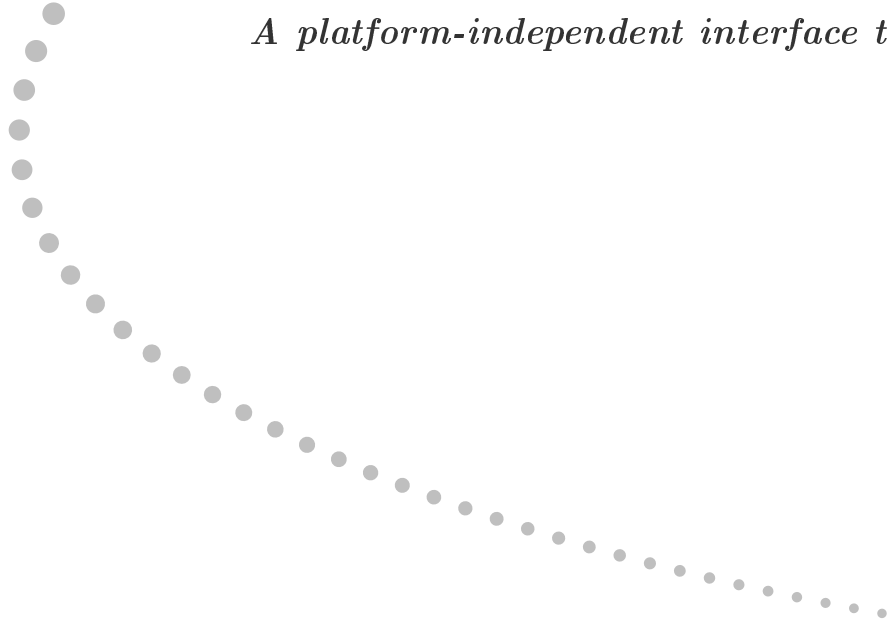




# XLConnect

*A platform-independent interface to Excel*



# The XLConnect Package

<https://mirai-solutions.ch>

<https://cran.r-project.org/package=XLConnect>

Author of this Vignette:

**Anna Maria Ksiezopolska,**

Mirai Solutions GmbH

**XLConnect** Version 1.0.9      April, 2024

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# 1 Introduction

## 1.1 Scope and purpose of this document

This document is a user manual for the **XLConnect** R package. It is meant to be a top-level introduction and some of the more advanced features of **XLConnect** are not presented here. For such details, please refer to the [Reference Manual](#).

### Examples

Any examples presented in this vignette can be found in the `XLConnect.R` script file, which you can find in the top level library directory. You can also open the document by using the following command:

```
edit(file = system.file("XLConnect.R", package = "XLConnect"))
```

## 1.2 Introduction to XLConnect

**XLConnect** is a package that allows for reading, writing and manipulating Microsoft Excel files from within R. It uses the Apache POI API<sup>1</sup> as the underlying interface.

**XLConnect** allows you to produce formatted Excel reports, including graphics, straight from within R. This enables automation of manual formatting and reporting processes. Reading and writing named ranges enables you to process complex inputs and outputs in an efficient way.

### XLConnect's Main Features

- Reading & writing of **Excel worksheets** (via `data.frames`)
- Reading & writing of **named ranges** (via `data.frames`)
- Creating, removing, renaming and cloning worksheets
- Adding **graphics**
- Specifying **cellstyles**: data formats, borders, back- and foreground fill color, fill pattern, text wrapping
- Controlling **sheet visibility**
- Defining **column width** and **row height**
- **Merging/unmerging** cells
- Setting/getting **cell formulas**
- Defining **formula recalculation** behavior (when workbooks are opened)
- Setting **auto-filters**
- **Style actions**: controlling application of cell styles when writing (e.g. when using templates)
- Defining behavior when **error cells** are encountered

---

<sup>1</sup>For more information on the Apache POI API, see the <https://poi.apache.org/> webpage.

