

LinkedIN_Analysis

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Before beginning we install the needed packages

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##   filter, lag

## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union

## -- Attaching packages ----- tidyverse 1.3.0 --

## v ggplot2 3.3.3      v purrr 0.3.4
## v tibble 3.1.0       v stringr 1.4.0
## v tidyr 1.1.3        v forcats 0.5.1
## v readr 1.4.0

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

##
## Attaching package: 'kableExtra'

## The following object is masked from 'package:dplyr':
##
##   group_rows
```

As a next step, we would like to use the LinkedIN data to investigate how migration is impacting the growth of a country. To do so we are going to use the data provided by a collaboration between World bank and LinkedIN. We can download the needed data from the website of the collaboration mentioned above:

```
download.file("https://development-data-hub-s3-public.s3.amazonaws.com/ddhfiles/1202896/country_migration_data.csv", "country_migration_data.csv")
download.file("https://development-data-hub-s3-public.s3.amazonaws.com/ddhfiles/1202896/industry_migration_data.csv", "industry_migration_data.csv")
```

Now, we will need to process this data. As a first step we need to filter out only the data relative to countries whose WB Region is marked as “Europe and Centra Asia”.

Table 1: First ten rows of the migration flux database.

year	base_country_code	base_country_name	base_country_GDPpc	base_country_GDPgrowth	base_country
2015	al	Albania	11658.87	2.218752	
2016	al	Albania	12078.80	3.314805	
2017	al	Albania	12811.76	3.802198	
2018	al	Albania	13974.01	4.071301	
2019	al	Albania	14648.27	2.240070	
2015	al	Albania	11658.87	2.218752	
2016	al	Albania	12078.80	3.314805	
2017	al	Albania	12811.76	3.802198	
2018	al	Albania	13974.01	4.071301	
2019	al	Albania	14648.27	2.240070	

```

countrydf_raw <- read.csv("CountryMigration.csv", header = T, sep = ",")
industrydf_raw <- read.csv("IndustryMigration.csv", header = T, sep = ",")
skilldf_raw <- read.csv("SkillMigration.csv", header = T, sep = ",")

countrydf <-countrydf_raw %>%
  filter(base_country_wb_region == "Europe & Central Asia") %>%
  filter(target_country_wb_region == "Europe & Central Asia")

industrydf <-industrydf_raw %>%
  filter(wb_region == "Europe & Central Asia")

skilldf <-skilldf_raw %>%
  filter(wb_region == "Europe & Central Asia")

```

While to get data on the countries GDP (normalized per capita), GDP growth and unemployment, we are going to use the WDI API interface, as from the following code snippet. To be consistent with the data provided by LinkedIn we are going to fetch the data between 2015 and 2019.

```

WDIdf <- WDI(indicator=c("NY.GDP.PCAP.PP.CD", "NY.GDP.MKTP.KD.ZG", "SL.UEM.TOTL.NE.ZS"), country ="all",
  select(country, year, NY.GDP.PCAP.PP.CD, NY.GDP.MKTP.KD.ZG, SL.UEM.TOTL.NE.ZS) %>%
  rename(GDPpc = NY.GDP.PCAP.PP.CD,
         GDPgrowth = NY.GDP.MKTP.KD.ZG,
         unemploymentRate = SL.UEM.TOTL.NE.ZS)

```

Now that we have the data that we need we can merge it in a single database that shows the migration flux among European countries, and GDPpc, GDP growth, and unemployment for both the source and destination countries. To better understand how to use this dataframe, Table @ref(tab:migrationFlux) shows the first 10 rows. We can see that each row contains information about a specific year, about the migration flux between a base and a target country. The migration flux is normalized according to the number of LinkedIn users in the base country. This number is positive when more people are arriving from, than leaving to the target country, and negative when the opposite happens.

Now that we have created the dataframe, we can start to investigate the relationship between the migration to a country and its wealth. As a first step we are going to plot a country's migration flux as a function of its GDP, grouped by year.

