Diverse examples of the custom `sie_function`

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Overview

The aim of this document is to share diverse examples on how to use the custome function `sie_function`, developed to get a quick view of diverse selected SIE series.

For details of the code of this function, look at the Rscript SIE_function.R in the **src** folder of this repository.

SIE's Series Catalogue

This notebook shows diverse examples using different time series published by Banco de Mexico in the SIE, using series as exhange rates, operations and number of ATMs, retail transactions, among other series.

Click here to look for the complete catalogue of the SIE's time series published by Banco de Mexico.

Examples

The time series used in this notebook for examples are:

1. Exchange Rate, of U.S. Dollar, Canadian Dollar, British Pound, Australian Dollar, and Euro to Mexican Pesos, since 2000.
2. Operations in ATMs with Debit and Credit Cards.
3. Number of ATM for the eight most-populated States in Mexico, since 2010.
4. Retail payment systems transactions at ATMs, POS, Checks, and Transfers by Electronic Payments, Internet Banking and Phone, from 2016 to 2019.
5. Consumer Price Index (INPC), main index and subindexes, during Enrique Peña Nieto's Presidency of Mexico (2012-2018).
6. Twenty pesos comparison of Banknotes vs. Coins, since 2000.
7. Banknote lifetime.
8. Remembrance of banknote security features.
9. Mexican Public Sector Revenues vs Expenditures

0. Load libraries and set token

The first step is to use the custome function is load the library, as well to call and set the token.

```
# load libraries
library("siebanxicor")
library("tidyverse")
```

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

```
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.3     v dplyr   1.0.2
## v tidyr   1.1.2     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.0

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

```r
library("reticulate")

# bring the token
token_file <- read.csv("../token/SIE_Token.csv", header=FALSE)

# set the token
setToken(token_file$V2)

# call the customed function from the RScript
source("SIE_function.R")
```

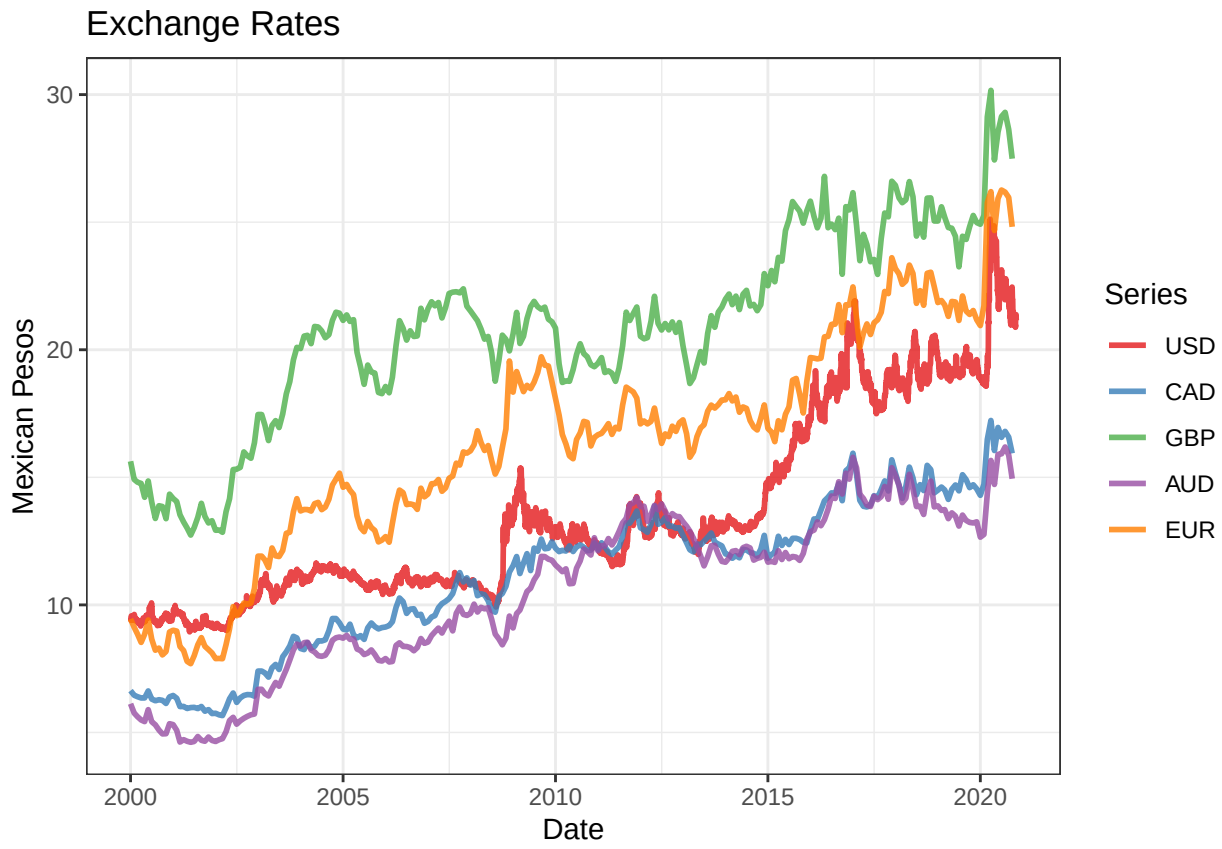
1. Exchange Rate

Exchange rate of U.S. Dollar, Canadian Dollar, British Pound, Australian Dollar, and Euro to Mexican Pesos, since 2000.

