

Part4

1.

(b)

The earliest data of South Korea is 1953, the latest is 2014.

```
suppressMessages(library(dplyr))
penn_world <- read.csv("~/Documents/2017-18/ECON241/Problem_Sets/ps3/pwt_ex_ps3.csv")
korea <- penn_world %>% filter(countrycode == "KOR") %>%
  mutate(gdpPercap = rgdpe/emp, capPercap = rkna/emp)
growthRate_korea <- korea %>%
  summarize(`Output Growth Rate` =
    (gdpPercap[nrow(korea)]/gdpPercap[1])^(1/(year[nrow(korea)]-year[1]))-1,
    `Physical Capital Growth Rate` =
    (capPercap[nrow(korea)]/capPercap[1])^(1/(year[nrow(korea)]-year[1]))-1,
    `Human Capital Growth Rate` =
    (hc[nrow(korea)]/hc[1])^(1/(year[nrow(korea)]-year[1]))-1)
knitr::kable(growthRate_korea)
```

Output Growth Rate	Physical Capital Growth Rate	Human Capital Growth Rate
0.0494656	0.0601412	0.0111553

```
growthRate_productivity_korea <- growthRate_korea$`Output Growth Rate` -
  1/3*growthRate_korea$`Physical Capital Growth Rate` -
  2/3*(growthRate_korea$`Human Capital Growth Rate`)
growthRate_factors_korea <- growthRate_korea$`Output Growth Rate` -
  growthRate_productivity_korea
```

$$\frac{\Delta A}{A} = \frac{\Delta y}{y} - \alpha \frac{\Delta k}{k} - (1-\alpha) \frac{\Delta h}{h} = 0.022$$

$$\frac{\Delta \text{Factors of production}}{\text{Factors of production}} = \frac{\Delta y}{y} - \frac{\Delta A}{A} = 0.027$$

(c)

```
us <- penn_world %>% filter(countrycode == "USA", year == 2014) %>%
  mutate(gdpPercap = rgdpe/emp, capPercap = rkna/emp)
korea_2014 <- korea %>% filter(year == 2014)
ratio_productivity <- (korea_2014$gdpPercap/us$gdpPercap)/
  ((korea_2014$capPercap^(1/3)*korea_2014$hc^(2/3))/(us$capPercap^(1/3)*us$hc^(2/3)))
```

$$\text{Relative productivity of Korea to US } \left(\frac{A_{Korea}}{A_{US}} \right) = \frac{\text{Ratio of y's}}{\text{Ratio of factors}} = \frac{\frac{y_{Korea}}{y_{US}}}{\frac{k_{Korea}^{\alpha} \times h_{Korea}^{1-\alpha}}{k_{US}^{\alpha} \times h_{US}^{1-\alpha}}} = 0.677$$

2.

```
productivity_gap <- c(10,20,30,40,50,75,100,125) %>% data.frame()
names(productivity_gap) = "years"
productivity_gap <- productivity_gap %>%
  mutate(technology = (1+growthRate_productivity_korea)^(-years))
productivity_gap <- productivity_gap %>%
  mutate(efficiency = ratio_productivity/technology)
```

```
names(productivity_gap) =
  c("Years Behind", "Relative Levels of Technology to the US", "Relative Efficiency to the US")
knitr::kable(productivity_gap)
```

Years Behind	Relative Levels of Technology to the US	Relative Efficiency to the US
10	0.8045792	0.8412461
20	0.6473477	1.0455727
30	0.5208425	1.2995274
40	0.4190591	1.6151640
50	0.3371662	2.0074642
75	0.1957790	3.4572102
100	0.1136811	5.9539304
125	0.0660101	10.2537266