## 2 Installation

### 2.1 Software Requirements

**XLConnect** is completely cross-platform and as such runs under Windows, Unix/Linux and Mac (32- and 64-bit). It does **not** require an installation of Microsoft Excel, or any special drivers.

All you need to use **XLConnect** are the following:

- R, version 2.10.0 or higher
- Java Runtime Environment (JRE), version 6 or higher

### 2.2 Package Installation

The **XLConnect** package is part of the Comprehensive R Archive Network (CRAN). It can be easily installed by using the `install.packages()` command in your R session:

```
install.packages("XLConnect")
```

## 3 Basic Usage and Examples

### 3.1 Getting Started

To load the package, use the `library()` or `require()` command in your R session:

```
library(XLConnect)
```

Now, you are ready to use **XLConnect**!

The User Manual (this document) can be opened by entering the following command:

```
vignette("XLConnect")
```

The Reference Manual, containing help pages for each function within the package, can be opened by using the `help()` command.

```
help(XLConnect)
```

### 3.2 loadWorkbook() - loading/creating an Excel workbook

The `loadWorkbook()` function loads a Microsoft Excel workbook, so that it can then be further manipulated. Setting the `create` argument to `TRUE` will ensure the file will be created, if it does not exist yet.

Both `.xls` and `.xlsx` file formats can be used.

Load an Excel workbook (create if not existing)

```
loadWorkbook(filename, create = TRUE)
```

### 3.3 Writing Excel files: basic functions

#### 3.3.1 createSheet() - creating sheets within an Excel workbook

createSheet() creates a sheet of a chosen name in the workbook specified as the object argument.

Create a worksheet of a chosen name within a workbook

```
createSheet(object, name)
```

#### 3.3.2 writeWorksheet() - writing into sheets within an Excel workbook

writeWorksheet() writes data into a worksheet (name or index specified as the sheet argument) of an Excel workbook (object). The startRow and startCol are both 1 by default, meaning that if they are not explicitly specified, the data will start being filled into the A1 cell of the worksheet.

Write into a worksheet

```
writeWorksheet(object, data, sheet, startRow = 1, startCol = 1,  
              header = TRUE)
```

#### 3.3.3 createName() - creating names within an Excel workbook

createName() creates a name for a specified formula in a workbook. The overwrite argument lets you define behaviour if the name already exists. If set to TRUE, the existing name will be removed before creating a new one. If set to FALSE (default setting), an exception will be thrown.

Create a name for a specified formula within a workbook

```
createName(object, name, formula, overwrite)
```

#### 3.3.4 writeNamedRegion() - writing named regions into an Excel workbook

writeNamedRegion() writes a named range into a workbook. The data is assumed to be a data.frame (or list of data.frames, if multiple named regions are written with one call). The header argument allows you to specify whether column names should be written.

Write a named range into a workbook

```
writeNamedRegion(object, data, name, header)
```

### 3.3.5 saveWorkbook() - saving a workbook to an Excel file

saveWorkbook() saves a workbook to the corresponding Excel file and writes the file to disk.

Save a workbook to a chosen Excel file

```
saveWorkbook(object)
```

### 3.3.6 writeWorksheetToFile() - writing into sheets of an Excel file

writeWorksheetToFile() is a wrapper function, calling loadWorkbook(), createSheet() and saveWorkbook() functions subsequently. It therefore allows for writing data into worksheets of an Excel file in one call.

The file is the path name of the file to write to. The styleAction argument controls the application of cell styles when writing to Excel (type ?setStyleAction into the console to see the supported styles). Within the '...' argument, arguments for the writeWorksheet function can be passed.

Write data to an Excel worksheet

```
writeWorksheetToFile(file, styleAction = XLC$STYLE_ACTION.XLCONNECT, ...)
```

### 3.3.7 writeNamedRegionToFile() - writing named regions into an Excel file

writeNamedRegionToFile() is a convenient wrapper function, calling loadWorkbook(), createSheet(), createName(), writeNamedRegion() and saveWorkbook() functions subsequently, therefore allowing for writing named regions to an Excel file in one call.