```r
serie_tc <- c("SF60653", "SF57771", "SF57815", "SF57753",
              "SF57923")
name_tc <- c("USD", "CAD", "GBP", "AUD", "EUR")
title_tc <- "Exchange Rates"
my_start <- '2000-01-01'
my_y <- "Mexican Pesos"
my_x <- "Date"

# run the function
df_tc <- sie_function(serie_tc, name_tc,
            title_tc, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie
## 1 SF57771
## 2 SF57753
## 3 SF60653
## 4 SF57815
## 5 SF57923
##
## 1                Foreign Exchange Rates for Fiscal Valuation Purposes used by Banco de México CAD Ca
## 2              Foreign Exchange Rates for Fiscal Valuation Purposes used by Banco de México AUD Austr
## 3                    Exchange rate pesos per US dollar Used to settle liabilities denominated in for
## 4 Foreign Exchange Rates for Fiscal Valuation Purposes used by Banco de México STG United Kingdom (Po
## 5     Foreign Exchange Rates for Fiscal Valuation Purposes used by Banco de México EUR E. Monetary Un
##    startDate    endDate frequency      dataType                 unit
## 1 2000-01-01 2020-10-01   Monthly Exchange Rate                Pesos
## 2 2000-01-01 2020-10-01   Monthly Exchange Rate                Pesos
## 3 1991-11-14 2020-11-09     Daily Exchange Rate Pesos per US Dollars
## 4 2000-01-01 2020-10-01   Monthly Exchange Rate                Pesos
## 5 2000-01-01 2020-10-01   Monthly Exchange Rate                Pesos
```

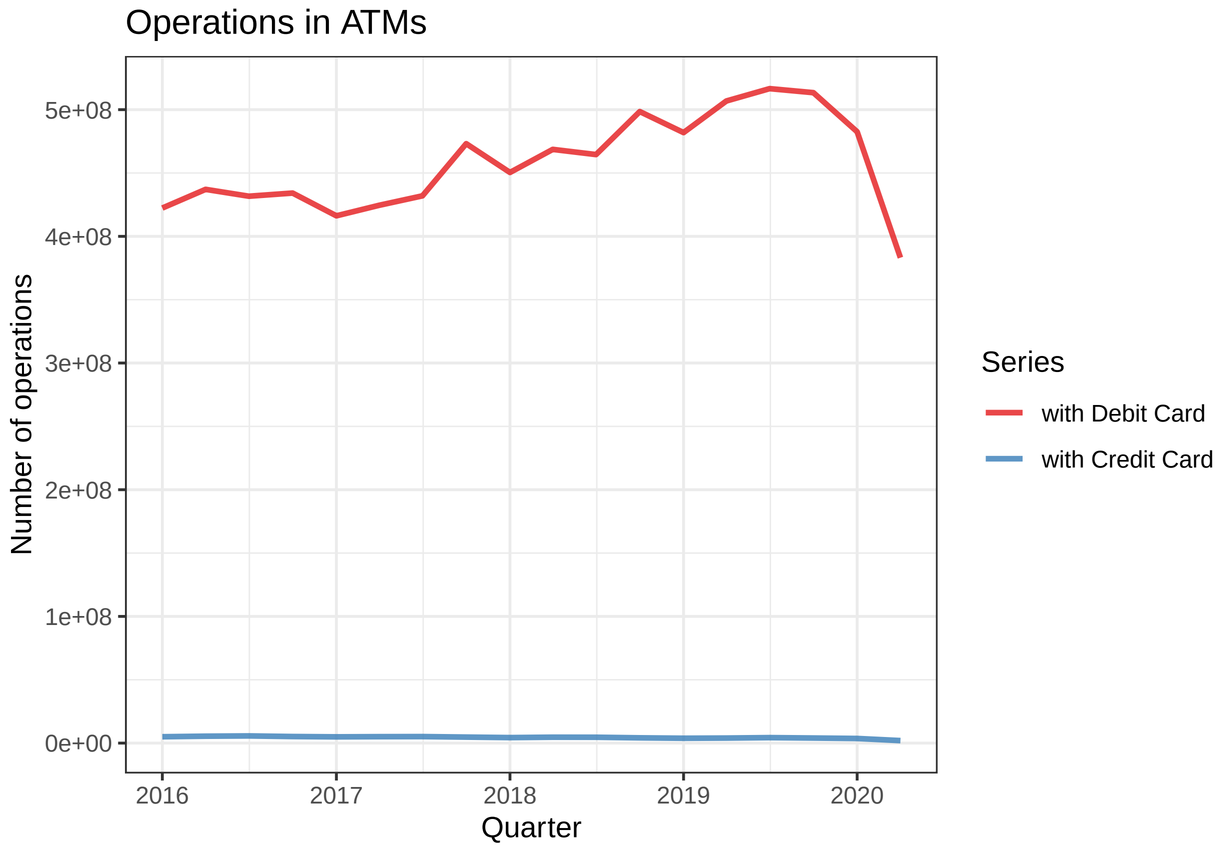
2. Operations in ATMs

Series with the number of operations in ATMs with Debit and Credit Cards.

```r
serie_atm <- c("SF62270", "SF62271")
name_atm <- c("with Debit Card", "with Credit Card")
title_atm <- "Operations in ATMs"
my_y <- "Number of operations"
my_x <- "Quarter"

