



european
actuarial
academy

Automating Reports with R Markdown

Claudio Rebelo

08 February 2021 | Zurich, Switzerland

*The European knowledge
centre for actuaries*



Disclaimer

The views and opinions expressed in this presentation are solely my own and do not necessarily represent the views of Swiss Re.

What is R Markdown?

R Markdown (.Rmd) is an authoring format that enables easy creation of dynamic documents, presentations, and reports from R.

It combines the core syntax of markdown (an easy to write plain text format) with embedded R code chunks that are run so their output can be included in the final document.

source: <https://rmarkdown.rstudio.com/>

Reproducibility and Automation: Shifting Paradigms!

R Markdown documents are fully reproducible i.e.: automatically regenerated whenever underlying R code or data changes

Some Key Benefits of Reproducibility:

- Less prone to error;
- Easy to re-adjust code or data and re-run all analysis;
- Share with others so they can further extend your research

source: [R Programming for research](#)

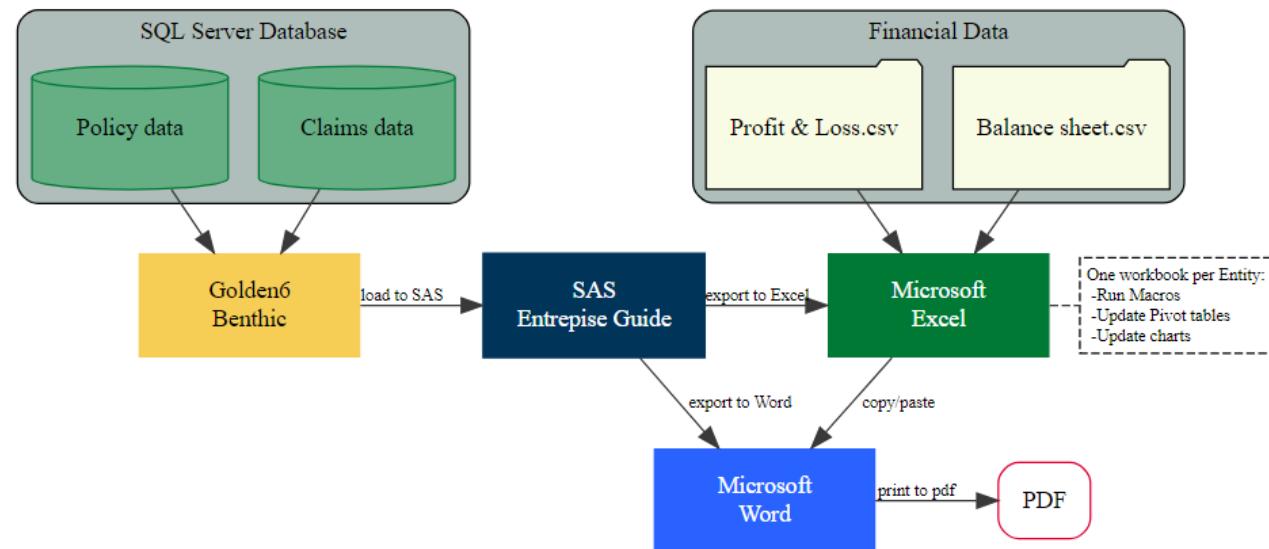


Automating reports

- Reproducibility entails automation but the converse is not always true
- We will focus on automating tasks regardless if the reproducibility chain is broken or not;
- A practical example of a fictional Casualty Insurance Company will be presented for illustration