The file is the path name of the file to write to. The name of the named region is passed as the name argument and the data to write, as data. The header argument specifies if column names should be written. If you are writing data to a template in which the named region already exists, you don't need to specify the formula. Otherwise, if you are creating the file from scratch, supply the named region location as formula. The styleAction argument controls the application of cell styles when writing to Excel (type ?setStyleAction into the console to see the supported styles).

Write data into an Excel named region

```
writeNamedRegionToFile(file, data, name, formula = NA, header = TRUE,  
                        styleAction = XLC$STYLE_ACTION.XLCONNECT)
```

## 3.4 Example: writing a sheet

Let's see how the basic functions introduced in this section can be used to create and save an Excel file. We will use the **ChickWeight** dataset (built-in R dataset) for this simple example.

The code below first loads the "XLConnectExample1.xlsx" workbook, using loadWorkbook(). If the workbook does not exist yet, the function creates it (since the create argument is set to TRUE).

Then, via `createSheet()`, a sheet named "chickSheet" is created within the workbook. We then use `writeWorksheet()` to write the **ChickWeight** data frame into chickSheet.

At the end, we use `saveWorkbook()` to save the `XLConnectExample1.xlsx` file.

```
> require(XLConnect)
> wb <- loadWorkbook("XLConnectExample1.xlsx", create = TRUE)
> createSheet(wb, name = "chickSheet")
> writeWorksheet(wb, ChickWeight, sheet = "chickSheet", startRow = 3, startCol = 4)
> saveWorkbook(wb)
```

Please note that only at the point when we call `saveWorkbook()`, the Excel file is written to disk. All the previous operations are performed in-memory, which has great performance advantages.

Figure 1: ChickWeight data frame written into the `XLConnectExample1.xlsx` file

	weight	Time	Chick	Diet
4	42	0 1	1	
5	51	2 1	1	
6	59	4 1	1	
7	64	6 1	1	

### 3.5 Example: writing a sheet with one call

The four lines of code presented in the previous example can be replaced with a single call of the `writeWorksheetToFile()` function:

```
> require(XLConnect)
> writeWorksheetToFile("XLConnectExample2.xlsx", data = ChickWeight,
+                      sheet = "chickSheet", startRow = 3, startCol = 4)
```

`writeWorksheetToFile()` loads the workbook, creates the sheet and finally saves the workbook. When you only need to write one sheet into an Excel file, this is probably the better choice. If you need to write more sheets, however, using the functions presented in the previous example will be more efficient. This is because calling `writeWorksheetToFile()` multiple times will open, write and close the Excel file with each call. Using the functions in the first example will, in contrast, allow you to open the workbook, do multiple operations on it and only then close it.

### 3.6 Example: writing a named region

In this example we will show how to write data into a named region. We will use the **women** dataset.

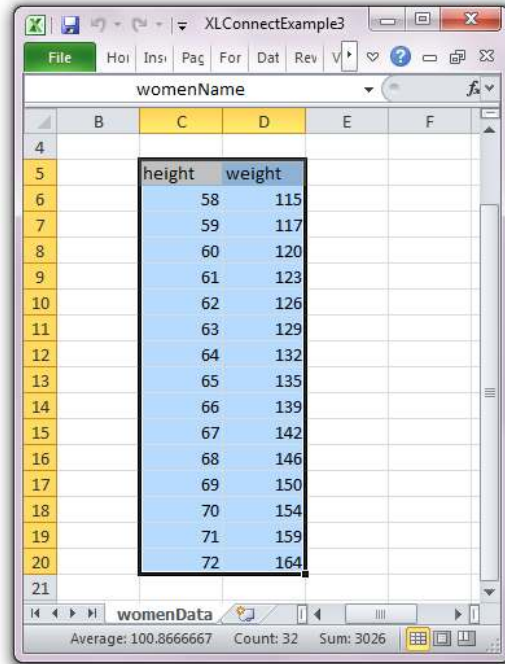
Similarly as in the example of writing an Excel sheet, we first load the workbook, using `loadWorkbook()`, and then create a sheet named "womenData", using `createSheet()`.