# run the function
df_atm <- sie_function(serie_atm, name_atm,
            title_atm, route="../img/",
            y_lab = my_y, x_lab = my_x)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie
## 1 SF62270
## 2 SF62271
##                                                                                             ti
## 1  Retail payment systems Transactions in ATMs Total transactions with debit cards Number of operati
## 2 Retail payment systems Transactions in ATMs Total transactions with credit cards Number of operati
##    startDate    endDate frequency dataType          unit
## 1 2002-01-01 2020-04-01 Quarterly   Volume Without units
## 2 2002-01-01 2020-04-01 Quarterly   Volume Without units
```

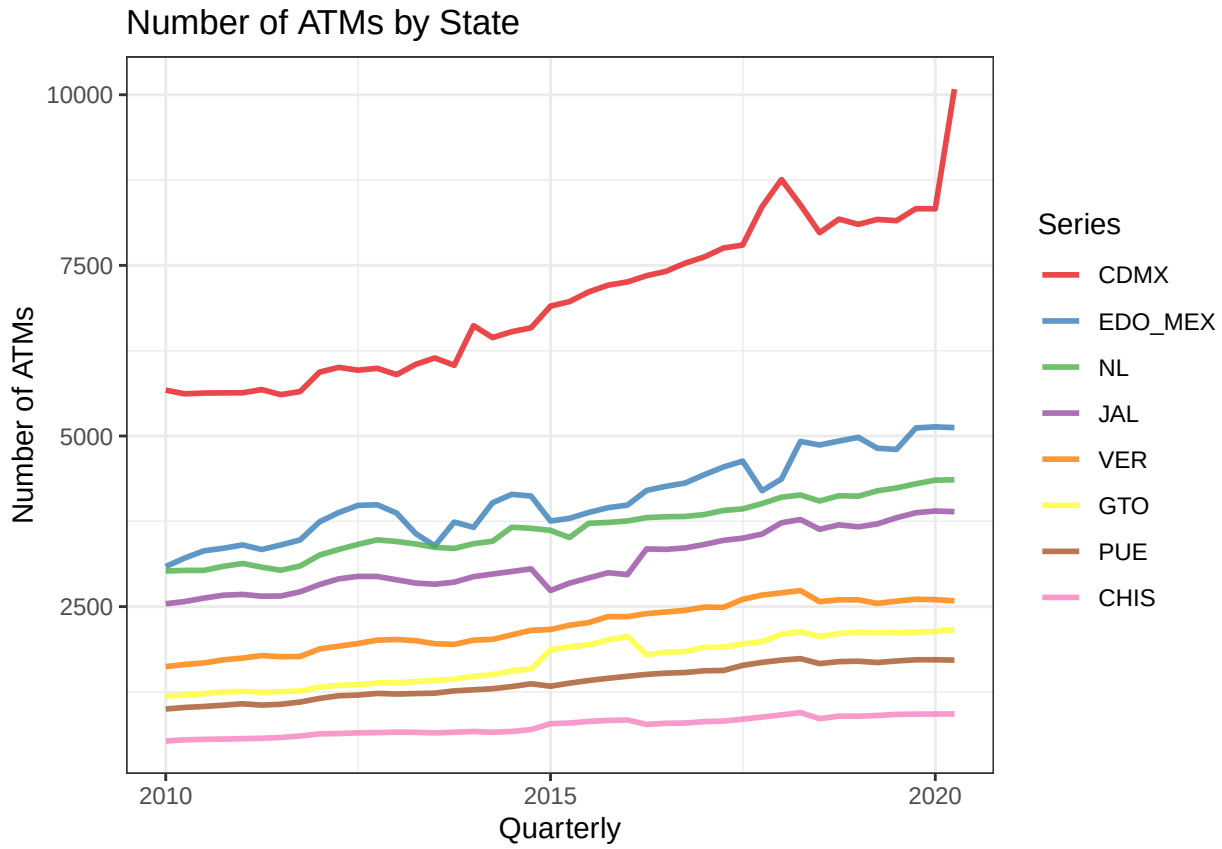
3. Number of ATM for the most populated States

Quarterly time series of the number of ATMs by State, for the 8 states more populated in Mexico, since 2010.

```
serie_state <- c("SF42310", "SF42338", "SF42346", "SF42336",
                 "SF42368", "SF42330", "SF42350", "SF42324")
name_state <- c("CDMX", "EDO_MEX", "NL", "JAL", "VER",
                "GTO", "PUE", "CHIS")
title_state <- "Number of ATMs by State"
my_start <- '2010-01-01'
my_y <- "Number of ATMs"
my_x <- "Quarterly"

# run the function
df_state <- sie_function(serie_state, name_state,
            title_state, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie
## 1 SF42310
## 2 SF42346
```

```
## 3 SF42368
## 4 SF42330
## 5 SF42324
## 6 SF42336
## 7 SF42350
## 8 SF42338
##                                                                  title
## 1 Retail payment systems Number of ATMs by State Total in Distrito Federal
## 2       Retail payment systems Number of ATMs by State Total in Nuevo León
## 3         Retail payment systems Number of ATMs by State Total in Veracruz
## 4       Retail payment systems Number of ATMs by State Total in Guanajuato
## 5          Retail payment systems Number of ATMs by State Total in Chiapas
## 6          Retail payment systems Number of ATMs by State Total in Jalisco
## 7           Retail payment systems Number of ATMs by State Total in Puebla
## 8 Retail payment systems Number of ATMs by State Total in Estado de México
##    startDate    endDate frequency             dataType          unit
## 1 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 2 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 3 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 4 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 5 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 6 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 7 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
## 8 2002-01-01 2020-04-01 Quarterly ciphers without type Without units
```

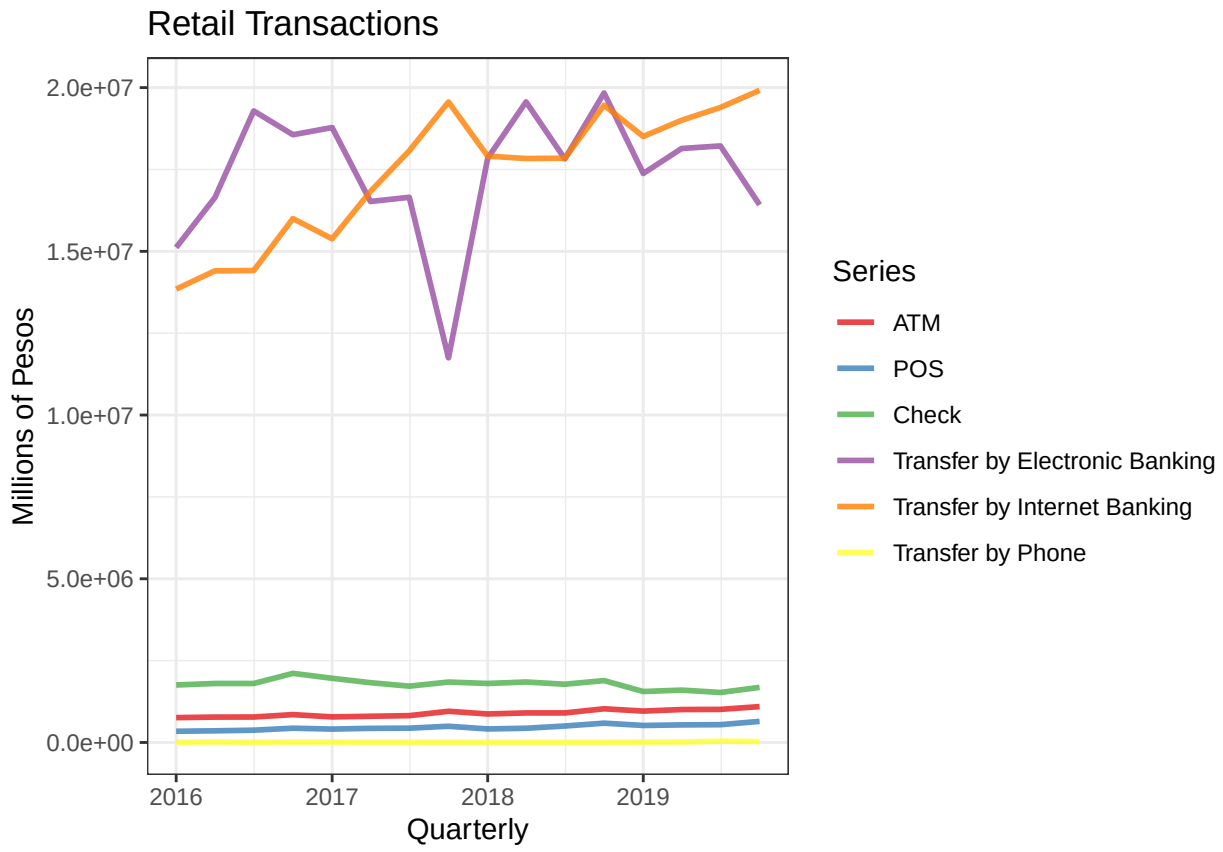
4. Retail payment systems transactions

Information from retail payments at ATMs, Points of Sales (POS), Checks, and Transfers by Electronic Payments, Internet Banking and Phone, from 2016 to 2019.