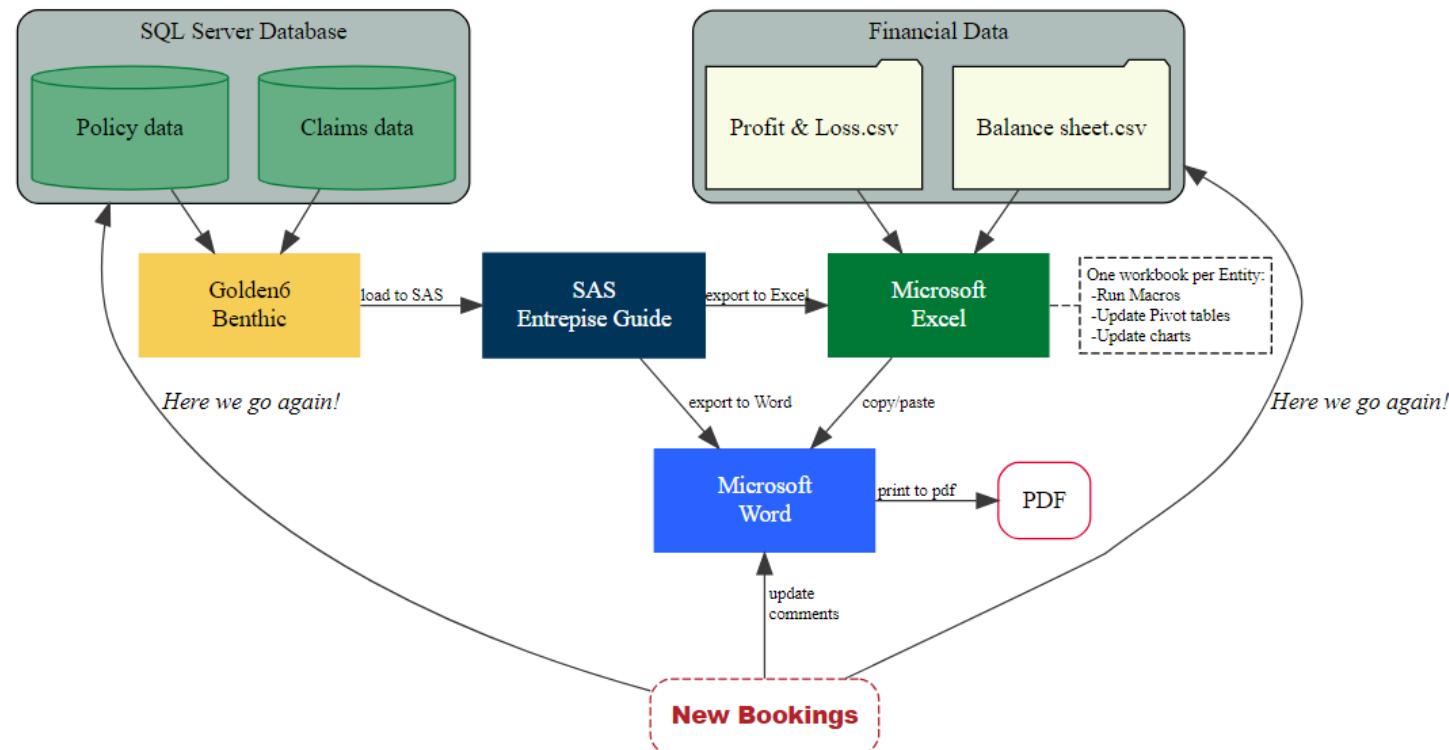


Quarterly Report: Messy Workflow



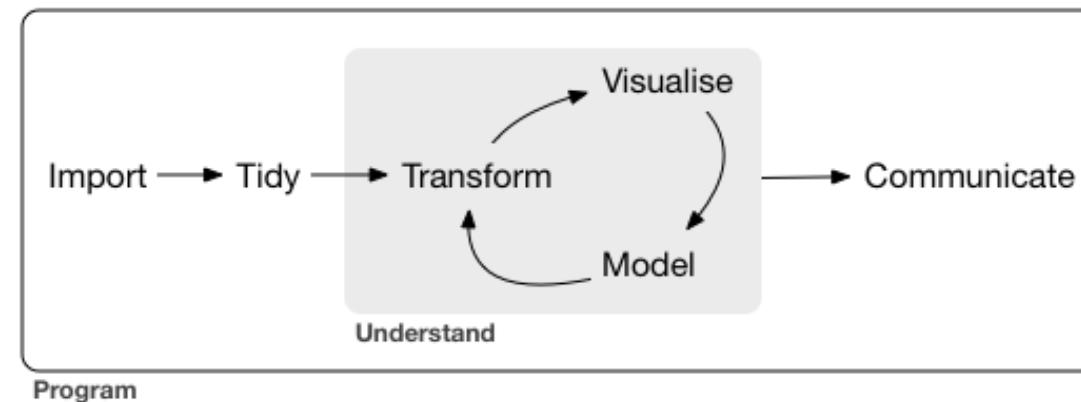
<https://rich-iannone.github.io/DiagrammeR/mov/DiagrammeR.mp4>