We then use `createName()` to produce a named region "womenName", starting in the C5 cell of the "womenData" sheet. Calling `writeNamedRegion()` writes the name into the workbook. At the end, we use `saveWorkbook()` to write the Excel file to disk.



```
> require(XLConnect)
> wb <- loadWorkbook("XLConnectExample3.xlsx", create = TRUE)
> createSheet(wb, name = "womenData")
> createName(wb, name = "womenName", formula = "womenData!$C$5", overwrite = TRUE)
> writeNamedRegion(wb, women, name = "womenName")
> saveWorkbook(wb)
```

Figure 2: women dataset written into womenName named region in the XLConnectExample3.xlsx file



The screenshot shows an Excel spreadsheet with a named region 'womenName' highlighted in blue. The region contains a table with two columns: 'height' and 'weight'. The data is as follows:

height	weight
58	115
59	117
60	120
61	123
62	126
63	129
64	132
65	135
66	139
67	142
68	146
69	150
70	154
71	159
72	164

The spreadsheet also shows a status bar at the bottom with the following information: Average: 100.866667, Count: 32, Sum: 3026.

### 3.7 Example: writing a named region with one call

The `writeNamedRegionToFile()` function can be used to produce the same result as in the previous example, with only one function call:

```
> require(XLConnect)
> writeNamedRegionToFile("XLConnectExample4.xlsx", women, name = "womenName",
+                         formula = "womenData!$C$5")
```

### 3.8 Reading Excel files: basic functions

#### 3.8.1 readWorksheet() - reading worksheets of an Excel workbook

`readWorksheet()` allows for reading data from a workbook that has been previously loaded and is passed as the `object` argument. The name or index of the worksheet to read from should be passed as the `sheet` argument. The `startRow` and `startCol` arguments specify the location of the top left corner of data to be read, while `endRow` and `endCol` specify the bottom right corner. If `header = TRUE`, the first row is interpreted as column names of the `data.frame` object read in.

If the `startRow`, `startCol`, `endRow` and `endCol` arguments are not specified, or are passed as `<= 0`, the "bounding box" of the data is treated as the corresponding boundaries.

All arguments (except `object`) are vectorized, which allows for reading of multiple worksheets with one call.

Read data from a worksheet of an Excel workbook

```
readWorksheet(object, sheet, startRow, startCol, endRow, endCol,
              header = TRUE)
```

#### 3.8.2 readWorksheetFromFile() - reading worksheets of an Excel file

`readWorksheetFromFile()` allows for reading data from a workbook with one call, without loading the workbook first. The `file` argument is the path of the file to read from. All arguments of the `readWorksheet()` function can be passed within the `'...'` argument.

Read data from a worksheet of an Excel workbook with one call

```
readWorksheetFromFile(file, ...)
```

#### 3.8.3 readNamedRegion() - reading named regions of an Excel workbook

`readNamedRegion()` can be used for reading data from named region in an Excel workbook. The workbook must first be loaded and passed as the `object` argument. Remaining arguments are the `name` of the named region and `header`, specifying whether the first row of data should be interpreted as column names.

Read data from a named region of an Excel workbook

```
readNamedRegion(object, name, header = TRUE)
```

### 3.8.4 readNamedRegionFromFile() - reading named regions of an Excel file

`readNamedRegionFromFile()` is a convenient wrapper function which allows for reading named regions from an Excel file with one call. The function subsequently calls `loadWorkbook()` and `readNamedRegion()`.

The `file` argument specifies the path to the Excel file to be read and `name` - the named region to be read. The `header` argument specifies whether the first row of data should be interpreted as column names.

