# Computer Assignment 2: France (Group 12)

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## Q1: Data Preparation

We will be using the GDP and investment data in euro, as this was the best data we found and transforming it using the exchange rate would lead to high fluctuations. The sources for all the data is given in the references at the end of this document.

All working files can be found on GitHub.

On the next two pages you may find the tables with our quarterly and annual data. After those, the code to import, clean and prepare the data for analysis will be visible.

Table 1: Quarterly Data for France

| Date | Current Account Balance (as % of GDP) | Interest Rate (in %) | Exchange Rate €/USD | GDP (millions of €) | Investment (millions of €) | Investment rate (as % of GDP) |
|---|---|---|---|---|---|---|
| 1999-Q1 | 4.3844 | 3.9442 | 0.8925 | 344117 | 70478 | 20.4808 |
| 1999-Q2 | 4.8480 | 4.2036 | 0.9463 | 347464 | 72075 | 20.7432 |
| 1999-Q3 | 2.2296 | 5.0046 | 0.9530 | 351727 | 73845 | 20.9950 |
| 1999-Q4 | 2.2150 | 5.2828 | 0.9645 | 356592 | 74774 | 20.9691 |
| 2000-Q1 | 1.5850 | 5.5710 | 1.0143 | 362660 | 76970 | 21.2237 |
| 2000-Q2 | 1.9327 | 5.3864 | 1.0713 | 367789 | 78600 | 21.3709 |
| 2000-Q3 | 0.3161 | 5.3928 | 1.1059 | 372166 | 80714 | 21.6876 |
| 2000-Q4 | 0.5900 | 5.2277 | 1.1518 | 376980 | 82060 | 21.7677 |
| 2001-Q1 | 1.7772 | 4.9031 | 1.0846 | 380845 | 82467 | 21.6537 |
| 2001-Q2 | 1.2125 | 5.1190 | 1.1447 | 383539 | 82632 | 21.5446 |
| 2001-Q3 | 1.3897 | 5.0156 | 1.1226 | 386507 | 83310 | 21.5546 |
| 2001-Q4 | 1.9134 | 4.7202 | 1.1171 | 388555 | 82894 | 21.3339 |
| 2002-Q1 | 1.4909 | 5.0546 | 1.1402 | 392514 | 82625 | 21.0502 |
| 2002-Q2 | 1.1986 | 5.2034 | 1.0887 | 395640 | 82682 | 20.8983 |
| 2002-Q3 | 0.8124 | 4.6969 | 1.0161 | 399012 | 83542 | 20.9372 |
| 2002-Q4 | 1.0951 | 4.4900 | 0.9997 | 401288 | 84117 | 20.9618 |
| 2003-Q1 | 0.9023 | 4.1114 | 0.9317 | 403234 | 84730 | 21.0126 |
| 2003-Q2 | 0.3858 | 3.9360 | 0.8806 | 404603 | 85027 | 21.0149 |
| 2003-Q3 | 0.7657 | 4.1337 | 0.8878 | 409627 | 86474 | 21.1104 |
| 2003-Q4 | 1.2776 | 4.3424 | 0.8389 | 414298 | 87009 | 21.0015 |
| 2004-Q1 | 1.1807 | 4.1059 | 0.8001 | 419847 | 88890 | 21.1720 |
