Computer Assignment 2: France (Group 12)

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Q1: Data preperation

We will be using the GDP data in euro, as this was the best data we found and transforming it using the exchange rate would lead to high fluctuation.

```
# 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 nicer tables
library(kableExtra) # Package for even nicer tables.https://cran.r-project.org/web/packages/kableExtra/

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

```
# Importing the Current Account Balance as a % of GDP of France

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

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)
```

```r
# This function transform dates in 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

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

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 US dollars

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 US dollars

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!

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


# 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 = format(as.Date(date), "%Y-%m"), InvestmentR_Fr = InvestmentR_Fr * 100)%>%
  rename(`Current Account Balance as % of GDP` = CAasPercGDP_quart_FR,
          `Inflation Rate` = IntRate_quart_FR,
          `Exchange Rate €/USD` = XR_quart_EurUSD,
          `GDP in millions of €` = GDP_quart_Millionseur_FR,
          `Invesment in millions of €` = Invest_quart_Millionseur_FR,
          `Investment rate as % of GDP` = InvestmentR_Fr,
         `Date (Year-Month)` = date
          )

DF_quart_FR %>%
  kable(caption = "Quarterly data for France") %>%
  kable_classic(html_font = "Cambria", full_width = TRUE, font_size = 4.5)
```

Table 1: Quarterly data for France

Date (Year-Month)	Current Account Balance as % of GDP	Inflation Rate	Exchange Rate €/USD	GDP in millions of €	Invesment in millions of €	Investment rate as % of GDP
1999-01	4.3843903	0.0394417	0.8925227	344117	70478	20.48082
1999-04	4.8479559	0.0420357	0.9463116	347464	72075	20.74316
1999-07	2.2295649	0.0500457	0.9530362	351727	73845	20.99498
1999-10	2.2150481	0.0528283	0.9644766	356592	74774	20.96906
2000-01	1.5849975	0.0557097	1.0143425	362660	76970	21.22374
2000-04	1.9326983	0.0538640	1.0713144	367789	78600	21.37095
2000-07	0.3160912	0.0539280	1.1059345	372166	80714	21.68763
2000-10	0.5900080	0.0522770	1.1518233	376980	82060	21.76773
2001-01	1.7772266	0.0490307	1.0846480	380845	82467	21.65369
2001-04	1.2125354	0.0511897	1.1446579	383539	82632	21.54461
2001-07	1.3896723	0.0501560	1.1226068	386507	83310	21.55459
2001-10	1.9134471	0.0472020	1.1171453	388555	82894	21.33392
2002-01	1.4908774	0.0505460	1.1402082	392514	82625	21.05020
2002-04	1.1986257	0.0520337	1.0886631	395640	82682	20.89829
2002-07	0.8123933	0.0469693	1.0160746	399012	83542	20.93721
2002-10	1.0950510	0.0448997	0.9997210	401288	84117	20.96175
2003-01	0.9023040	0.0411140	0.9316889	403234	84730	21.01261
2003-04	0.3858072	0.0393603	0.8805736	404603	85027	21.01492
2003-07	0.7656657	0.0413373	0.8877829	409627	86474	21.11042
2003-10	1.2776413	0.0434240	0.8389228	414298	87009	21.00155
2004-01	1.1807017	0.0410590	0.8000692	419847	88890	21.17200
2004-04	0.4774014	0.0430660	0.8301123	423647	90435	21.34678
2004-07	0.3557276	0.0415890	0.8178893	426215	91196	21.39671
2004-10	0.1348405	0.0382527	0.7697562	431768	92734	21.47774
2005-01	0.2788261	0.0364193	0.7626489	435001	93764	21.55489
2005-04	-0.1390665	0.0337377	0.7941875	438435	95310	21.73868
2005-07	0.3455717	0.0323350	0.8199746	441972	96752	21.89098
2005-10	-0.0656630	0.0338857	0.8410278	448518	98537	21.96946
2006-01	0.1408078	0.0351250	0.8310780	453785	100428	22.13119
2006-04	-0.3136958	0.0398703	0.7951476	460637	103263	22.41744
2006-07	0.5670738	0.0389737	0.7848550	463892	104645	22.55805
2006-10	0.6059834	0.0378607	0.7752927	471205	107074	22.72344
2007-01	0.6308237	0.0405407	0.7628075	477008	109163	22.88494
2007-04	-0.1652836	0.0438790	0.7416025	483601	111688	23.09507
2007-07	-0.3437623	0.0444283	0.7273984	488760	113982	23.32065
2007-10	-0.5084232	0.0432800	0.6904967	493210	115657	23.44985
2008-01	-0.6819473	0.0408287	0.6663772	499044	118276	23.70052
2008-04	-1.0176915	0.0446983	0.6399917	499558	119017	23.82446
2008-07	-0.7171070	0.0448467	0.6653305	498729	118548	23.77002