Read data from a named region of an Excel file

```
readNamedRegionFromFile(file, name, header = TRUE)
```

### 3.9 Example: reading from an Excel sheet

In this example, we will show how you can use **XLConnect** to read from an Excel sheet. For this purpose, we will use the file created in the example in section 3.4. We set the `endRow` argument to 10, to limit the result. We set the rest of arguments specifying boundaries as 0, so that they are automatically determined.

Please note, that alternatively to setting the `sheet` argument to the name of the sheet we want to read from, "chickSheet", we could also specify it with the sheet index, as `sheet = 1`.

```
> require(XLConnect)
> wb <- loadWorkbook("XLConnectExample1.xlsx", create = TRUE)
> data <- readWorksheet(wb, sheet = "chickSheet", startRow = 0, endRow = 10,
+                       startCol = 0, endCol = 0)
> data
```

	weight	Time	Chick	Diet
1	42	0	1	1
2	51	2	1	1
3	59	4	1	1
4	64	6	1	1
5	76	8	1	1
6	93	10	1	1
7	106	12	1	1

### 3.10 Example: reading from an Excel sheet with one call

The `readWorksheetFromFile()` function can be used to, with only one call, obtain the same result as was shown in the previous example:

```
> require(XLConnect)
> data <- readWorksheetFromFile("XLConnectExample1.xlsx", sheet = "chickSheet",
+                               startRow = 0, endRow = 10, startCol = 0, endCol = 0)
```

### 3.11 Example: reading from an Excel named region

In this example, we will show how to use **XLConnect**'s functions to read from a named region in an Excel file. We will use the file created in the example in section 3.6.

```
> require(XLConnect)
> wb <- loadWorkbook("XLConnectExample3.xlsx", create = TRUE)
> data <- readNamedRegion(wb, name = "womenName")
> data
```

	height	weight
1	58	115

2	59	117
3	60	120
4	61	123
5	62	126
6	63	129
7	64	132
8	65	135
9	66	139
10	67	142
11	68	146
12	69	150
13	70	154
14	71	159
15	72	164

### 3.12 Example: reading from an Excel named region with one call

The result obtained in the previous example can be reproduced by calling the wrapper function: `readNamedRegionFromFile()`, without the necessity of loading the workbook first:

```
> require(XLConnect)
> data <- readNamedRegionFromFile("XLConnectExample3.xlsx", "womenName")
```

## 4 Advanced Usage and Examples

### 4.1 Generating an Excel Report of Swiss Franc (CHF) Exchange Rates

In this example, we will show an example use case of **XLConnect**: generation of a simple Excel report, showing the development of exchange rates (CHF vs EUR, USD and GBP).

For this example we will be using additional packages:

- **zoo**: S3 Infrastructure for Regular and Irregular Time Series
- **ggplot2**: An implementation of the Grammar of Graphics

```
install.packages(c("XLConnect", "zoo", "ggplot2"))
```

Loading the required packages:

```
> require(XLConnect)
> require(zoo)
> require(ggplot2) # >= 0.9.3
```

Preparing the data to be reported:

```
> # Read in (historical) currency data
> # For this example take sample data set 'swissfranc' from XLConnect
> curr <- XLConnect::swissfranc
> curr <- curr[order(curr$Date),]
```

Now, let's write the data to Excel:

```
> # Workbook filename
> wbFilename <- "swiss_franc.xlsx"
> # Create a new workbook
```

```

> wb <- loadWorkbook(wbFilename, create = TRUE)
> # Create a new sheet named 'Swiss_Franc'
> sheet <- "Swiss_Franc"
> createSheet(wb, name = sheet)
> # Create a new Excel name referring to the top left corner
> # of the sheet 'Swiss_Franc' - this name is going to hold
> # our currency data
> dataName <- "currency"
> nameLocation <- paste(sheet, "$A$1", sep = "!")
> createName(wb, name = dataName, formula = nameLocation)
> # Instruct XLConnect to only apply a data format for a cell
> # but not to apply any other cell styling
> setStyleAction(wb, XLC$"STYLE_ACTION.DATA_FORMAT_ONLY")
> # Set the default format for numeric data to display
> # four digits after the decimal point
> setDataFormatForType(wb, type = XLC$"DATA_TYPE.NUMERIC", format = "0.0000")
> # Write the currency data to the named region created above
> # Note: the named region will be automatically redefined to encompass all
> # written data
> writeNamedRegion(wb, data = curr, name = dataName, header = TRUE)
> # Save the workbook (this actually writes the file to disk)
> saveWorkbook(wb)