| 2004-Q2 | 0.4774 | 4.3066 | 0.8301 | 423647 | 90435 | 21.3468 |
| 2004-Q3 | 0.3557 | 4.1589 | 0.8179 | 426215 | 91196 | 21.3967 |
| 2004-Q4 | 0.1348 | 3.8253 | 0.7698 | 431768 | 92734 | 21.4777 |
| 2005-Q1 | 0.2788 | 3.6419 | 0.7626 | 435001 | 93764 | 21.5549 |
| 2005-Q2 | -0.1391 | 3.3738 | 0.7942 | 438435 | 95310 | 21.7387 |
| 2005-Q3 | 0.3456 | 3.2335 | 0.8200 | 441972 | 96752 | 21.8910 |
| 2005-Q4 | -0.0657 | 3.3886 | 0.8410 | 448518 | 98537 | 21.9695 |
| 2006-Q1 | 0.1408 | 3.5125 | 0.8311 | 453785 | 100428 | 22.1312 |
| 2006-Q2 | -0.3137 | 3.9870 | 0.7951 | 460637 | 103263 | 22.4174 |
| 2006-Q3 | 0.5671 | 3.8974 | 0.7849 | 463892 | 104645 | 22.5581 |
| 2006-Q4 | 0.6060 | 3.7861 | 0.7753 | 471205 | 107074 | 22.7234 |
| 2007-Q1 | 0.6308 | 4.0541 | 0.7628 | 477008 | 109163 | 22.8849 |
| 2007-Q2 | -0.1653 | 4.3879 | 0.7416 | 483601 | 111688 | 23.0951 |
| 2007-Q3 | -0.3438 | 4.4428 | 0.7274 | 488760 | 113982 | 23.3206 |
| 2007-Q4 | -0.5084 | 4.3280 | 0.6905 | 493210 | 115657 | 23.4498 |
| 2008-Q1 | -0.6819 | 4.0829 | 0.6664 | 499044 | 118276 | 23.7005 |
| 2008-Q2 | -1.0177 | 4.4698 | 0.6400 | 499558 | 119017 | 23.8245 |
| 2008-Q3 | -0.7171 | 4.4847 | 0.6653 | 498729 | 118548 | 23.7700 |
| 2008-Q4 | -0.3666 | 3.8999 | 0.7575 | 493593 | 113934 | 23.0826 |
| 2009-Q1 | -0.9334 | 3.6424 | 0.7672 | 484599 | 108793 | 22.4501 |
| 2009-Q2 | -1.0537 | 3.7878 | 0.7343 | 482344 | 106466 | 22.0726 |
| 2009-Q3 | -0.1551 | 3.6357 | 0.6991 | 482260 | 105505 | 21.8772 |
| 2009-Q4 | -0.0606 | 3.5294 | 0.6774 | 487648 | 106705 | 21.8816 |
| 2010-Q1 | -1.0327 | 3.4837 | 0.7235 | 491370 | 107600 | 21.8980 |
| 2010-Q2 | -1.1858 | 3.1835 | 0.7849 | 495993 | 109348 | 22.0463 |
| 2010-Q3 | -0.4468 | 2.7816 | 0.7729 | 501089 | 110992 | 22.1502 |
| 2010-Q4 | 0.1287 | 3.0192 | 0.7360 | 505200 | 112330 | 22.2348 |
| 2011-Q1 | -1.6412 | 3.5519 | 0.7300 | 511232 | 113312 | 22.1645 |
| 2011-Q2 | -1.8491 | 3.5366 | 0.6945 | 512641 | 114766 | 22.3872 |
| 2011-Q3 | -0.6333 | 3.0094 | 0.7081 | 515339 | 115532 | 22.4186 |
| 2011-Q4 | 0.6644 | 3.1863 | 0.7421 | 518136 | 117550 | 22.6871 |
| 2012-Q1 | -0.9644 | 3.0499 | 0.7621 | 520378 | 117693 | 22.6168 |
| 2012-Q2 | -1.6003 | 2.7716 | 0.7791 | 521185 | 117224 | 22.4918 |
| 2012-Q3 | -0.9006 | 2.2106 | 0.7995 | 523736 | 117272 | 22.3914 |