Quarterly Report: Messy Workflow



<https://rich-iannone.github.io/DiagrammeR/mov/DiagrammeR.mp4>

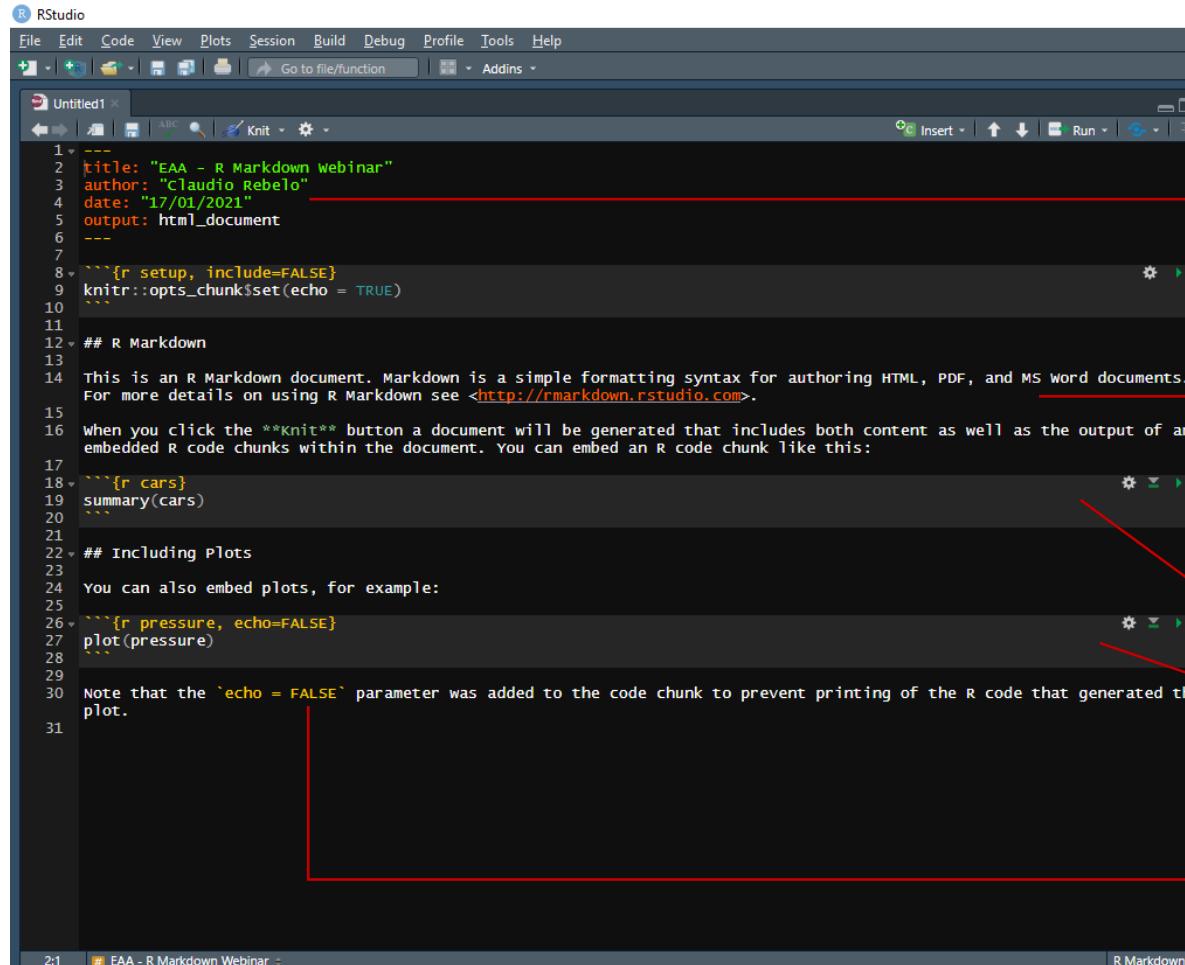
Why not do that all in R?