```
## List of 93
```

```

## $ line :List of 6
## ..$ colour : chr "black"
## ..$ size : num 0.5
## ..$ linetype : num 1
## ..$ lineend : chr "butt"
## ..$ arrow : logi FALSE
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ rect :List of 5
## ..$ fill : chr "white"
## ..$ colour : chr "black"
## ..$ size : num 0.5
## ..$ linetype : num 1
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ text :List of 11
## ..$ family : chr ""
## ..$ face : chr "plain"
## ..$ colour : chr "black"
## ..$ size : num 11
## ..$ hjust : num 0.5
## ..$ vjust : num 0.5
## ..$ angle : num 0
## ..$ lineheight : num 0.9
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug : logi FALSE
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ title : NULL
## $ aspect.ratio : NULL
## $ axis.title : NULL
## $ axis.title.x :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : NULL
## ..$ hjust : NULL
## ..$ vjust : num 1
## ..$ angle : NULL
## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 2.75points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.x.top :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : NULL
## ..$ hjust : NULL
## ..$ vjust : num 0
## ..$ angle : NULL

```

```

## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 0points 0points 2.75points 0points
## .. ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.x.bottom : NULL
## $ axis.title.y :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : NULL
## ..$ hjust : NULL
## ..$ vjust : num 1
## ..$ angle : num 90
## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 0points 2.75points 0points 0points
## .. ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.title.y.left : NULL
## $ axis.title.y.right :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : NULL
## ..$ hjust : NULL
## ..$ vjust : num 0
## ..$ angle : num -90
## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 0points 0points 0points 2.75points
## .. ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : chr "grey30"
## ..$ size : 'rel' num 0.8
## ..$ hjust : NULL
## ..$ vjust : NULL
## ..$ angle : NULL
## ..$ lineheight : NULL
## ..$ margin : NULL
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : NULL

```

```

## ..$ hjust      : NULL
## ..$ vjust      : num 1
## ..$ angle      : NULL
## ..$ lineheight : NULL
## ..$ margin     : 'margin' num [1:4] 2.2points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug      : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x.top      :List of 11
## ..$ family           : NULL
## ..$ face              : NULL
## ..$ colour           : NULL
## ..$ size              : NULL
## ..$ hjust            : NULL
## ..$ vjust            : num 0
## ..$ angle            : NULL
## ..$ lineheight       : NULL
## ..$ margin           : 'margin' num [1:4] 0points 0points 2.2points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug            : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.x.bottom   : NULL
## $ axis.text.y          :List of 11
## ..$ family           : NULL
## ..$ face              : NULL
## ..$ colour           : NULL
## ..$ size              : NULL
## ..$ hjust            : num 1
## ..$ vjust            : NULL
## ..$ angle            : NULL
## ..$ lineheight       : NULL
## ..$ margin           : 'margin' num [1:4] 0points 2.2points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug            : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.text.y.left     : NULL
## $ axis.text.y.right    :List of 11
## ..$ family           : NULL
## ..$ face              : NULL
## ..$ colour           : NULL
## ..$ size              : NULL
## ..$ hjust            : num 0
## ..$ vjust            : NULL
## ..$ angle            : NULL
## ..$ lineheight       : NULL
## ..$ margin           : 'margin' num [1:4] 0points 0points 0points 2.2points
## ..- attr(*, "unit")= int 8
## ..$ debug            : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ axis.ticks           :List of 6

```

```

## ..$ colour      : chr "grey20"
## ..$ size        : NULL
## ..$ linetype    : NULL
## ..$ lineend     : NULL
## ..$ arrow       : logi FALSE
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ axis.ticks.x      : NULL
## $ axis.ticks.x.top  : NULL
## $ axis.ticks.x.bottom: NULL
## $ axis.ticks.y      : NULL
## $ axis.ticks.y.left : NULL
## $ axis.ticks.y.right: NULL
## $ axis.ticks.length : 'simpleUnit' num 2.75points
## ..- attr(*, "unit")= int 8
## $ axis.ticks.length.x : NULL
## $ axis.ticks.length.x.top : NULL
## $ axis.ticks.length.x.bottom: NULL
## $ axis.ticks.length.y : NULL
## $ axis.ticks.length.y.left : NULL
## $ axis.ticks.length.y.right: NULL
## $ axis.line          : list()
## ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ axis.line.x        : NULL
## $ axis.line.x.top    : NULL
## $ axis.line.x.bottom : NULL
## $ axis.line.y        : NULL
## $ axis.line.y.left   : NULL
## $ axis.line.y.right  : NULL
## $ legend.background  :List of 5
## ..$ fill             : NULL
## ..$ colour           : logi NA
## ..$ size             : NULL
## ..$ linetype         : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ legend.margin      : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points
## ..- attr(*, "unit")= int 8
## $ legend.spacing     : 'simpleUnit' num 11points
## ..- attr(*, "unit")= int 8
## $ legend.spacing.x   : NULL
## $ legend.spacing.y   : NULL
## $ legend.key          :List of 5
## ..$ fill             : chr "white"
## ..$ colour           : logi NA
## ..$ size             : NULL
## ..$ linetype         : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ legend.key.size     : 'simpleUnit' num 1.2lines
## ..- attr(*, "unit")= int 3
## $ legend.key.height   : NULL
## $ legend.key.width    : NULL
## $ legend.text         :List of 11

```

