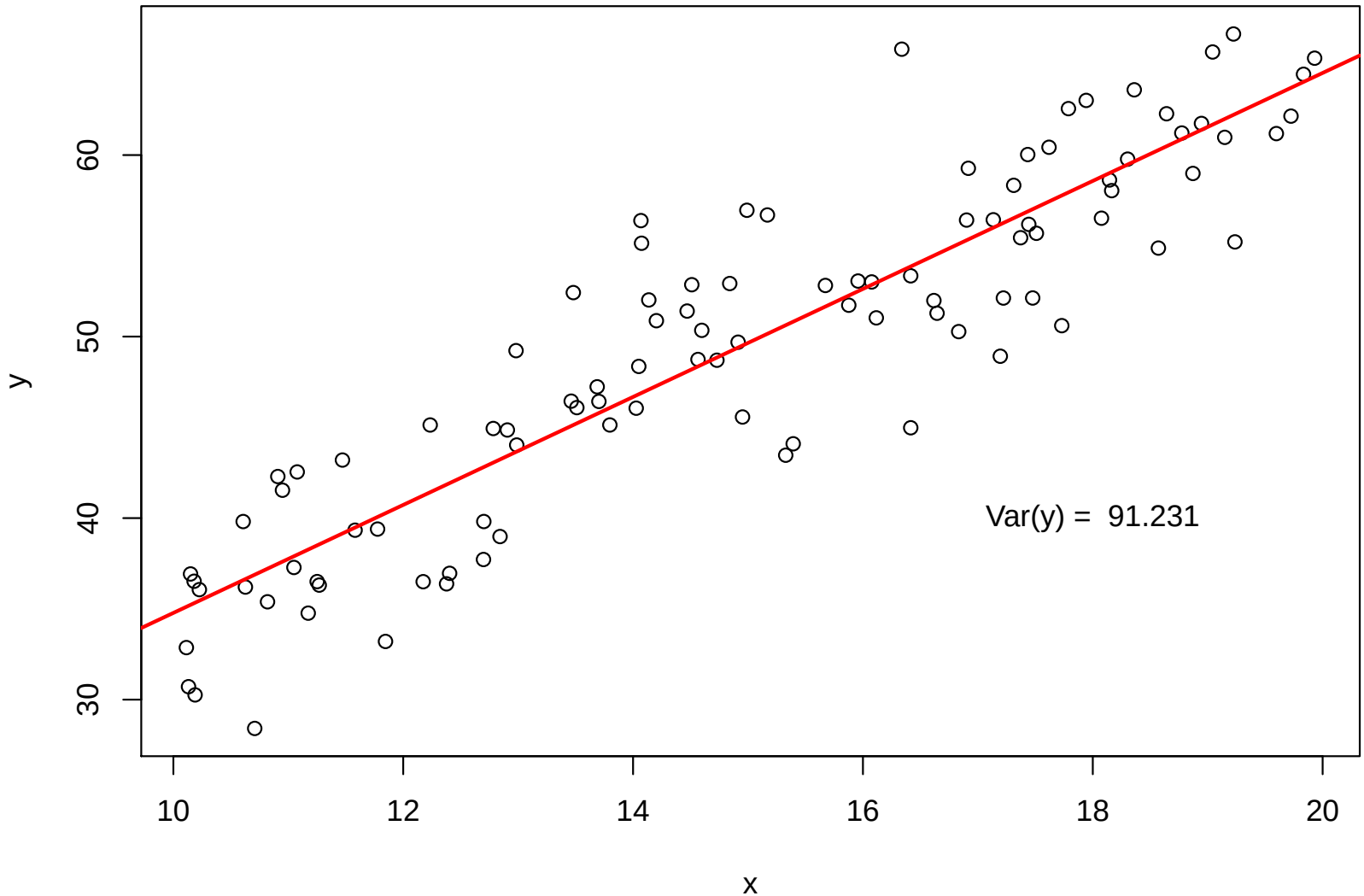
Data Set Example 1



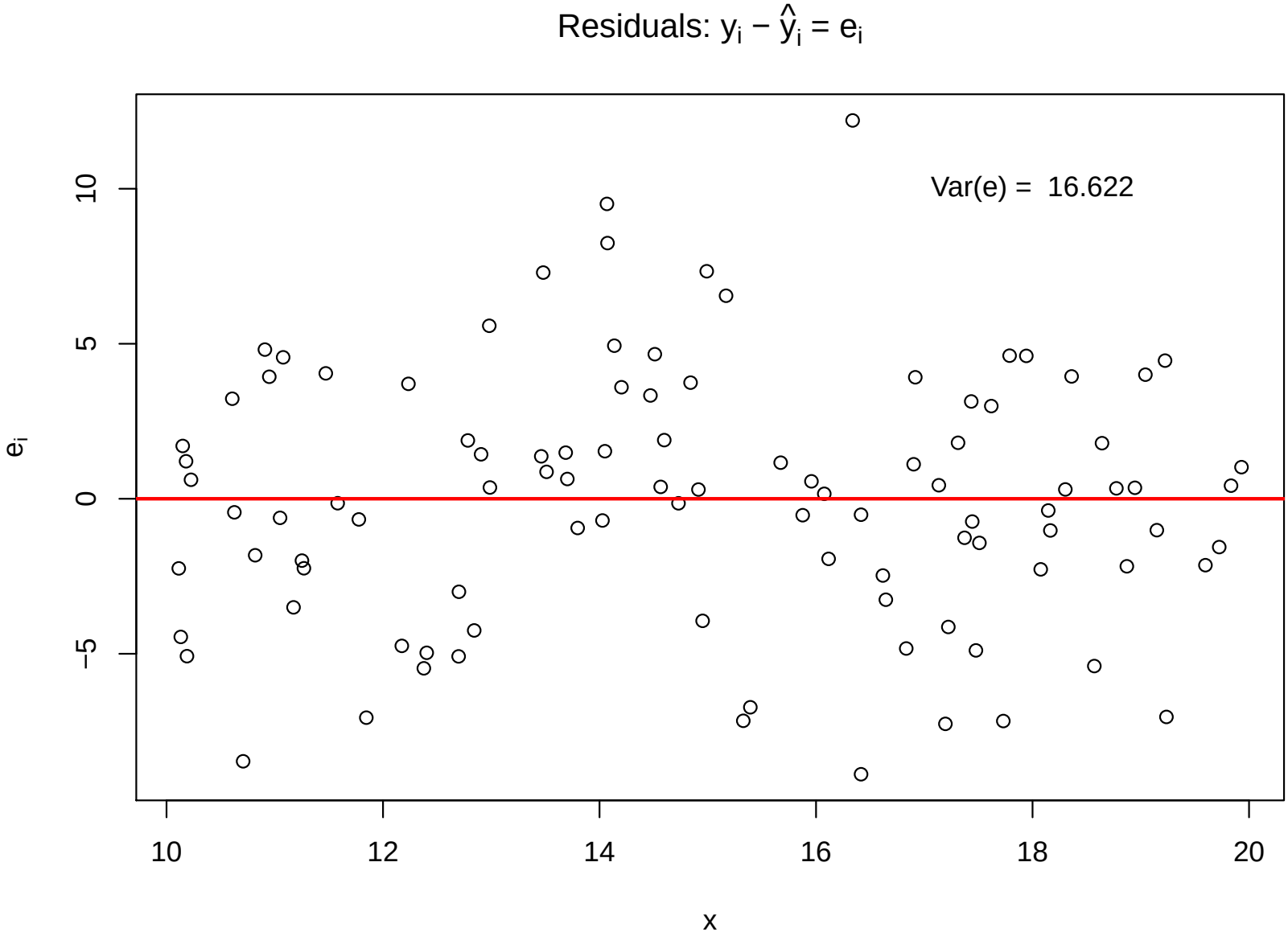
Data Set Example 1



Data Set Example 2



Data Set Example 2



R^2 vs R

Important Concept in Model Fitting

R^2_{adj} describes the strength of fit while adhering to the following:

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R^2_{adj} describes the strength of fit while adhering to the following:

- Parsimony: Adoption of the simplest assumption in the formulation of a theory or in the interpretation of data.
- Occam's Razor: When you have two competing theories that make exactly the same predictions, the simpler one is the better.

Adjusted R^2_{adj}

Parsimony/Occam's Razor

Pared Down Mario Kart Regression Output

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)      41.34       1.71   24.15  < 2e-16
condused         -5.13       1.05   -4.88 2.91e-06
stockPhotoyes     1.08       1.06    1.02    0.308
duration         -0.03       0.19   -0.14    0.888
wheels            7.30       0.55   13.13  < 2e-16
---

Residual standard error: 4.901 on 136 degrees of freedom
Multiple R-squared:  0.719,Adjusted R-squared:  0.7108
```

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              Estimate Std. Error t value Pr(>|t|)
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condused         -5.13       1.05   -4.88 2.91e-06
stockPhotoyes     1.08       1.06    1.02    0.308
duration         -0.03       0.19   -0.14    0.888
wheels            7.30       0.55   13.13  < 2e-16
---

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```

Duration doesn't seem to be all that informative. Why not drop it?

Pared Down Mario Kart Regression Output

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)      41.22       1.49   27.65  < 2e-16
condused         -5.18       1.00   -5.20 7.21e-07
stockPhotoyes     1.12       1.02    1.10    0.275
wheels            7.30       0.54   13.40  < 2e-16
---

Residual standard error: 4.884 on 137 degrees of freedom
Multiple R-squared:  0.719,Adjusted R-squared:  0.7128
```

Next Time

Is there a systematic way to pick which predictor variables to include?

Checking model assumptions as well.