| 2012-Q4 | -0.3964 | 2.1119 | 0.7706 | 523834 | 117130 | 22.3601 |
| 2013-Q1 | -0.2135 | 2.1603 | 0.7578 | 525342 | 116349 | 22.1473 |
| 2013-Q2 | -0.5737 | 1.9621 | 0.7654 | 529783 | 116589 | 22.0069 |
| 2013-Q3 | -1.1343 | 2.3650 | 0.7546 | 530170 | 116656 | 22.0035 |
| 2013-Q4 | -0.1168 | 2.3300 | 0.7342 | 532841 | 117668 | 22.0831 |
| 2014-Q1 | -0.7892 | 2.2629 | 0.7297 | 535238 | 117833 | 22.0151 |
| 2014-Q2 | -2.0642 | 1.8587 | 0.7291 | 535848 | 117277 | 21.8862 |
| 2014-Q3 | -0.7180 | 1.4387 | 0.7547 | 538574 | 117483 | 21.8137 |
| 2014-Q4 | -0.2588 | 1.1055 | 0.8002 | 541699 | 116961 | 21.5915 |
| 2015-Q1 | 0.1386 | 0.5934 | 0.8892 | 546839 | 117750 | 21.5328 |
| 2015-Q2 | -0.0859 | 0.8398 | 0.9035 | 547600 | 116790 | 21.3276 |
| 2015-Q3 | -0.4265 | 1.0411 | 0.8994 | 551067 | 118151 | 21.4404 |
| 2015-Q4 | -1.0907 | 0.8932 | 0.9129 | 552787 | 119934 | 21.6962 |
| 2016-Q1 | -0.6819 | 0.6481 | 0.9062 | 557860 | 121077 | 21.7038 |
| 2016-Q2 | -0.3702 | 0.4712 | 0.8853 | 555959 | 120940 | 21.7534 |
| 2016-Q3 | -0.6182 | 0.1695 | 0.8958 | 557486 | 121575 | 21.8077 |
| 2016-Q4 | -0.2777 | 0.5827 | 0.9277 | 561128 | 123171 | 21.9506 |
| 2017-Q1 | -1.6937 | 0.9718 | 0.9380 | 567132 | 126956 | 22.3856 |
| 2017-Q2 | -0.7552 | 0.7845 | 0.9084 | 572562 | 128451 | 22.4344 |
| 2017-Q3 | -0.0253 | 0.7485 | 0.8507 | 576959 | 130098 | 22.5489 |
| 2017-Q4 | -0.6077 | 0.7346 | 0.8491 | 581934 | 131790 | 22.6469 |
| 2018-Q1 | -1.3809 | 0.8920 | 0.8137 | 585024 | 132470 | 22.6435 |
| 2018-Q2 | -0.4898 | 0.7711 | 0.8388 | 587880 | 134223 | 22.8317 |
| 2018-Q3 | 0.2059 | 0.7119 | 0.8599 | 592206 | 136528 | 23.0541 |
| 2018-Q4 | -0.5818 | 0.7614 | 0.8761 | 597300 | 138123 | 23.1246 |
| 2019-Q1 | -1.6098 | 0.5441 | 0.8808 | 602638 | 140292 | 23.2796 |
| 2019-Q2 | 1.3553 | 0.2518 | 0.8899 | 605984 | 143004 | 23.5986 |
| 2019-Q3 | -1.1091 | -0.2279 | 0.8992 | 608584 | 144970 | 23.8209 |
| 2019-Q4 | -1.3020 | -0.0472 | 0.9030 | 609740 | 145772 | 23.9072 |
| 2020-Q1 | -2.6078 | -0.0809 | 0.9073 | 580233 | 131148 | 22.6026 |
| 2020-Q2 | -0.8781 | -0.0054 | 0.9078 | 515406 | 111945 | 21.7198 |
| 2020-Q3 | -2.9307 | -0.1754 | 0.8548 | 593490 | 138276 | 23.2988 |
| 2020-Q4 | NA | -0.3193 | 0.8385 | 588053 | 140339 | 23.8650 |