```
serie_trans <- c("SF62275", "SF62278", "SF61610", "SF60841",
                 "SF60842", "SF60843")
name_trans <- c("ATM", "POS", "Check",
                "Transfer by Electronic Banking",
                "Transfer by Internet Banking",
                "Transfer by Phone")
title_trans <- "Retail Transactions"
my_y <- "Millions of Pesos"
my_x <- "Quarterly"
my_start <- '2016-01-01'
my_end <- '2019-12-31'

# run the function
df_trans <- sie_function(serie_trans, name_trans,
            title_trans, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start, endDate=my_end)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie                                                          title
## 1 SF60841  Retail payment systems Operations by electronic banking Total Amount
## 2 SF61610          Retail payment systems Total checks in local currency Amount
## 3 SF62275 Retail payment systems Transactions in ATMs Total transactions Amount
## 4 SF60842    Retail payment systems Operations by Internet banking Total Amount
## 5 SF60843               Retail payment systems Operations by phone Total Amount
## 6 SF62278    Retail payment systems Operations in POS Total transactions Amount
##    startDate    endDate frequency          dataType              unit
## 1 2002-01-01 2020-04-01 Quarterly Accumulated flows Millions of Pesos
## 2 2002-01-01 2020-04-01 Quarterly Accumulated flows Millions of Pesos
## 3 2002-01-01 2020-04-01 Quarterly Accumulated flows Millions of Pesos
## 4 2002-01-01 2020-04-01 Quarterly Accumulated flows Millions of Pesos
## 5 2002-01-01 2020-04-01 Quarterly Accumulated flows Millions of Pesos
## 6 2002-01-01 2020-04-01 Quarterly Accumulated flows Millions of Pesos
```

5. Consumer Price Index (INPC)

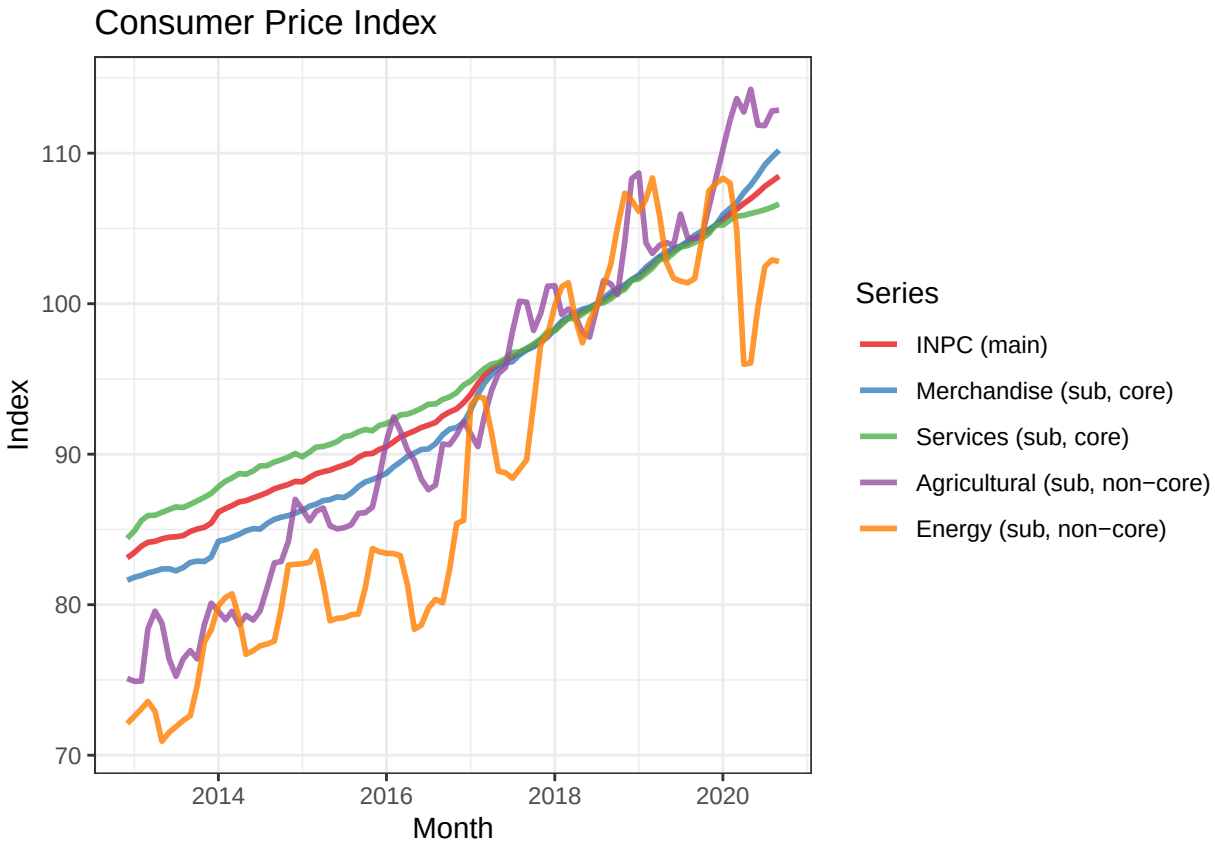
Main time series of the Consumer Price Index (INPC for it's acronym in spanish), and their core and non-core subindexes. Time window of Enrique Peña Nieto's Presidency of Mexico (December 1, 2012 – November 30, 2018).