```

## ..$ family      : NULL
## ..$ face        : NULL
## ..$ colour      : NULL
## ..$ size        : 'rel' num 0.8
## ..$ hjust       : NULL
## ..$ vjust       : NULL
## ..$ angle       : NULL
## ..$ lineheight  : NULL
## ..$ margin      : NULL
## ..$ debug       : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ legend.text.align      : NULL
## $ legend.title           :List of 11
## ..$ family      : NULL
## ..$ face        : NULL
## ..$ colour      : NULL
## ..$ size        : NULL
## ..$ hjust       : num 0
## ..$ vjust       : NULL
## ..$ angle       : NULL
## ..$ lineheight  : NULL
## ..$ margin      : NULL
## ..$ debug       : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ legend.title.align    : NULL
## $ legend.position       : chr "right"
## $ legend.direction      : NULL
## $ legend.justification  : chr "center"
## $ legend.box            : NULL
## $ legend.box.just       : NULL
## $ legend.box.margin     : 'margin' num [1:4] 0cm 0cm 0cm 0cm
## ..- attr(*, "unit")= int 1
## $ legend.box.background : list()
## ..- attr(*, "class")= chr [1:2] "element_blank" "element"
## $ legend.box.spacing    : 'simpleUnit' num 11points
## ..- attr(*, "unit")= int 8
## $ panel.background      :List of 5
## ..$ fill                : chr "white"
## ..$ colour              : logi NA
## ..$ size                : NULL
## ..$ linetype            : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ panel.border          :List of 5
## ..$ fill                : logi NA
## ..$ colour              : chr "grey20"
## ..$ size                : NULL
## ..$ linetype            : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ panel.spacing        : 'simpleUnit' num 5.5points
## ..- attr(*, "unit")= int 8

```

```

## $ panel.spacing.x          : NULL
## $ panel.spacing.y          : NULL
## $ panel.grid                :List of 6
##   ..$ colour              : chr "grey92"
##   ..$ size                 : NULL
##   ..$ linetype             : NULL
##   ..$ lineend              : NULL
##   ..$ arrow                : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ panel.grid.major          : NULL
## $ panel.grid.minor          :List of 6
##   ..$ colour              : NULL
##   ..$ size                 : 'rel' num 0.5
##   ..$ linetype             : NULL
##   ..$ lineend              : NULL
##   ..$ arrow                : logi FALSE
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_line" "element"
## $ panel.grid.major.x        : NULL
## $ panel.grid.major.y        : NULL
## $ panel.grid.minor.x        : NULL
## $ panel.grid.minor.y        : NULL
## $ panel.ontop               : logi FALSE
## $ plot.background           :List of 5
##   ..$ fill                 : NULL
##   ..$ colour              : chr "white"
##   ..$ size                 : NULL
##   ..$ linetype             : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ plot.title                :List of 11
##   ..$ family              : NULL
##   ..$ face                 : NULL
##   ..$ colour              : NULL
##   ..$ size                 : 'rel' num 1.2
##   ..$ hjust               : num 0
##   ..$ vjust               : num 1
##   ..$ angle               : NULL
##   ..$ lineheight          : NULL
##   ..$ margin              : 'margin' num [1:4] 0points 0points 5.5points 0points
##   .. ..- attr(*, "unit")= int 8
##   ..$ debug               : NULL
##   ..$ inherit.blank: logi TRUE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.title.position       : chr "panel"
## $ plot.subtitle             :List of 11
##   ..$ family              : NULL
##   ..$ face                 : NULL
##   ..$ colour              : NULL
##   ..$ size                 : NULL
##   ..$ hjust               : num 0
##   ..$ vjust               : num 1
##   ..$ angle               : NULL

```