```

Now, we are going to enhance the report further. Let's say that for each currency we want to highlight the points in time when there was a change of more than 2% compared to the previous day.

```

> # Load the workbook created above
> wb <- loadWorkbook(wbFilename)
> # Create a cell style for the header row
> csHeader <- createCellStyle(wb, name = "header")
> setFillPattern(csHeader, fill = XLC$FILL.SOLID_FOREGROUND)
> setFillForegroundColor(csHeader, color = XLC$COLOR.GREY_25_PERCENT)
> # Create a date cell style with a custom format for the Date column
> csDate <- createCellStyle(wb, name = "date")
> setDataFormat(csDate, format = "yyyy-mm-dd")
> # Create a highlighting cell style
> csHlight <- createCellStyle(wb, name = "highlight")
> setFillPattern(csHlight, fill = XLC$FILL.SOLID_FOREGROUND)
> setFillForegroundColor(csHlight, color = XLC$COLOR.CORNFLOWER_BLUE)
> # Apply header cell style to the header row
> setCellStyle(wb, sheet = sheet, row = 1,
+             col = seq(length.out = ncol(curr)),
+             cellstyle = csHeader)
> # Index for all rows except header row
> allRows <- seq(length = nrow(curr)) + 1
> # Apply date cell style to the Date column
> setCellStyle(wb, sheet = sheet, row = allRows, col = 1,
+             cellstyle = csDate)
> # Set column width such that the full date column is visible
> setColumnWidth(wb, sheet = sheet, column = 1, width = 2800)
> # Check if there was a change of more than 2% compared
> # to the previous day (per currency)
> idx <- rollapply(curr[, -1], width = 2,
+                 FUN = function(x) abs(x[2] / x[1] - 1),
+                 by.column = TRUE) > 0.02

```

```

> idx <- rbind(rep(FALSE, ncol(idx)), idx)
> widx <- lapply(as.data.frame(idx), which)
> # Apply highlighting cell style
> for (i in seq(along = widx)) {
+   if (length(widx[[i]]) > 0) {
+     setCellStyle(wb, sheet = sheet, row = widx[[i]] + 1, col = i + 1,
+                 cellstyle = csHlight)
+   }
+ }
+
+ # Note:
+ # +1 for row since there is a header row
+ # +1 for column since the first column is the time column
+ }
> saveWorkbook(wb)

```

As a next step, let's add a graph to our report.