<https://r4ds.had.co.nz/>

Are you ready to knit?

The three components of an R Markdown file: YAML, Text & Code chunks



```
1 ---  
2 title: "EAA - R Markdown webinar"  
3 author: "claudio rebelo"  
4 date: "17/01/2021"  
5 output: html_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10  
11  
12 ## R Markdown  
13  
14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents.  
For more details on using R Markdown see <http://rmarkdown.rstudio.com>.  
15  
16 when you click the **Knit** button a document will be generated that includes both content as well as the output of any  
embedded R code chunks within the document. You can embed an R code chunk like this:  
17  
18 ```{r cars}  
19 summary(cars)  
20  
21  
22 ## Including Plots  
23  
24 You can also embed plots, for example:  
25  
26 ```{r pressure, echo=FALSE}  
27 plot(pressure)  
28  
29 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the  
plot.  
30  
31
```

YAML header defines the structure of the file such as defining the output format e.g.: Word, PDF, HTML...

Text written in Markdown. Markdown is designed to be an easy-to-write formatting syntax

R Code either via code chunks e.g.:

```
```{r}  
some code
...
...``
```

or via inline code `r age\_of\_insured`

## Hit the knit! To generate the report (alternatively, use the shortcut Ctrl+Shift+K)

R RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Untitled1 x

Knit

```

1 ---

2 title: "EAA - R

3 author: "Claudio Rebelo"

4 date: "17/01/2021"

5 output: html_document

8 ``{r setup, include=FALSE}

9 knitr::opts_chunk$set(echo = TRUE)

12 ## R Markdown

13

14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents.

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23

24 You can also embed plots, for example:

25

26 ``{r pressure, echo=FALSE}

27 plot(pressure)

28

29 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the

plot.

31

```

2:1 # EAA - R Markdown Webinar R Markdown

### EAA - R Markdown Webinar

Claudio Rebelo

17/01/2021

### R Markdown

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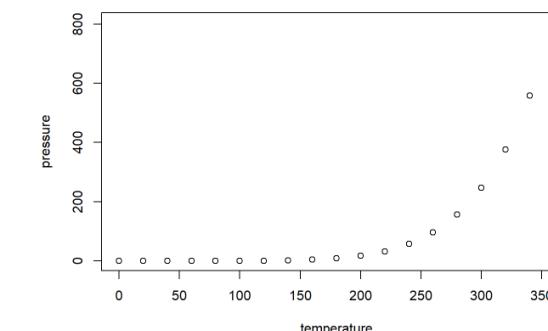
When you click the Knit button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)

speed dist
Min. :4.0 Min. : 2.00
1st Qu.:12.0 1st Qu.:26.00
Median :15.0 Median :36.00
Mean :15.4 Mean :42.98
3rd Qu.:19.0 3rd Qu.:56.00
Max. :25.0 Max. :120.00
```

### Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

## What is happening under the hood?



When R Markdown renders the .Rmd file it sends it to knitr, which executes the code chunks and creates a new markdown (.md) file

