## Dependencies

In [1]:
```
using DataFrames
using ExcelReaders
```

## Data

In [2]:
```
df_assignment = readxl(DataFrame, "./gw1_macro.xlsx", "Sheet1!A1:B101")
df_data = readxl(DataFrame, "./pwt90.xlsx", "Data!A1:AU11831");
```

In [3]:
```
head(df_assignment,2)
```

Out[3]:

| | group | country |
|---|---|---|
| 1 | 100.0 | CHN |
| 2 | 101.0 | USA |

In [4]:
```
head(df_data,2)
```

Out[4]:

| | countrycode | country | currency_unit | year | rgdpe | rgdpo | pop | emp | avh | hc | ccon | cda | cgdpe | cgdpo | ck | ctfp | cwtfp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ABW | Aruba | Aruban Guilder | 1950.0 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2 | ABW | Aruba | Aruban Guilder | 1951.0 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

## Code

In [5]:
```
function GW1_respondes(group)

    # Country selection
    country = df_assignment[(df_assignment[:group].==group),:][2]
    country_message = string("The second section of the anwers will show the solutions for PRT a

    # Exercise 1
    df_country = df_data[.|(df_data[:countrycode] .== "PRT", df_data[:countrycode] .== country),
    data = df_country[.|(df_country[:year] .== 2000, df_country[:year] .== 2014), [:countrycode,

    # Exercise 2
    gdp = []
    for i in 1:2 push!(gdp, ((data[i*2,4]/data[i*2-1,4])^(1/(data[i*2,3]-data[i*2-1,3]))-1)*100)
    ex2_results = ["" data[1,2] data[3,2]; "Growth Rate (%)" gdp[1] gdp[2]]

    # Exercise 3
    ex3_results = ["Country" "TFP2000" "TFP2014" "ΔTFP/TFP"]
    for i in 1:2
        α = 1 - data[i*2-1,7]
        TFP2000 = data[i*2-1,4]/(data[i*2-1,6]^α * data[i*2-1,5]^(1-α))
        TFP2014 = data[i*2,4]/(data[i*2,6]^α * data[i*2,5]^(1-α))
        ex3_results = [ex3_results; data[i*2,2] TFP2000 TFP2014 (TFP2014-TFP2000)/TFP2000*100]
    end

    # Exercise 4
    ex4_changes = ["Country" "ΔY/Y" "ΔTFP/TFP" "α*ΔK/K" "(1-α)*ΔL/L"]
    ex4_contributions = ["Country" "%ΔTFP/TFP" "%α*ΔK/K" "%(1-α)*ΔL/L"]
    for i in 1:2
        α = 1 - data[i*2-1,7]
        ΔY_Y = (data[i*2,4]-data[i*2-1,4])/data[i*2-1,4]
        ΔA_A = ex3_results[i+1,4]
        ΔK_K = (data[i*2,6]-data[i*2-1,6])/data[i*2-1,6]
        ΔL_L = (data[i*2,5]-data[i*2-1,5])/data[i*2-1,5]
        deltas = [ΔA_A α*ΔK_K (1-α)*ΔL_L]
        ex4_changes = [ex4_changes; data[i*2,2] ΔY_Y deltas]
        ex4_contributions = [ex4_contributions; data[i*2,2] deltas*(100/ΔY_Y)]
    end
    if ex4_contributions[2,2] == maximum(ex4_contributions[2,2:4])
        yn1 = "Yes, in $(ex4_contributions[2,1])." else yn1 = "No, in $(ex4_contributions[2,1]).
    if ex4_contributions[3,2] == maximum(ex4_contributions[3,2:4])
        yn2 = "Yes, in $(ex4_contributions[3,1])." else yn2 = "No, in $(ex4_contributions[3,1]).

    return data, ex2_results, ex3_results, ex4_changes, ex4_contributions, yn1, yn2, country_mes
end;
```

## Group Selection

Use the cell below to check the solutions of other groups:

In [6]:
```
group_number = 125;
```

In [7]:
```
GW1_respondes(group_number)[8]
```

Out[7]:
```
"The second section of the anwers will show the solutions for PRT and NLD."
```

# Questions

## 1) Retrieving Data

Use the most recent version (9.0) of the Penn World Tables (at https://www.rug.nl/ggdc/productivity/pwt/ (https://www.rug.nl/ggdc/productivity/pwt/) ) and retrieve the correct value to each component below to your designated country, as well as Portugal, for the years of 2000 and 2014.