```
serie_inpc <- c("SP74625", "SP74626", "SP74628", "SP56337",
                "SP74631")
name_inpc <- c("INPC (main)", "Merchandise (sub, core)",
               "Services (sub, core)",
```

```
               "Agricultural (sub, non-core)",
               "Energy (sub, non-core)")
title_inpc <- "Consumer Price Index"
my_y <- "Index"
my_x <- "Month"
my_start <- '2012-12-01'
my_end <- '2018-11-30'

# run the function
df_inpc <- sie_function(serie_inpc, name_inpc,
            title_inpc, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie
## 1 SP74625
## 2 SP74626
## 3 SP56337
## 4 SP74628
## 5 SP74631
##
## 1                                    Core and complementary subindexes Consumer price index
```

```
## 2                                  Core and complementary subindexes Consumer price index (INPC) Core
## 3                              Core and complementary subindexes Consumer price index (INPC) Non-Core
## 4                                 Core and complementary subindexes Consumer price index (INPC) C
## 5 Core and complementary subindexes Consumer price index (INPC) Non-Core Energy and Prices Approved
##    startDate    endDate frequency dataType          unit
## 1 1982-01-01 2020-09-01   Monthly  Indexes Without units
## 2 1982-01-01 2020-09-01   Monthly  Indexes Without units
## 3 1969-01-01 2020-09-01   Monthly  Indexes Without units
## 4 1982-01-01 2020-09-01   Monthly  Indexes Without units
## 5 1982-01-01 2020-09-01   Monthly  Indexes Without units
```

6. Twenty pesos comparison of Banknotes vs. Coins

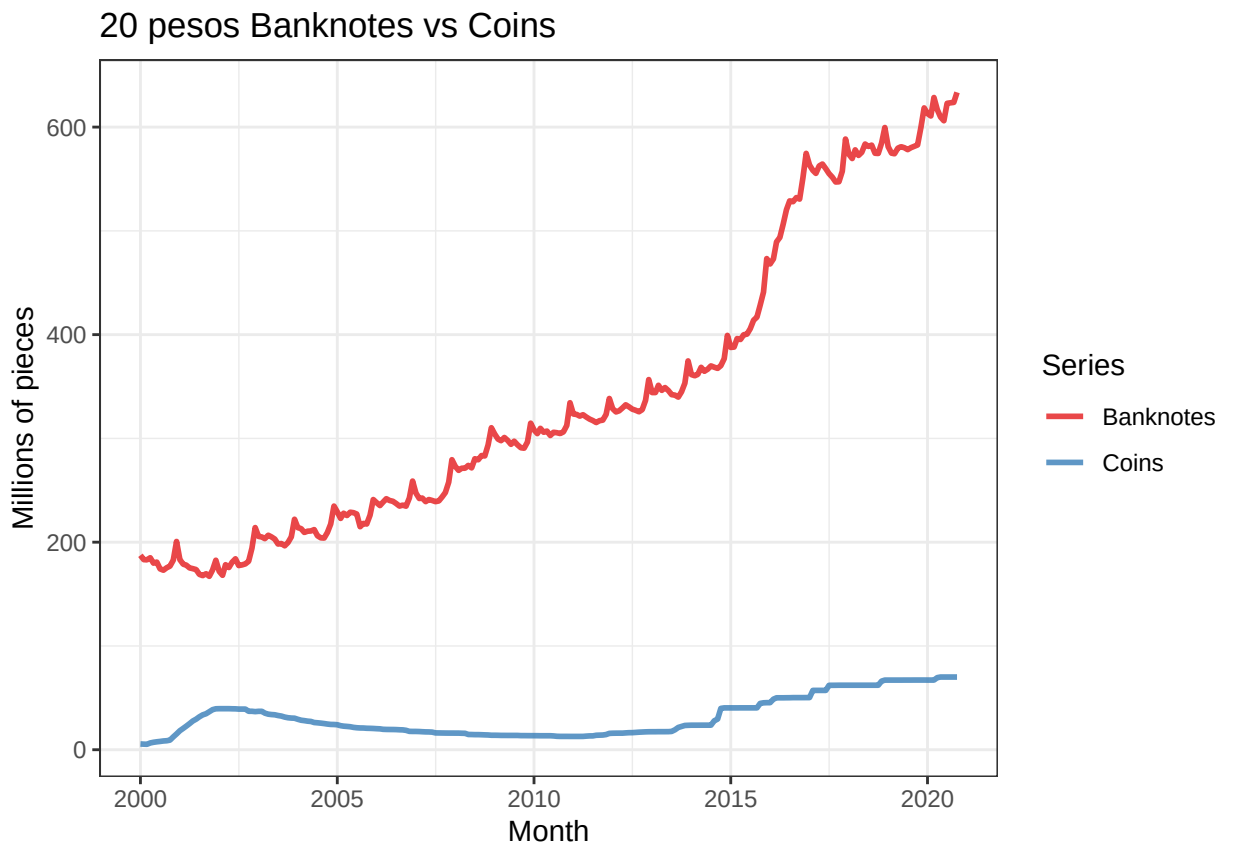
In Mexico the 20 pesos banknote has coexisted with coin of the same denomination for more than twenty years. For this brief analysis, the idea is to compare the volumen of both type of cash for the 20 pesos denomination, since 2000.

In general, while the **20 pesos banknotes** has been issued as a common monetary sign for daily payments, the Central Bank has used the **20 pesos coins** to issue conmemorative events.