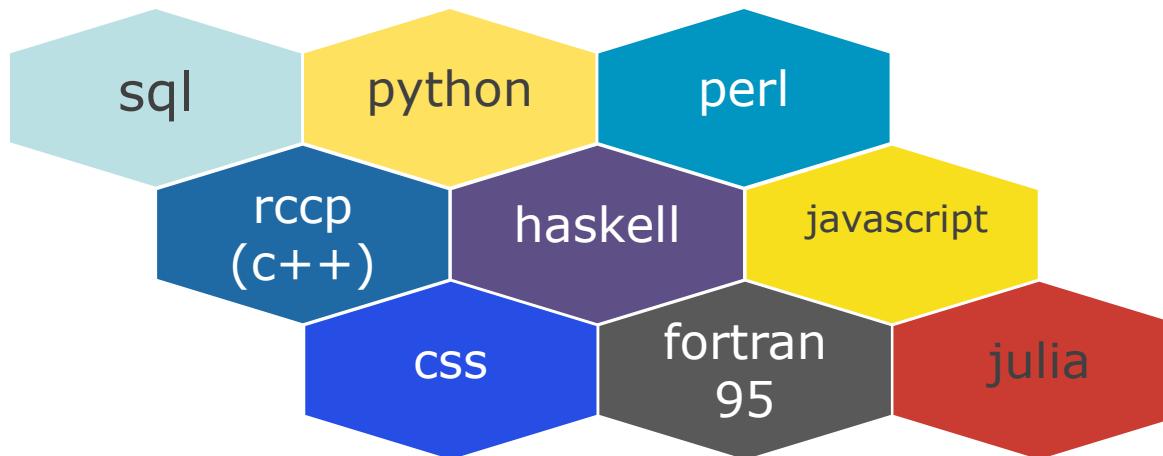
The markdown file is then processed by pandoc which is responsible for creating the finished format

All this happens with a simple click of a button!



## What about my Python/SQL/Javascript... skills?

Code chunks in R Markdown can execute code in many other languages besides R such as:



```
```{python}
x = 'hello, python world!'
print(x.split(' '))
```
```

To get the full list of supported engines, type in the console:  
`names(knitr::knit_engines$get())`

Aaron Berg:

<https://rstudio.com/resources/rstudioconf-2018/beyond-r-using-r-markdown-with-python-sql-bash-and-more/>

# Automating Reports

## Remarkable Re (RR) – Study Case



## RR's Database: Policy Data

| POL_ID | POL_INCEP  | UWY  | Insured         | LoB               | Region     | LE                   | Industry      | UP        | UAC  | PL   | CR   | IBNR       |
|--------|------------|------|-----------------|-------------------|------------|----------------------|---------------|-----------|------|------|------|------------|
| POL_10 | 31.03.2013 | 2013 | Ganso           | General Liability | Connynland | Remarkable Solutions | Sports        | 11'965.71 | 0.00 | 0.00 | 0.00 | -308.23    |
| POL_10 | 31.03.2014 | 2014 | Ganso           | General Liability | Connynland | Remarkable Solutions | Sports        | 12'656.65 | 0.00 | 0.00 | 0.00 | -604.68    |
| POL_10 | 20.06.2013 | 2013 | Virgil van Dijk | General Liability | Disneyland | Remarkable Solutions | Mining/Metals | 30'640.19 | 0.00 | 0.00 | 0.00 | -445.77    |
| POL_10 | 01.01.2014 | 2014 | Virgil van Dijk | General Liability | Disneyland | Remarkable Solutions | Mining/Metals | 57'647.79 | 0.00 | 0.00 | 0.00 | -1'297.13  |
| POL_10 | 01.04.2015 | 2015 | Virgil van Dijk | General Liability | Disneyland | Remarkable Solutions | Mining/Metals | 37'758.71 | 0.00 | 0.00 | 0.00 | -4'691.57  |
| POL_10 | 01.04.2016 | 2016 | Virgil van Dijk | General Liability | Disneyland | Remarkable Solutions | Mining/Metals | 30'981.87 | 0.00 | 0.00 | 0.00 | -6'085.97  |
| POL_10 | 01.04.2017 | 2017 | Virgil van Dijk | General Liability | Disneyland | Remarkable Solutions | Mining/Metals | 30'981.87 | 0.00 | 0.00 | 0.00 | -9'852.87  |
| POL_10 | 01.05.2018 | 2018 | Virgil van Dijk | General Liability | Disneyland | Remarkable Solutions | Mining/Metals | 23'642.07 | 0.00 | 0.00 | 0.00 | -11'166.90 |