- Output-side real GDP at chained PPPs (in mil. US$2011) (rgdpo)
- Number of persons engaged (in millions) (emp)
- Capital stock at constant 2011 national prices (in mil. 2011US$) (rkna)
- Share of labour compensation in GDP at current national prices (labsh)

Fill out the table below:

Answer of our group:

| | Portugal | | Thailand | |
|---|---|---|---|---|
| year | 2010 | 2014 | 2010 | 2014 |
| rgdpo | 219630.03125 | 281354.90625 | 434126.28125 | 929554.5625 |
| emp | 5.0140275955200195 | 4.3413472175598145 | 31.74068260192871 | 38.893306732177734 |
| rkna | 1.30302975e6 | 1.7131235e6 | 2.38961475e6 | 3.62297275e6 |
| labsh | 0.6547812819480896 | 0.5807642936706543 | 0.38971802592277527 | 0.3928701877593994 |

Answer for the group chosen at the beginning:

In [8]:
```
GW1_respondes(group_number)[1]
```

Out[8]:

| | countrycode | country | year | rgdpo | emp | rkna | labsh |
|---|---|---|---|---|---|---|---|
| **1** | NLD | Netherlands | 2000.0 | 596606.9375 | 8.19922924041748 | 2.6317835e6 | 0.6248472929000854 |
| **2** | NLD | Netherlands | 2014.0 | 812675.375 | 8.742557525634766 | 3.36735875e6 | 0.5955878496170044 |
| **3** | PRT | Portugal | 2000.0 | 219630.03125 | 5.0140275955200195 | 1.30302975e6 | 0.6547812819480896 |
| **4** | PRT | Portugal | 2014.0 | 281354.90625 | 4.3413472175598145 | 1.7131235e6 | 0.5807642936706543 |

## 2) Simple Math

Taking only these values from the above table, calculate Portugal's and your country's GDP growth rate. Fill out the below table:

Answer of our group:

$$g_{2000-2014} = \left( \frac{Y_{2014}}{Y_{2000}} \right)^{\frac{1}{2014-2000}} - 1$$

| | Portugal | Thailand |
|---|---|---|
| GDP growth rate (%) | 1.78483 | 5.588954 |

Answer for the group chosen at the beginning:

In [9]:
```
GW1_respondes(group_number)[2]
```

Out[9]:
```
2×3 Array{Any,2}:
 ""                 "Netherlands"   "Portugal"
 "Growth Rate (%)"  2.23222         1.78483
```

## 3) Cobb Douglas

Taking only the variables from the initial table, believing that the volume of a country's production is well approximated by a Cobb Douglas Production Function and **assuming that the share of labor income is constant and equal to that retrieved for the year 2000** calculate:

- The Total Factor Productivity level in the year 2000
- The Total Factor Productivity level in the year 2014
- The accumulated growth rate of TFP from 2000 to 2014

Answer of our group:

$$Y = A \cdot K^{\alpha} \cdot L^{1-\alpha}$$
$$A = \frac{Y}{K^{\alpha} \cdot L^{1-\alpha}}$$

| | Portugal | | Thailand | |
|---|---|---|---|---|
| year | 2010 | 2014 | 2010 | 2014 |
| TFP | 591.869 | 758.105 | 14.4488 | 22.1714 |
| ΔTFP/TFP (%) | | 28.0865% | | 53.4483% |

Answer for the group chosen at the beginning:

In [10]:
```
GW1_respondes(group_number)[3]
```

Out[10]:
```
3×4 Array{Any,2}:
 "Country"         "TFP2000"     "TFP2014"    "ΔTFP/TFP"
 "Netherlands"  625.382       746.116       19.3057
 "Portugal"     591.869       758.105       28.0865
```

## 4) Growth

Was the growth in TFP the responsible for the majority of the growth experienced by Portugal? [ Yes / No ]

Was the growth in TFP the responsible for the majority of the growth experienced by your assigned country? [ Yes / No ]

Answer of our group:

$$Y = A \cdot K^{\alpha} \cdot L^{1-\alpha}$$

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + \alpha \cdot \frac{\Delta K}{K} + (1-\alpha) \cdot \frac{\Delta L}{L}$$

| Country | ΔY/Y | ΔTFP/TFP | α*ΔK/K | (1-α)*ΔL/L |
|---|---|---|---|---|
| Portugal | 0.28104 | 0.280865 | 0.108648 | -0.0878453 |
| Thailand | 1.14121 | 0.534483 | 0.314986 | 0.0878213 |

| Country | %ΔTFP/TFP | %α*ΔK/K | %(1-α)*ΔL/L |
|---|---|---|---|
| Portugal | 99.9378 | 38.6594 | -31.2572 |
| Thailand | 46.8349 | 27.6011 | 7.69547 |

Yes, in Portugal.

Yes, in Thailand.

Answer for the group chosen at the beginning:

In [11]:
```
GW1_respondes(group_number)[4]
```

Out[11]:
```
3×5 Array{Any,2}:
 "Country"       "ΔY/Y"     "ΔTFP/TFP"   "α*ΔK/K"    "(1-α)*ΔL/L"
 "Netherlands"  0.362162  19.3057       0.104854    0.041406
 "Portugal"     0.28104   28.0865       0.108648   -0.0878453
```

In [12]:
```
GW1_respondes(group_number)[5]
```

Out[12]:
```
3×4 Array{Any,2}:
 "Country"          "%ΔTFP/TFP"    "%α*ΔK/K"     "%(1-α)*ΔL/L"
 "Netherlands"  5330.67          28.9522        11.433
 "Portugal"     9993.78          38.6594       -31.2572
```

In [13]:
```
GW1_respondes(group_number)[6]
```

Out[13]:
```
"Yes, in Netherlands."
```

In [14]:
```
GW1_respondes(group_number)[7]
```

Out[14]:
```
"Yes, in Portugal."
```