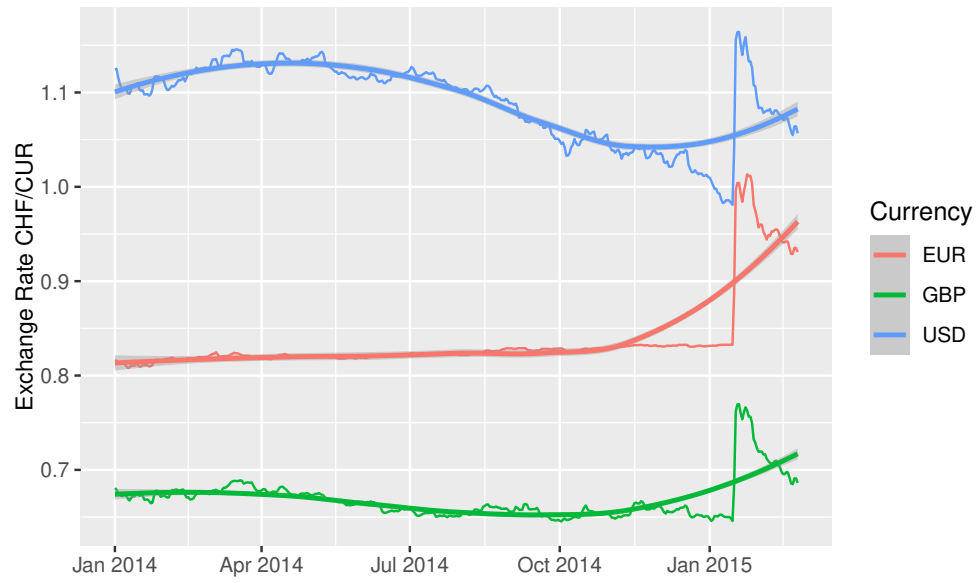
```

> wb <- loadWorkbook(wbFilename)
> # Stack currencies into a currency variable (for use with ggplot2 below)
> currencies <- names(curr)[-1]
> gcurr <- reshape(curr, varying = currencies, direction = "long", v.names = "Value",
+                 times = currencies, timevar = "Currency")
> # Create a png graph showing the currencies in the context
> # of the Swiss Franc
> png(filename = "swiss_franc.png", width = 800, height = 600)
> p <- ggplot(gcurr, aes(Date, Value, colour = Currency)) +
+   geom_line() + stat_smooth(method = "loess") +
+   scale_y_continuous("Exchange Rate CHF/CUR") +
+   labs(title = paste0("CHF vs ", paste(currencies, collapse = ", ")),
+        x = "") +
+   theme(axis.title.y = element_text(size = 10, angle = 90, vjust = 0.3))
> print(p)
> dev.off()
> # Define where the image should be placed via a named region;
> # let's put the image two columns left to the data starting
> # in the 5th row
> createName(wb, name = "graph",
+ formula <- paste(sheet, idx2cref(c(5, ncol(curr) + 2)), sep = "!"))
> # Note: idx2cref converts indices (row, col) to Excel cell references
>
> # Put the image created above at the corresponding location
> addImage(wb, filename = "swiss_franc.png", name = "graph",
+         originalSize = TRUE)
> saveWorkbook(wb)

```

As a result, we obtain the following graph:

CHF vs EUR, USD, GBP



Check out the Excel file to see how the data and the graph have been exported!

## 5 What's new in XLConnect version 1.0.9

We have introduced the following updates in version 1.0.9 of **XLConnect**:

- Upgraded XLConnectJars dependency to version 0.2-15
- Rely on Java version check from XLConnectJars which now supports Java 10

A summary of news in **XLConnect** 1.0.9 can be found in the [NEWS](#) file on CRAN.

## 6 Frequently Asked Questions

### 6.1 Running out of memory when processing large data sets

#### Question:

I'm running out of memory when processing large data sets:

```
writeNamedRegionToFile(file = "huge.xls", data = giant.data.frame,
  namedRegion = "LargeRegion", formula = "LotsOfData!A1")

Error: OutOfMemoryError (Java): Java heap space
```

#### Answer:

This is caused by the fact that **XLConnect** needs to copy your entire data object over to the JVM in order to write it to a file and the JVM has to be initialized with a fixed upper limit on its memory size. To change this amount, you can pass parameters to R's JVM just like you can to a command line Java process via `rJava`'s options support:

```
options(java.parameters = "-Xmx1024m")
library(XLConnect)
```

Note, however, that these parameters are evaluated exactly once per R session when the JVM is initialized - this is usually once you load the first package that uses Java support, so you should do this as early as possible.



Some general Java advice: The upper limit of the Xmx parameter is system dependent - most prominently, 32bit Windows will fail to work with anything much larger than 1500m, and it is usually a bad idea to set Xmx larger than your physical memory size because garbage collection and virtual memory do not play well together.