Table 2: Annual Data for France

| Year | General Government Debt (as % of GDP) | Gross National Savings (as % of GDP) |
|---|---|---|
| 1999 | 74.0152 | 24.4935 |
| 2000 | 72.4292 | 23.8347 |
| 2001 | 71.4731 | 23.9391 |
| 2002 | 75.1616 | 22.7448 |
| 2003 | 79.0776 | 22.2346 |
| 2004 | 80.5495 | 22.5492 |
| 2005 | 82.1422 | 22.4634 |
| 2006 | 77.2693 | 23.3063 |
| 2007 | 75.9418 | 23.7466 |
| 2008 | 82.5035 | 23.4340 |
| 2009 | 97.5731 | 20.9645 |
| 2010 | 100.9953 | 21.0843 |
| 2011 | 103.8066 | 22.1130 |
| 2012 | 111.9382 | 21.4558 |
| 2013 | 112.4676 | 21.3892 |
| 2014 | 120.1551 | 21.4860 |
| 2015 | 120.8252 | 22.2540 |
| 2016 | 123.6707 | 22.0046 |
| 2017 | 122.9442 | 22.7529 |
| 2018 | 121.3599 | 23.0591 |
| 2019 | 123.9643 | 23.3952 |

```r
# Here we import all relevant packages and set options

library(dplyr)
library(tidyverse)
library(lubridate) # This package is used for working with dates
library(knitr) # This package is for nice tables
library(kableExtra) # Package for even nicer tables.

options(scipen = 999) # Disable scientific notation
```

```r
# Importing the Current Account Balance as a % of GDP of France
# SOURCE: FRED https://fred.stlouisfed.org/series/FRAB6BLTT02STSAQ

CABalance_FR <- read_csv("sourcecode/FRED_bop_france_quarterly.csv",
    col_types = cols(DATE = col_date(format = "%d/%m/%Y"),
        FRAB6BLTT02STSAQ = col_number())) %>%
  mutate(FRAB6BLTT02STSAQ = FRAB6BLTT02STSAQ /100) %>%
  rename(date = DATE, CAasPercGDP_quart_FR = FRAB6BLTT02STSAQ)


# Importing the General Government Debt as a % of GDP.
# THIS IS NOT IN PERCENT! GOVERNMENT DEBT OF 100%  -> 1
# SOURCE: OECD https://data.oecd.org/gga/general-government-debt.htm

GovDebt_FR <- read_csv("sourcecode/OECD_gov_debt_annual.csv",
    col_types = cols(LOCATION = col_character(),
        INDICATOR = col_skip(), SUBJECT = col_skip(),
        MEASURE = col_skip(), FREQUENCY = col_skip(),
        TIME = col_date(format = "%Y"), Value = col_number(),
        `Flag Codes` = col_skip())) %>%
  rename(date = TIME) %>%
  filter(LOCATION == "FRA") %>%
  mutate(LOCATION = NULL, GovDebt_ann_FR = Value / 100, Value = NULL)


# This function transform dates
# from a quarterly format of "2000-Q1" to 2000-01-01
QuarterToDate <- function(QuarterlyDate){

  NumberofQuarter <- substr(QuarterlyDate, 7, 7)

  Month <- 3 * as.numeric(NumberofQuarter) - 2
  Month <- ifelse(Month == 10, Month, paste(0, Month))

  Year <- substr(QuarterlyDate, 1, 4)

  Date_String <- paste(Year, "-", Month, "-01") %>%
    str_replace_all(" ", "")

  Date <- as.Date(Date_String)

  Date
}
```

```
# Importing Interest Rate on Government Bonds (10 year),
# also called "Long term interest rate", in %/annum
# SOURCE: OECD https://data.oecd.org/interest/long-term-interest-rates.htm

IntRate_FR <- read_csv("sourcecode/OECD_interest_rates_france_quarterly.csv",
    col_types = cols(INDICATOR = col_skip(),
        SUBJECT = col_skip(), MEASURE = col_skip(),
        FREQUENCY = col_skip(), Value = col_number(),
        `Flag Codes` = col_skip())) %>%
  mutate(date = QuarterToDate(TIME),
         IntRate_quart_FR = Value / 100,
         Value = NULL, TIME = NULL, LOCATION = NULL)


# Exchange rate against the US dollar
# SOURCE: FRED https://fred.stlouisfed.org/series/DEXUSEU

XR_EurUSD <- read_csv("sourcecode/FRED_exchage_rate_quarterly.csv",
