

Project Part Three

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Data Introduction

This data set is a World Bank economics report of world gross domestic product (GDP) data from the years 1960 to 2016. This data set was retrieved from Kaggle.com, an open source data repository, as a comma separated value (CSV) file. In Part 1 of the project, I took this data and structured it in the form of a dataframe called 'World_Asia_dfrm', which I have imported here via .rds file (for ease). A small portion of that data frame is shown below.

```
World_Asia_dfrm <- readRDS('World_Asia_dfrm.rds')
kable(head(World_Asia_dfrm), format="markdown")
```

	World GDP Years (USD)	East Asia and Pacific GDP (USD)	Asian share of World GDP (%)	East Asia and Pacific Growth Rates (%)	World Growth Rates (%)
1960	1.36668e+12	1.53612e+11	11.240	NA	NA
1961	1.42179e+12	1.54058e+11	10.835	0.290	4.032
1962	1.52696e+12	1.57634e+11	10.323	2.321	7.397
1963	1.64375e+12	1.75902e+11	10.701	11.589	7.649
1964	1.80080e+12	2.02100e+11	11.223	14.894	9.554
1965	1.96178e+12	2.25097e+11	11.474	11.379	8.939

```
growth_rates <- World_Asia_dfrm[,5][2:57]
sd_gr <- sd(growth_rates)
mean_gr <- mean(growth_rates)
n <- length(growth_rates)
```

The variable 'growth_rates' is the growth rates in GDP terms of the East Asia Pacific (EAS) region, excluding the first element of the original column in the dataframe, which contained an NA value.

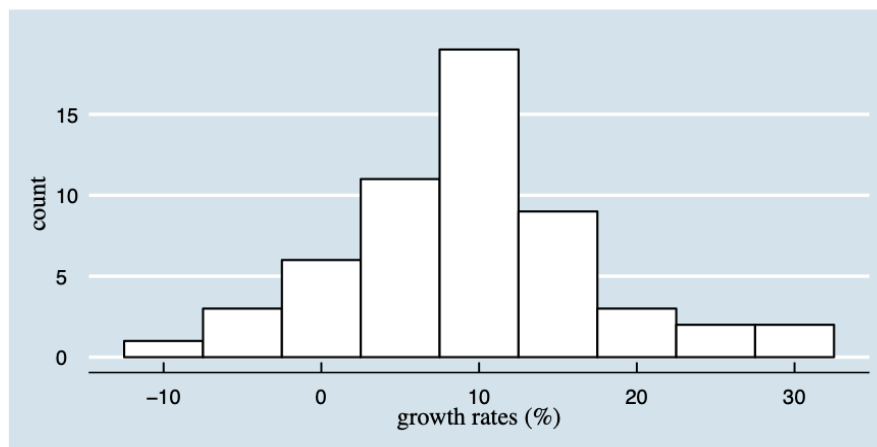
Question

Does the population of EAS nations (including growth_rates sample and other data hypothetically collected under similar circumstances), for which growth_rates is a sample, have an average GDP growth rate that exceeds the 2018 estimate for world GDP growth rate of 3.7%? (Ref 1)

Test

We have quantitative data and are interested in one population. Further, we are looking at a 'larger than' question, so this is a one-sided test. We do not know the population standard deviation. Since the sample size is 56 and it is normally distributed (histogram provided below), we can use a one-sided t-test for this.

```
# Ref 2
theme_set(theme_economist())
growth_rates_dfrm <- as.data.frame(growth_rates)
gr_hist <- ggplot(growth_rates_dfrm)
total_hist <- gr_hist + geom_histogram(aes(x=growth_rates),
                                       binwidth=5, fill="white", colour="black") +
  theme(axis.title.x=element_text(size=12,family="Times"),
        axis.title.y=element_text(size=12,family="Times")) +
  labs(x="growth rates (%)")
total_hist
```



```
t.test_results <- t.test(growth_rates, alternative = c("greater"),
                        mu = 3.7, conf.level = 0.95)
pander(unlist(t.test_results))
```

Table 2: Table continues below

statistic.t	parameter.df	p.value	conf.int1
5.32103065163426	55	9.76538840787909e-07	7.75956902901319

Table 3: Table continues below

conf.int2	estimate.mean of x	null.value.mean	alternative
Inf	9.62135714285714	3.7	greater

method	data.name
One Sample t-test	growth_rates

```
# Ref 3
power_result <- pwr.t.test(d=0.5,n=56,sig.level=0.05,
                          type="one.sample",alternative="greater")
power_result$power
## [1] 0.9798278
```

Conclusion

Since the p-value for this test is 9.765e-07, far smaller than 0.05, we confidently reject the null hypothesis. Further, the power is ~98%, so this is above the 80% value commonly accepted. In other words, we can say that the population of East Asian Pacific GDP growth rates represented by the given sample has a mean that is greater than 3.7, the predicted world GDP growth for 2018. In this case, this means that the nations grouped as EAS countries by the world bank would have an average GDP growth rate higher than 3.7 in similar circumstances to those in which the tested data was collected.

References

1. International Monetary Fund, https://www.imf.org/external/datamapper/NGDP__RPCH@WEO/OEMDC/ADVEC/WEOWORLD
2. Stack Overflow, <https://stackoverflow.com/questions/39634520/specify-height-and-width-of-ggplot-graph-in-rmarkdown-knitr-output/39634521>>
3. Stack Overflow, <https://stackoverflow.com/questions/46903792/r-markdown-output-test-results-htest-when-chunk-option-results-asis>