## 6.2 How can I style my output - set fonts, colors etc?

### Question:

How can I style my output - set fonts, colors etc?

### Answer:

**XLConnect** does not currently allow direct access to low-level formatting options. However, it is possible to assign named cell styles to cells, so the preferred workflow would be to:

1. define some named cell styles in an Excel document ("Format" -> "Styles" in pre-2007 Excel, "Cell styles" on the default pane of Excel 2007 and on)
2. save the document to a file
3. then load this template in **XLConnect** and use the `setCellStyle` method to assign the predefined styles:

```
library(XLConnect)
w <- loadWorkbook("template.xls")
df <- data.frame("foo")
c <- getCellStyle(w, "FatFont")

writeWorksheet(w, data = df, sheet = 1, startRow = 1, startCol = 1,
              header = TRUE)
setCellStyle(w, sheet = 1, row = 1, col = 1, cellstyle = c)
saveWorkbook(w)
```

## 6.3 I'm getting errors trying to import Excel data

### Question:

I'm getting errors trying to import Excel data like:

```
Unexpected eval type
(org.apache.poi.hssf.record.formula.eval.MissingArgEval)
```

or

```
Error: NotImplementedException (Java): Error evaluating cell Sheet1!A1
```

## Answer:

This type of error is triggered when **XLConnect** can not determine the value of a cell in the region you're trying to import. Usually, this happens because Apache POI does not support all possible Excel formulae.

There is no direct solution for accessing the values of fields that Apache POI doesn't know how to compute. However, if you can live without the cell values and just want to ignore uncomputable cells, have a look at the `onErrorCell` function to tell **XLConnect** that you want to ignore errors.

If you have Excel and are willing to invest some manual effort, you can manually create a static copy, that can be imported as follows:

- Select the region containing your data
- **Edit -> Copy**
- Select an empty cell and **Edit -> Paste Special**
- In the Paste radio group, select **Values**

You should then be able to import the pasted region without problems.

## 7 Contact and Support

We are very glad that you are using **XLConnect** and we would be happy to hear from you!



Please log any bug reports, feature requests or technical inquiries at:  
<https://github.com/miraisolutions/xlconnect/issues>



For any other feedback you may have, please contact us at:  
[xlconnect@mirai-solutions.com](mailto:xlconnect@mirai-solutions.com)



You can also follow and contact us on **LinkedIn**:  
<https://www.linkedin.com/company/mirai-solutions-gmbh/>

We will do our best to reply to your enquires as quickly as possible!

## 8 Further Resources and References

1. Mirai Solutions website:  
<https://mirai-solutions.ch>
2. Mirai Solutions on LinkedIn:  
<https://www.linkedin.com/company/mirai-solutions-gmbh/>
3. **XLConnect** on CRAN:  
<https://CRAN.R-project.org/package=XLConnect>
4. **XLConnect** on RDocumentation:  
<https://www.rdocumentation.org/packages/XLConnect>

5. **XLConnect** on METACRAN:  
<https://www.r-pkg.org/pkg/XLConnect>
6. **XLConnect** on crantastic!:  
<https://crantastic.org/packages/XLConnect>
7. **XLConnect** in the R Programming section on Wikibooks:  
[https://en.wikibooks.org/wiki/R\\_Programming/Importing\\_and\\_exporting\\_data](https://en.wikibooks.org/wiki/R_Programming/Importing_and_exporting_data)
8. Quick Intro to **XLConnect**:  
<https://altons.github.io/rstats/2015/02/13/quick-intro-to-xlconnect/>
9. "How to Read Data from Excel into R", article by Joris Meys and Andrie de Vries:  
<https://www.dummies.com/how-to/content/how-to-read-data-from-excel-into-r.html>
10. R and Excel: Making Your Data Dumps Pretty with XLConnect:  
<https://www.youtube.com/watch?v=G3mOUbZr4HI>  
<https://amunategui.github.io/excel-data-dumps/>