    col_types = cols(DATE = col_date(format = "%d/%m/%Y"),
        DEXUSEU = col_number())) %>%
  rename(date = DATE, XR_quart_EurUSD = DEXUSEU) %>%
  mutate(XR_quart_EurUSD = 1/XR_quart_EurUSD)


# Total GDP, in millions of euro
# SOURCE: FRED https://fred.stlouisfed.org/series/CPMNACSCAB1GQFR

GDP_FR <- read_csv("sourcecode/FRED_euros_france_gdp_quarterly.csv",
    col_types = cols(DATE = col_date(format = "%d/%m/%Y"),
        CPMNACSCAB1GQFR = col_number())) %>%
  mutate(date = DATE, GDP_quart_Millionseur_FR = CPMNACSCAB1GQFR,
         CPMNACSCAB1GQFR = NULL, DATE = NULL)


# Investment (usually Gross Fixed Capital Formation), in millions of euro
# SOURCE: FRED https://fred.stlouisfed.org/series/FRAGFCFQDSMEI#0

Invest_FR <- read_csv("sourcecode/FRED_euros_investments_quarterly.csv",
    col_types = cols(DATE = col_date(format = "%d/%m/%Y"),
        FRAGFCFQDSMEI = col_number())) %>%
  mutate(Invest_quart_Millionseur_FR = FRAGFCFQDSMEI / 1000000,
         FRAGFCFQDSMEI = NULL) %>%
  rename(date = DATE)


# Gross national savings as a % of GDP (savings rate).
# Again, this is in decimals, and not percent!
# SOURCE: World Bank https://data.worldbank.org/indicator/NY.GNS.ICTR.ZS

SavingsR_FR <- read_csv("sourcecode/WorldBank_GrossSavings_annual.csv",
    col_types = cols(`Country Code` = col_skip(),
        `Indicator Name` = col_character(),
        `Indicator Code` = col_skip()), skip = 3) %>%
```

```
  filter(`Country Name` == "France") %>%
  pivot_longer(cols = -c(`Country Name`, `Indicator Name`),
               names_to = "date",
               values_to = "Savings_PercentageGDP") %>%
  mutate(`Country Name` = NULL,
         `Indicator Name` = NULL,
         date = as.Date(paste(date, "-01-01", sep = "")),
         SavR_ann_FR = Savings_PercentageGDP / 100,
         Savings_PercentageGDP = NULL) %>%
  filter(date >= "1999-01-01", "2019-01-01" >= date)


# Merging them all together

DF_FR <- CABalance_FR %>%
  full_join(IntRate_FR, by = "date") %>%
  full_join(XR_EurUSD, by = "date") %>%
  full_join(GDP_FR, by = "date") %>%
  full_join(Invest_FR, by = "date") %>%
  full_join(GovDebt_FR, by = "date") %>%
  full_join(SavingsR_FR, by = "date") %>%
  filter(date != "1998-10-01") %>%
  mutate(InvestmentR_Fr = Invest_quart_Millionseur_FR/GDP_quart_Millionseur_FR)


# Creating and printing a table with all the quarterly data

DF_quart_FR <- DF_FR %>%
  select(!c(GovDebt_ann_FR, SavR_ann_FR)) %>%
  mutate(date = paste(as.character(year(date)), "-Q",
                      as.character(quarter(date)), sep = ""),
         InvestmentR_Fr = InvestmentR_Fr * 100,
         CAasPercGDP_quart_FR = CAasPercGDP_quart_FR * 100,
         IntRate_quart_FR = IntRate_quart_FR * 100) %>%
  rename(`Current Account Balance (as % of GDP)` = CAasPercGDP_quart_FR,
          `Interest Rate (in %)` = IntRate_quart_FR,
          `Exchange Rate €/USD` = XR_quart_EurUSD,
          `GDP (millions of €)` = GDP_quart_Millionseur_FR,
          `Investment (millions of €)` = Invest_quart_Millionseur_FR,
          `Investment rate (as % of GDP)` = InvestmentR_Fr,
         `Date` = date
          )

table_quart_FR <- DF_quart_FR %>%
  kbl(caption = "Quarterly Data for France", booktabs = T,
      linesep = "", digits = 4) %>%
  kable_styling(latex_options = c("striped", "scale_down"))
```