```
serie_twenty <- c("SM1472", "SM17")
name_twenty <- c("Banknotes", "Coins")
title_twenty <- "20 pesos Banknotes vs Coins"
my_y <- "Millions of pieces"
my_x <- "Month"
my_start <- '2000-01-01'

# run the function
df_twenty <- sie_function(serie_twenty, name_twenty,
            title_twenty, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie                                    title  startDate    endDate
## 1  SM1472 Total of banknotes in circulation 20 pesos 1993-01-01 2020-10-01
## 2    SM17              Coins in circulation 20 pesos 1999-01-01 2020-10-01
##   frequency dataType               unit
## 1   Monthly   Stocks Millions of pieces
## 2   Monthly   Stocks Millions of pieces
```

7. Banknote lifetime

The banknotes have a life cycle similar to the humans: they get borned, have a life for certain time, and die. The lifetime of a banknote is the time that lapses from the point where it is delivered to a bank, until it is deposit as unfit banknote in the Central Bank.

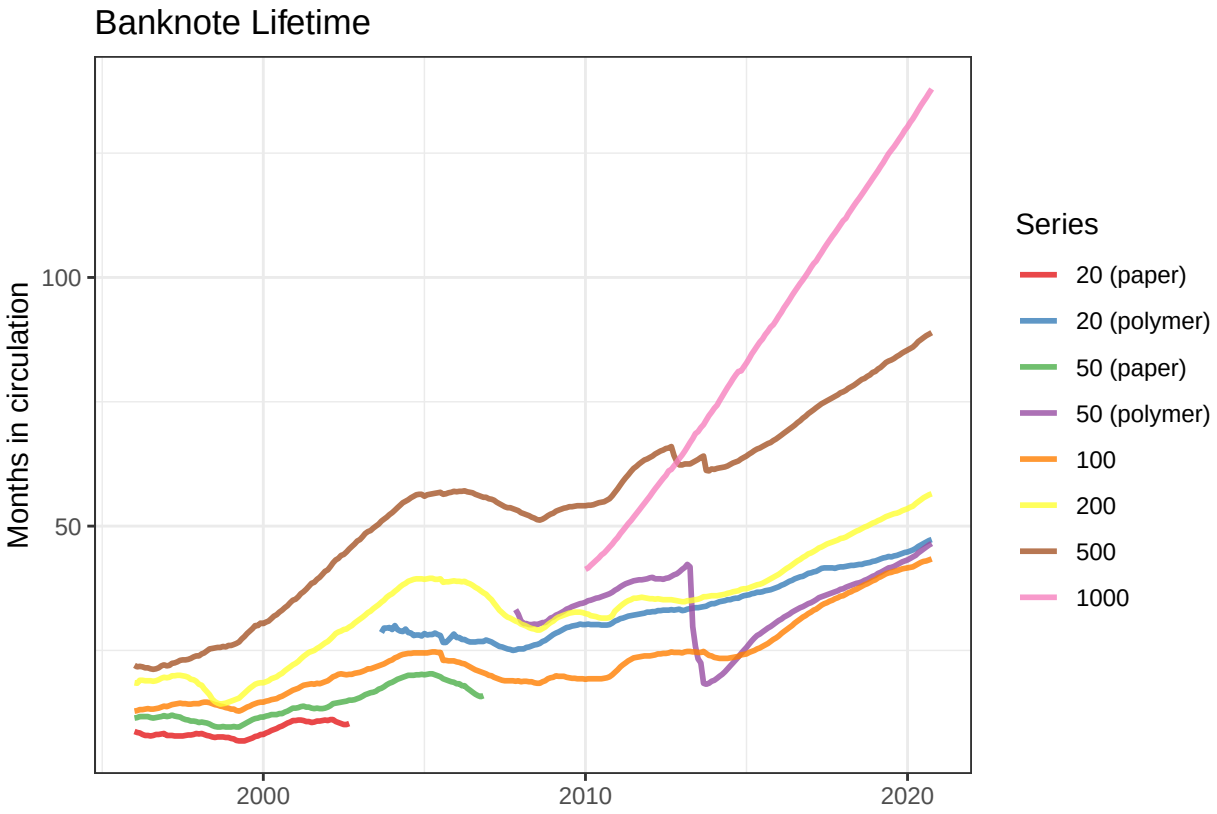
The aim of the next graph is to compare the lifetime of the different denomination Mexican Banknotes, since 1996. In the case of the lower denominations (20 and 50 pesos), at the begining the substratum (material) of this denomination was paper-based, while it changed between 2003 and 2008 to polymer; both series are considerate in the plot.

```
serie_lifetime <- c("SM28", "SM29", "SM30","SM60",
                    "SM31", "SM32", "SM33", "SM40")
name_lifetime <- c("20 (paper)", "20 (polymer)",
                   "50 (paper)", "50 (polymer)",
                   "100", "200", "500", "1000")
title_lifetime <- "Banknote Lifetime"
my_y <- "Months in circulation"
```

```
my_start <- '1996-01-01'

# run the function
df_lifetime <- sie_function(serie_lifetime,
            name_lifetime, title_lifetime,
            route="../img/", y_lab = my_y,
            startDate=my_start)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie                                        title  startDate    endDate
## 1    SM28           Average banknote lifetime 20 pesos 1996-01-01 2020-10-01
## 2    SM32          Average banknote lifetime 200 pesos 1996-01-01 2020-10-01
## 3    SM30           Average banknote lifetime 50 pesos 1996-01-01 2020-10-01
## 4    SM40         Average banknote lifetime 1000 pesos 1996-01-01 2020-10-01
## 5    SM31          Average banknote lifetime 100 pesos 1996-01-01 2020-10-01
## 6    SM33          Average banknote lifetime 500 pesos 1996-01-01 2020-10-01
## 7    SM60 Average banknote lifetime 50 pesos (polymer) 1996-01-01 2020-10-01
## 8    SM29 Average banknote lifetime 20 pesos (polymer) 1996-01-01 2020-10-01
##   frequency             dataType                 unit
## 1   Monthly ciphers without type Months in circulation
## 2   Monthly ciphers without type Months in circulation
## 3   Monthly ciphers without type Months in circulation
## 4   Monthly ciphers without type Months in circulation
```