2008-10	-0.3665779	0.0389993	0.7574776	493593	113934	23.08258
2009-01	-0.9333621	0.0364237	0.7671644	484599	108793	22.45011
2009-04	-1.0536778	0.0378777	0.7342725	482344	106466	22.07263
2009-07	-0.1551247	0.0363573	0.6990924	482260	105505	21.87720
2009-10	-0.0605930	0.0352940	0.6774364	487648	106705	21.88156
2010-01	-1.0327454	0.0348373	0.7235384	491370	107600	21.89796
2010-04	-1.1858214	0.0318350	0.7849419	495993	109348	22.04628
2010-07	-0.4467889	0.0278160	0.7729039	501089	110992	22.15016
2010-10	0.1286623	0.0301923	0.7360465	505200	112330	22.23476
2011-01	-1.6412046	0.0355193	0.7299863	511232	113312	22.16450
2011-04	-1.8491211	0.0353657	0.6944874	512641	114766	22.38721
2011-07	-0.6333156	0.0300943	0.7080868	515339	115532	22.41864
2011-10	0.6643889	0.0318630	0.7420500	518136	117550	22.68709
2012-01	-0.9643651	0.0304990	0.7621117	520378	117693	22.61683
2012-04	-1.6002511	0.0277157	0.7790873	521185	117224	22.49182
2012-07	-0.9006000	0.0221060	0.7995127	523736	117272	22.39143
2012-10	-0.3964272	0.0211190	0.7706066	523834	117130	22.36014
2013-01	-0.2134870	0.0216027	0.7577772	525342	116349	22.14729
2013-04	-0.5736621	0.0196210	0.7654349	529783	116589	22.00693
2013-07	-1.1343437	0.0236500	0.7546155	530170	116656	22.00351
2013-10	-0.1167983	0.0233003	0.7342457	532841	117668	22.08314
2014-01	-0.7891905	0.0226290	0.7296581	535238	117833	22.01507
2014-04	-2.0642416	0.0185867	0.7290747	535848	117277	21.88624
2014-07	-0.7180165	0.0143873	0.7546947	538574	117483	21.81372
2014-10	-0.2587609	0.0110547	0.8001899	541699	116961	21.59151
2015-01	0.1386293	0.0059340	0.8892375	546839	117750	21.53285
2015-04	-0.0859321	0.0083977	0.9034508	547600	116790	21.32761
2015-07	-0.4265375	0.0104110	0.8993804	551067	118151	21.44041
2015-10	-1.0906565	0.0089317	0.9129152	552787	119934	21.69624
2016-01	-0.6819375	0.0064813	0.9062168	557860	121077	21.70383
2016-04	-0.3702019	0.0047123	0.8853095	555959	120940	21.75340
2016-07	-0.6181651	0.0016950	0.8958278	557486	121575	21.80772
2016-10	-0.2777243	0.0058267	0.9276706	561128	123171	21.95061
2017-01	-1.6937339	0.0097180	0.9380113	567132	126956	22.38562
2017-04	-0.7551960	0.0078447	0.9084470	572562	128451	22.43443
2017-07	-0.0252646	0.0074853	0.8506995	576959	130098	22.54892
2017-10	-0.6077256	0.0073463	0.8490536	581934	131790	22.64690
2018-01	-1.3808523	0.0089200	0.8137252	585024	132470	22.64352
2018-04	-0.4897966	0.0077113	0.8387722	587880	134223	22.83170
2018-07	0.2058543	0.0071187	0.8599262	592206	136528	23.05414
2018-10	-0.5818429	0.0076143	0.8761017	597300	138123	23.12456
2019-01	-1.6097991	0.0054413	0.8807719	602638	140292	23.27965
2019-04	1.3553001	0.0025180	0.8899234	605984	143004	23.59864
2019-07	-1.1091373	-0.0022793	0.8992465	608584	144970	23.82087
2019-10	-1.3019662	-0.0004720	0.9029635	609740	145772	23.90724
2020-01	-2.6078248	-0.0008087	0.9072750	580233	131148	22.60264
2020-04	-0.8781318	-0.0000543	0.9077911	515406	111945	21.71977
2020-07	-2.9306503	-0.0017543	0.8548344	593490	138276	23.29879
2020-10	NA	-0.0031933	0.8385451	588053	140339	23.86503

Table 2: Annual data for France

Year	General government debt as a % of GDP	Gross national savings as a % of GDP
1999	74.01518	9.118922
2000	72.42918	8.563187
2001	71.47308	8.497075
2002	75.16156	7.180433
2003	79.07757	6.584242
2004	80.54945	6.848104
2005	82.14224	6.420674
2006	77.26933	6.810266
2007	75.94181	7.096520
2008	82.50349	6.288158
2009	97.57310	3.085278
2010	100.99530	3.391840
2011	103.80660	4.203814
2012	111.93820	3.441778
2013	112.46760	3.285913
2014	120.15510	3.451633
2015	120.82520	4.389310
2016	123.67070	4.084366
2017	122.94420	4.697851
2018	121.35990	4.781235
2019	123.96430	4.787386

```
# Creating and printing atable 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 a % of GDP` = GovDebt_ann_FR,
         `Gross national savings as a % of GDP` = SavR_ann_FR,
         `Year` = date)

DF_ann_FR %>%
  kable(caption = "Annual data for France") %>%
  kable_classic(html_font = "Cambria", full_width = TRUE)
```

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

1. Government debt and interest rate

2. Current account and the exchange rate

3. Relevant events and policy responses

4. Currency union and its effects

Q3: Investment rate and the Feldstein-Horioka puzzle

1. Investment rate

2. Investment rate: Graph

3. Feldstein-Horioka puzzle

References