For the resulting table, see page 2

```r
# Creating and printing a table with all the annual data

DF_ann_FR <- DF_FR %>%
  select(c(date, GovDebt_ann_FR, SavR_ann_FR)) %>%
  mutate(date = format(as.Date(date), "%Y"),
         GovDebt_ann_FR = GovDebt_ann_FR * 100,
         SavR_ann_FR = SavR_ann_FR * 100) %>%
  na.omit() %>%
  rename(`General Government Debt (as % of GDP)` = GovDebt_ann_FR,
         `Gross National Savings (as % of GDP)` = SavR_ann_FR,
         `Year` = date)

table_ann_FR <- DF_ann_FR %>%
  kbl(caption = "Annual Data for France", booktabs = T,
      linesep = "", digits = 4) %>%
  kable_styling(latex_options = c("striped", "hold_position"))
```

For the resulting table, see page 3.

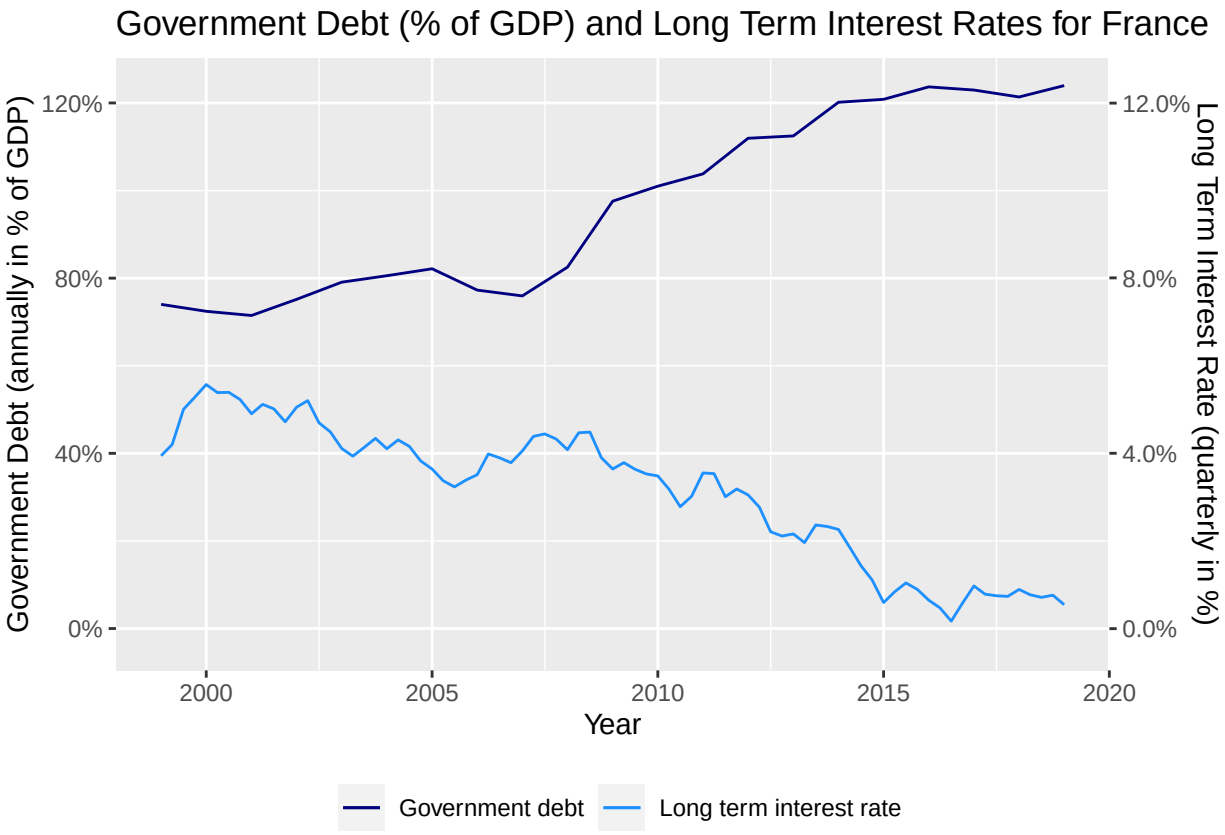
## Q2: Government debt, interest rate, current account and the exchange rate

### 1. Government debt and interest rate

```
#Creating plot for Gov Debt & Interest Rate v Time
#Omitting NA first
DF_FR_NA <- DF_FR %>%
  na.omit


colors1 <- c("Government debt" = "navyblue",
             "Long term interest rate" = "dodgerblue1")


ggplot() +
  geom_line(DF_FR_NA,
            mapping = aes(x = date,
                          y = GovDebt_ann_FR,
                          color = "Government debt")) +
  geom_line(DF_FR,
            mapping = aes(x = date, y = IntRate_quart_FR*10,
                          color = "Long term interest rate")) +
  scale_y_continuous(labels = scales::percent,
                     name = "Government Debt (annually in % of GDP)",
                     sec.axis = sec_axis(~ . /10,
                                         name = paste("Long Term Interest",
                                                      "Rate (quarterly in %)"),
                                         labels = scales::percent)) +
  labs(x = "Year",
       title = "Government Debt (% of GDP) and Long Term Interest Rates for France",
       color = "") +
  scale_color_manual(values = colors1) +
  theme(legend.position="bottom") +
  scale_x_date(limits = c(as.Date("1999-01-01"), as.Date("2019-01-01")))
```