```
## 5   Monthly ciphers without type Months in circulation
## 6   Monthly ciphers without type Months in circulation
## 7   Monthly ciphers without type Months in circulation
## 8   Monthly ciphers without type Months in circulation
```

8. Remembrance of banknote security features

Each quarter of the year the Cash Area of the Central Bank conducts a national poll with different topics related with Coins and Banknotes[1].

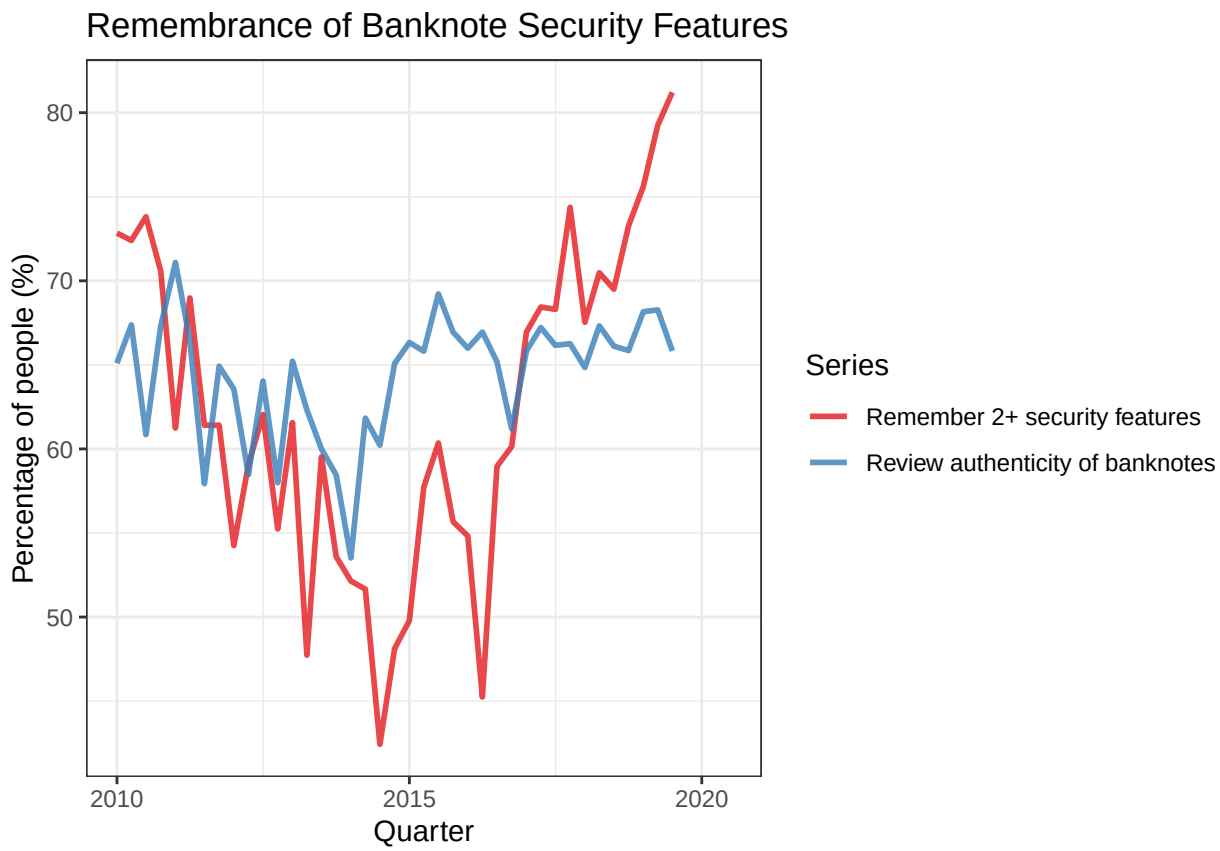
Among the information obtained in this polls, the Central Bank studies the percentage of people that remember two or more security features, and that check for the authenticity of their banknotes. As well, the The aim of this example is compare to look into the previously mentioned timeseries, since 2010.

```
serie_perception <- c("SM69", "SM70")
name_perception <- c("Remember 2+ security features",
                     "Review authenticity of banknotes")
title_perception <- "Remembrance of Banknote Security Features"
my_y <- "Percentage of people (%)"
my_x <- "Quarter"
my_start <- '2010-01-01'

# run the function
df_perception <- sie_function(serie_perception, name_perception,
            title_perception, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start)
```

```
## Saving 6.5 x 4.5 in image
```

[1]1. For more information look at this link, with the results of the different Qualitative (as focus groups) and Quantitaves studies (as polls). Warning: the information related with this studies is only available in Spanish language