```

## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 0points 0points 5.5points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.caption :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : 'rel' num 0.8
## ..$ hjust : num 1
## ..$ vjust : num 1
## ..$ angle : NULL
## ..$ lineheight : NULL
## ..$ margin : 'margin' num [1:4] 5.5points 0points 0points 0points
## ..- attr(*, "unit")= int 8
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.caption.position : chr "panel"
## $ plot.tag :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : NULL
## ..$ size : 'rel' num 1.2
## ..$ hjust : num 0.5
## ..$ vjust : num 0.5
## ..$ angle : NULL
## ..$ lineheight : NULL
## ..$ margin : NULL
## ..$ debug : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ plot.tag.position : chr "topleft"
## $ plot.margin : 'margin' num [1:4] 5.5points 5.5points 5.5points 5.5points
## ..- attr(*, "unit")= int 8
## $ strip.background :List of 5
## ..$ fill : chr "grey85"
## ..$ colour : chr "grey20"
## ..$ size : NULL
## ..$ linetype : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_rect" "element"
## $ strip.background.x : NULL
## $ strip.background.y : NULL
## $ strip.placement : chr "inside"
## $ strip.text :List of 11
## ..$ family : NULL
## ..$ face : NULL
## ..$ colour : chr "grey10"
## ..$ size : 'rel' num 0.8
## ..$ hjust : NULL
## ..$ vjust : NULL

```

```

## ..$ angle          : NULL
## ..$ lineheight     : NULL
## ..$ margin         : 'margin' num [1:4] 4.4points 4.4points 4.4points 4.4points
## ..- attr(*, "unit")= int 8
## ..$ debug          : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ strip.text.x      : NULL
## $ strip.text.y      :List of 11
## ..$ family         : NULL
## ..$ face           : NULL
## ..$ colour         : NULL
## ..$ size           : NULL
## ..$ hjust          : NULL
## ..$ vjust          : NULL
## ..$ angle          : num -90
## ..$ lineheight     : NULL
## ..$ margin         : NULL
## ..$ debug          : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## $ strip.switch.pad.grid : 'simpleUnit' num 2.75points
## ..- attr(*, "unit")= int 8
## $ strip.switch.pad.wrap : 'simpleUnit' num 2.75points
## ..- attr(*, "unit")= int 8
## $ strip.text.y.left   :List of 11
## ..$ family         : NULL
## ..$ face           : NULL
## ..$ colour         : NULL
## ..$ size           : NULL
## ..$ hjust          : NULL
## ..$ vjust          : NULL
## ..$ angle          : num 90
## ..$ lineheight     : NULL
## ..$ margin         : NULL
## ..$ debug          : NULL
## ..$ inherit.blank: logi TRUE
## ..- attr(*, "class")= chr [1:2] "element_text" "element"
## - attr(*, "class")= chr [1:2] "theme" "gg"
## - attr(*, "complete")= logi TRUE
## - attr(*, "validate")= logi TRUE

```

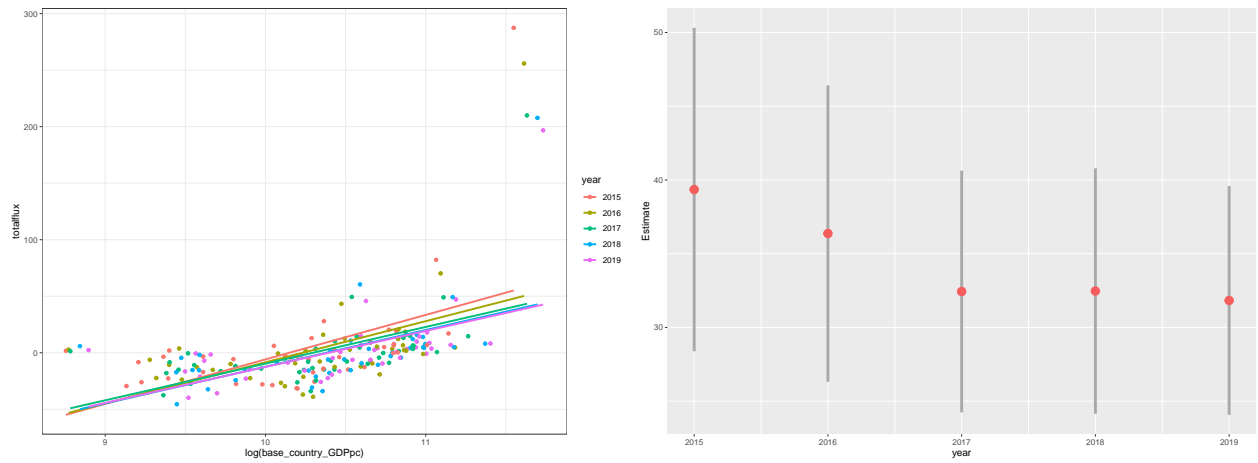


Figure 1: Relation between net flux migration of country X expressed as unit per 10k linkedIN users of that country and the country's GDP per capita. The data are grouped by year, and interpolated by means of linear regression.