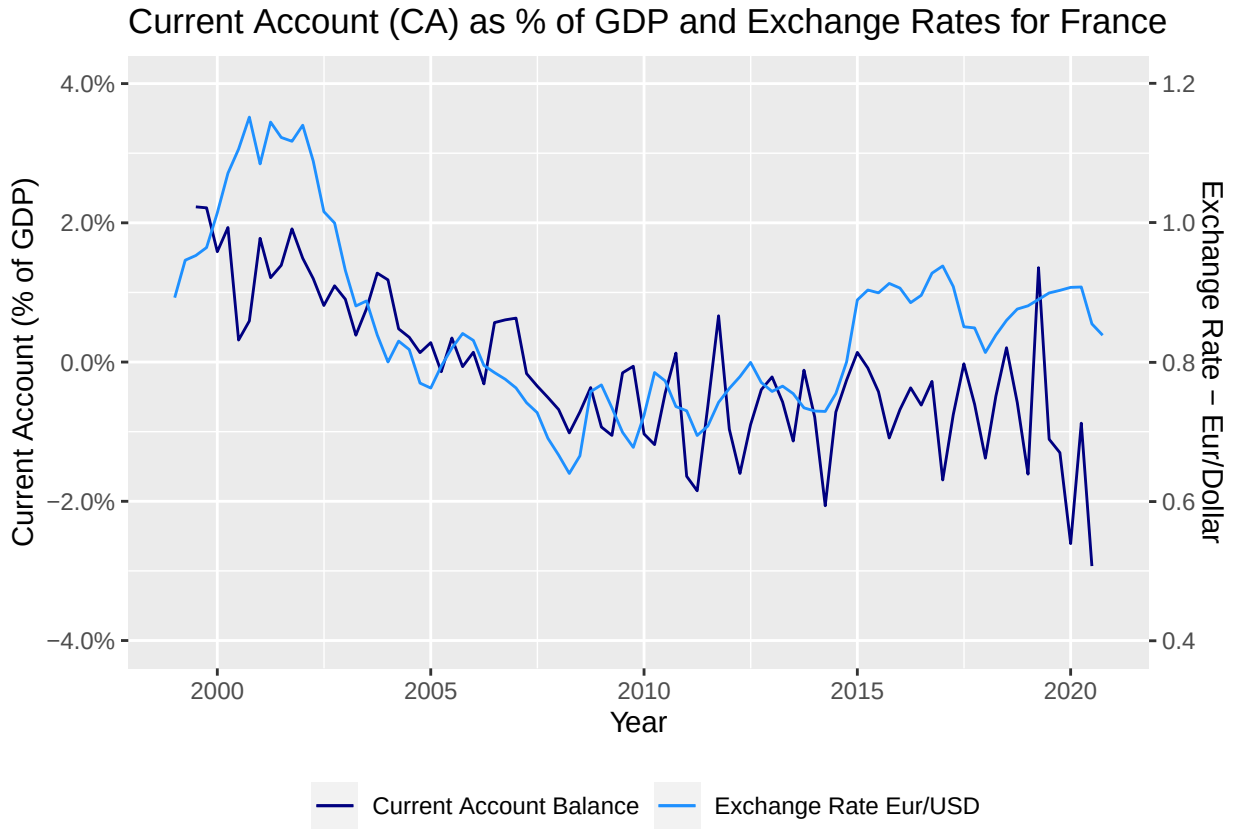



Government debt has been rising steadily, while long term interest rates have decreased. Hence, they move against each other. This might be because, during recessions, low interest rates and expansionary fiscal policy (causing government debt) are used as economic stimuli. Low interest rates also decrease the borrowing costs for governments.

## 2. Current account and the exchange rate

```
# Plotting Current Account and Exchange Rates with different y-axes
colors2 <- c("Current Account Balance" = "navyblue",
             "Exchange Rate Eur/USD" = "dodgerblue1")


ggplot() +
  geom_line(DF_FR,
            mapping = aes(x = date,
                          y = CAasPercGDP_quart_FR,
                          color = "Current Account Balance")) +
  geom_line(DF_FR,
            mapping = aes(x = date,
                          y = (XR_quart_EurUSD - 0.8) / 10,
                          color = "Exchange Rate Eur/USD")) +
  scale_y_continuous(labels = scales::percent,
                     limits = c(-.04, 0.04),
                     sec.axis = sec_axis(~ . *10 +.8,
                                         name = "Exchange Rate - Eur/Dollar")) +
  labs(x = "Year",
       y = "Current Account (% of GDP)",
       title = paste("Current Account (CA) as % of GDP",
                     "and Exchange Rates for France"),
       color = "") +
  scale_color_manual(values = colors2) +
  theme(legend.position="bottom")
```




The current account and the exchange rate have both decreased, seemingly moving together (deviations might occur because of e.g. changes in exchange rate expectations). Assuming relative price levels to be stable, if the euro appreciates, imports will get more expensive, while exports become less competitive abroad, worsening the current account.

## 3. Relevant events and policy responses

The euro appreciated steadily during the 2000s as it established itself as an international currency (Maggiori, Brent, & Schreger, 2019). This might, combined with France's competitive weaknesses (International Monetary Fund. European Dept., 2013), have driven the deterioration of its current account. During the Great Recession government debt increased. Interest rates have declined due to a fall in both inflation expectations and the real interest rate (Claeys & Efstathiou, 2017). The latter and the sudden depreciation of the euro in 2015 were partially caused by the ECB's quantitative easing program (Dedola, Georgiadis, Gräb, & Mehl, 2020).

## 4. Currency union and its effects

As France is a euro area country, it only has limited influence on its exchange rate and its monetary policy. To increase its real exchange rate it would need to decrease its price levels. France can reduce its current account deficit through contractionary fiscal policy, potentially disrupting its internal balance.