```
##   idSerie
## 1    SM69
## 2    SM70
##
## 1 Indicators of public perception of banknotes (quarterly data) Percent of people that remember or k
## 2        Indicators of public perception of banknotes (quarterly data) Percent of people mentioning
##    startDate    endDate frequency    dataType        unit
## 1 2008-07-01 2020-07-01 Quarterly Percentages Percentages
## 2 2008-07-01 2020-07-01 Quarterly Percentages Percentages
```

9. Mexican Public Sector Revenues vs Expenditures

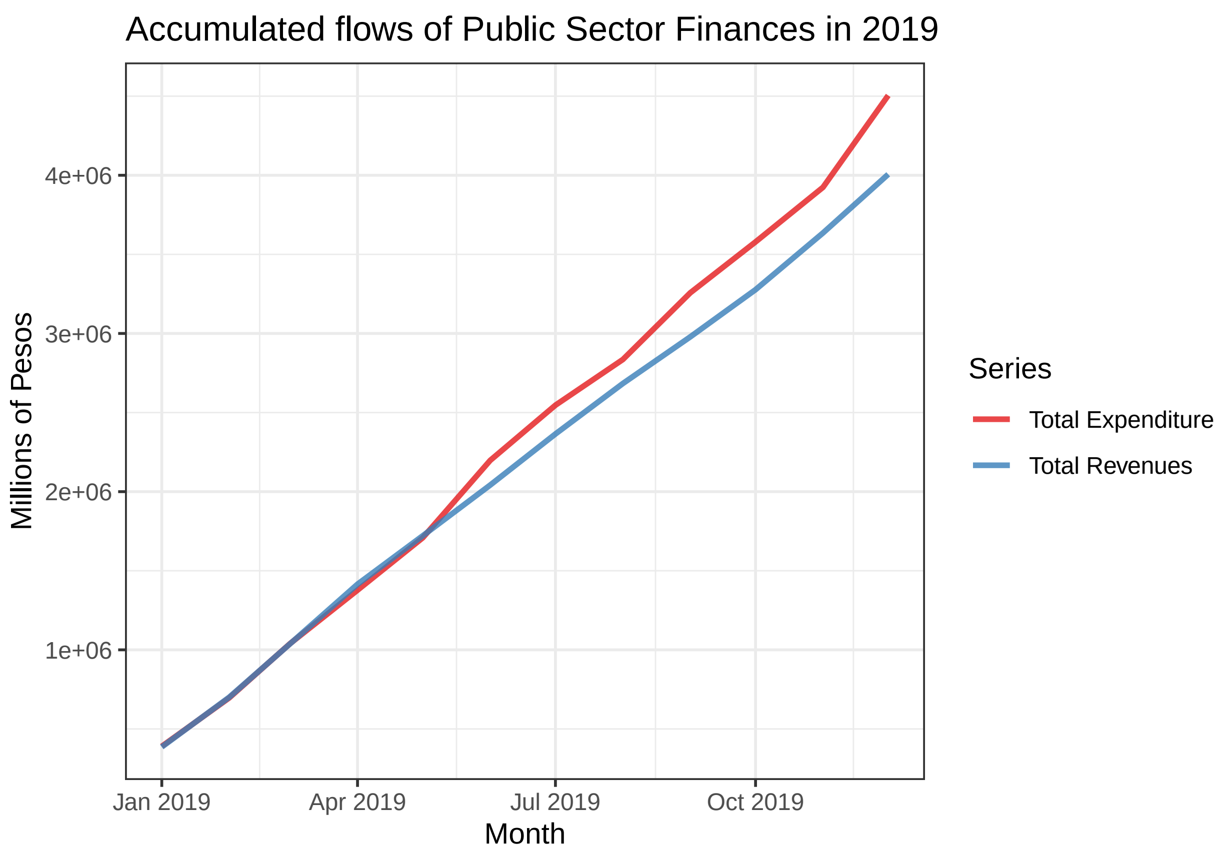
Banco de Mexico publishes the Public Finances with detail of the accumulated flows of Revenues and Expenditures in the year, which is showed in the next example, with information for 2019.

```
serie_public <- c("SG46", "SG9")
name_public <- c("Total Expenditure", "Total Revenues")
title_public <- "Accumulated flows of Public Sector Finances in 2019"
my_y <- "Millions of Pesos"
my_x <- "Month"
my_start <- '2019-01-01'
my_end <- '2019-12-31'

# run the function
df_public <- sie_function(serie_public, name_public,
```

```
            title_public, route="../img/",
            y_lab = my_y, x_lab = my_x,
            startDate=my_start, endDate=my_end)
```

```
## Saving 6.5 x 4.5 in image
```




```
##   idSerie
## 1     SG9
## 2    SG46
##                                                                                  title
## 1    Revenues and Expenditures of the Federal Government Accumulated monthly figures Total Revenues
## 2 Revenues and Expenditures of the Federal Government Accumulated monthly figures Total Expenditure
##    startDate    endDate frequency          dataType              unit
## 1 1977-01-01 2020-09-01   Monthly Accumulated flows Millions of Pesos
## 2 1977-01-01 2020-09-01   Monthly Accumulated flows Millions of Pesos
```

Save data results

Last step in this case is to save the data frames returned by the custome funtion `sie_function` for each example. In this case, I used the `reticulate` package for using **Python** to save the databases in only one file, adding a general description of each database.

```
# load libraries
import numpy as np
import pandas as pd

# Add a comments data frame
comments = pd.DataFrame()

comments['Example'] = [1,2,3,4,5,6,7,8,9]
comments['Database'] = [
'Exchange Rate',
  'Operations in ATM',
  'Number of ATM',
  'Retail transactions',
  'Consumer Price Index',
  '$20 banknote vs coin',
  'Banknote lifetime',
  'Banknote security features',
  'Public Sector finances'
]
comments['Description'] = [
  "Exchange Rate, of U.S. Dollar, Canadian Dollar, British Pound, Australian Dollar, and Euro to Mexica
  "Operations in ATMs with Debit and Credit Cards.",
  "Number of ATM for the eight most-populated States in Mexico, since 2010.",
  "Retail payment systems transactions at ATMs, POS, Checks, and Transfers by Electronic Payments, Inte
  "Consumer Price Index (INPC), main index and subindexes, during Enrique Peña Nieto's Presidency of Me
  "Twenty pesos comparison of Banknotes vs. Coins, since 2000.",
  "Banknote lifetime.",
  "Remembrance of banknote security features.",
  "Mexican Public Sector Revenues vs Expenditures."
]

# Save database:
# Create a Pandas Excel writer using XlsxWriter as the engine.
my_writer = pd.ExcelWriter('../data/SIE_function_examples-data.xlsx', engine='xlsxwriter')

# Write each dataframe to a worksheet.
comments.to_excel(my_writer, sheet_name='README')
r.df_tc.to_excel(my_writer, sheet_name='Exchange Rate')
r.df_atm.to_excel(my_writer, sheet_name='Operations in ATM')
r.df_state.to_excel(my_writer, sheet_name='Number of ATM')
r.df_trans.to_excel(my_writer, sheet_name='Retail transactions')
r.df_inpc.to_excel(my_writer, sheet_name='Consumer Price Index')
r.df_twenty.to_excel(my_writer, sheet_name='$20 banknote vs coin')
r.df_lifetime.to_excel(my_writer, sheet_name='Banknote lifetime')
r.df_perception.to_excel(my_writer, sheet_name='Banknote security features')
r.df_public.to_excel(my_writer, sheet_name='Public Sector finances')

# Save the datbases to Excel file.
my_writer.save()
```

Final Comments

With this examples I have tried to explain the use of the customed function `sie_function` that take advantage of the utility functions from the R-package `siebanxicor` developed by Banco de Mexico to help developers, analysts and researchers to retrieve and analyze information published by the Central Bank in the Economyc Information System (SIE).

I just want to remember the users of this notebook that the views and conclusions presented in this notebook and also in the repository, are exclusively the responsibility of the author and do not necessarily reflect those of Banco de México.

If you have any question related with this notebook and/or repository, please feel free to drop me a line by email.