Homework 8

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Github Link: https://github.com/Ahantya/SDS315/blob/main/HW8/HW8Markdown.Rmd

Problem 1 - regression warm up

A.

The creatinine clearance rate we should expect for a 55-year-old is approximately 113.723. This was done by finding the linear model of the relationship between a patient's age (in years) and a patient's creatine clearance rate (in mL/minute). Then we used that formula with the intercept as 147.8129 and the slope as -0.6198 and plugged in x (the age) as 55, to find the predicted creatinine clearance rate.

B.

The creatinine clearance rate changes with age by -0.6198 mL/minutes per year. This is found by the slope of our linear model (formally named as the age coefficient in the linear model).

C.

The creatinine clearance rate is higher (higher) for a 40-year-old with a rate of 135 compared to a 60-year-old with a rate of 112. This is because through the linear model equation (147.8219 - 0.168x), a 60-year-old is expected to have a creatinine clearance rate of 110.624 while a 40-year-old is expected to have a creatinine clearance rate of 123.0203. Since the difference between the 40-year-old's creatinine clearance rate of 135 to its predicted value is higher compared to the difference between the 60-year-old's creatinine clearance rate of 112 to its predicted value, this means that the 40-year-old's creatinine clearance rate is higher and healthier.

Problem 2 - Modeling disease growth

A.

Table 1: 95% Bootstrapped CI for Growth Rate (Italy)

	name	lower	upper	level	method	estimate
2	days_since_first_death	0.1593083	0.2077205	0.95	percentile	0.183218

Table 2: 95% Bootstrapped CI for Doubling Time (Italy)

name	lower	upper	level	method	estimate
doubling	3.355109	4.40591	0.95	percentile	3.820586

Through a 95% bootstrapped confidence interval, the estimated growth rate for Italy is about 0.183 with the interval range specifically being about (0.159, 0.209).

Through a 95% bootstrapped confidence interval, the estimated doubling time for Italy is about 3.8 with the interval range specifically being about (3.4, 4.4).

B.

Table 3: 95% Bootstrapped CI for Growth Rate (Spain)

	name	lower	upper	level	method	estimate
2	days_since_first_death	0.2350267	0.3175786	0.95	percentile	0.2762447

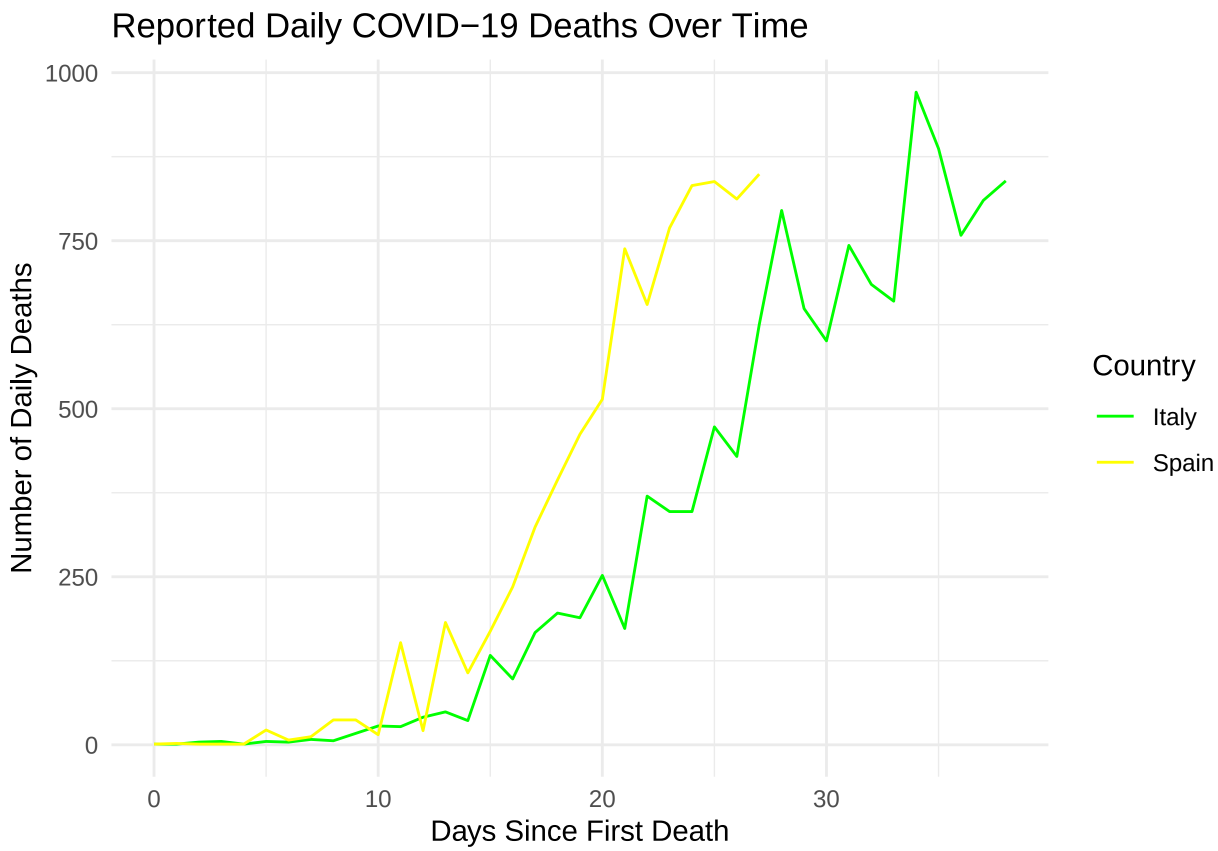
Table 4: 95% Bootstrapped CI for Doubling Time (Spain)

name	lower	upper	level	method	estimate
doubling	2.203465	2.986226	0.95	percentile	2.533985

Through a 95% bootstrapped confidence interval, the estimated growth rate for Spain is about 0.276 with the interval range specifically being about (0.236, 0.318).

Through a 95% bootstrapped confidence interval, the estimated doubling time for Spain is about 2.5 with the interval range specifically being about (2.2, 3.0).

C.



As the line graph shows, Spain's number of daily deaths increased at a faster slope than Italy's number of daily deaths since the first death (up to the point of around 26 days since the first death).

Problem 3 - price elasticity of demand

Table 5: 95% Bootstrapped CI for Price Elasticity of Demand (Milk)

	name	lower	upper	level	method	estimate
2	log.price.	-1.77358	-1.457236	0.95	percentile	-1.618578

I estimated the price elasticity of demand by fitting a log-log linear model of sales on price, where the coefficient of log(price) gives the elasticity. Through a bootstrapped 95% confidence interval that finds the linear model, the estimated elasticity is about -1.619, with the interval range specifically being about (-1.770, -1.456). This means that a 1% increase in price leads to approximately a 1.619 decrease in the quantity demanded.