# Q3: Investment rate and the Feldstein-Horioka puzzle

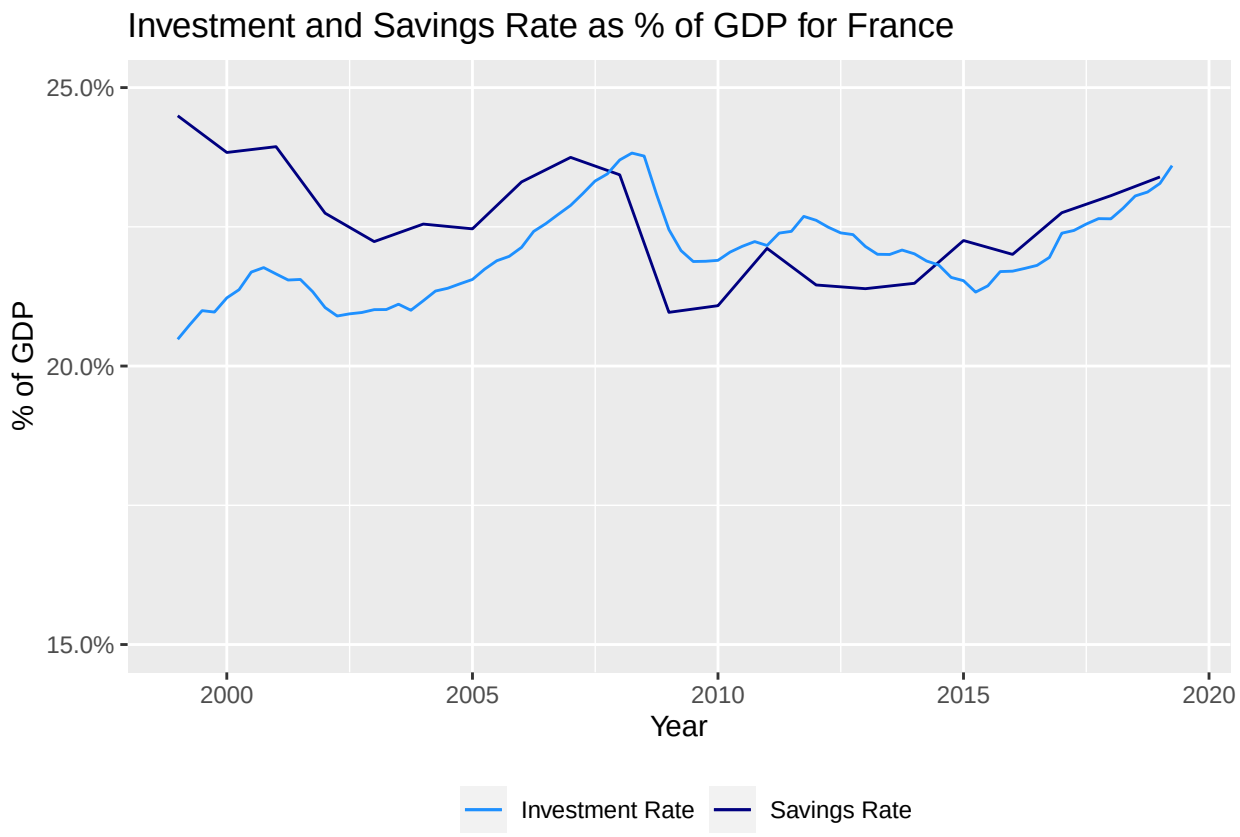
## 1. Investment rate

See table "Quarterly data for France" in question 1 on page 2.

## 2. Investment rate: Graph

```
#Assinging colors to titles
colors3 <- c("Savings Rate" = "navyblue", "Investment Rate" = "dodgerblue1")

#Plotting graph
ggplot() +
  geom_line(DF_FR_NA,
            mapping = aes(x = date,
                          y = SavR_ann_FR,
                          color = "Savings Rate")) +
  geom_line(DF_FR,
            mapping = aes(x = date,
                          y = InvestmentR_Fr,
                          color = "Investment Rate")) +
  labs(x = "Year",
       y = "% of GDP",
       title = "Investment and Savings Rate as % of GDP for France",
       color = "") +
  scale_y_continuous(labels = scales::percent,
                     breaks = seq(0, 0.25, by = 0.05),
                     limits = c(0.15, 0.25)) +
  scale_color_manual(values = colors3) +
  theme(legend.position="bottom") +
  scale_x_date(limits = c(as.Date("1999-01-01"), as.Date("2019-06-01")))
```




## 3. Feldstein-Horioka puzzle

France's investments and savings rates correlate quite strongly. According to Feldstein and Horioka this does not indicate a smoothly working international capital market. The graph illustrates an increasing correlation, more specifically, we observe a stronger correlation after the 2008 financial crisis, perhaps due to a home bias on equity holdings.

# References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