**POL\_ID** Unique policy identifier

**LE** Legal Entity issuing the policy

**POL\_INCEP** Policy inception date

**Industry** Industry/Occupancy of the policy holder

**UWY** Underwriting year

**UP, UAC, IBNR** Ultimate Premium, Ultimate Acquisition Costs and Incurred But Not Reported (losses) respectively as at the valuation date

**Insured** Name of policy holder

**PL, CR** Cumulative Paid Losses and Outstanding Case Reserves as at the evaluation date for all claims under the policy

**Region** Domicile of the insured

## RR's Database: Claims Data

| CLAIM_ID | CLAIM_DESC                                  | POL_ID  | PL           | CR           |
|----------|---------------------------------------------|---------|--------------|--------------|
| CLAIM_15 | CLNAME1/155005CLNAME2/<NA>                  | POL_101 | -30012.35007 | 0            |
| CLAIM_18 | CLNAME1/189601CLNAME2/<NA>                  | POL_101 | -41705.42971 | 0            |
| CLAIM_16 | CLNAME1/ALLEGED NON CONFORMITY POL_105      |         | 0            | 0            |
| CLAIM_16 | CLNAME1/ALLEGED NEGLIGENCE AND POL_108      |         | 0            | -162803.0546 |
| CLAIM_17 | CLNAME1/CLAIMANT FALL OFF HIS CY POL_108    |         | 0            | 0            |
| CLAIM_14 | CLNAME1/POTENTIAL LIABILITIES ARISI POL_111 |         | -90724.10646 | 0            |
| CLAIM_14 | CLNAME1/POTENTIAL LIABILITIES ARISI POL_111 |         | -7026.228238 | 0            |
| CLAIM_16 | CLNAME1/CORROSIONCLNAME2/<NA> POL_111       |         | -1204.873506 | 0            |
| CLAIM_17 | CLNAME1/ ENGINE VALVE GU POL_111            |         | -28166.80285 | -74196.441   |
| CLAIM_18 | CLNAME1/PROLONGED DETENTION OF POL_111      |         | -8379.212486 | 0            |
| CLAIM_18 | CLNAME1/ALLEGED BAD SETTING OF IN POL_111   |         | -82894.27445 | 9.95E-13     |
| CLAIM_18 | CLNAME1/ALLEGED LOSS OF 320 VEHIC POL_111   |         | -143260.1276 | 0            |
| CLAIM_19 | CLNAME1/DAMAGES TO A CRANECLNA POL_111      |         | -62238.69053 | -160028.7414 |
| CLAIM_20 | CLNAME1/BREAK ON ONE SCREW OCC POL_111      |         | -1236.379065 | 0            |
| CLAIM_20 | CLNAME1/NON-COMPLIANT WELDING POL_111       |         | -36112.38537 | -577531.537  |
| CLAIM_16 | CLNAME1/KITCHEN - FIRECLNAME2/<NA> POL_116  |         | -3436.171394 | 0            |
| CLAIM_15 | CLNAME1/EXTERNAL GLASS OF OVEN I POL_116    |         | -2408.405443 | 0            |
| CLAIM_17 | CLNAME1/BCR - LIABILITY CLAIM AGAI POL_120  |         | -771.8786296 | -842.034355  |
| CLAIM_20 | CLNAME1/BULK FILE 2017CLNAME2/<N POL_120    |         | -9.922389963 | -842.034355  |
| CLAIM_19 | CLNAME1/BCR CLAIMCLNAME2/<NA> POL_120       |         | -19107.48395 | -196474.6828 |
| CLAIM_22 | CLNAME1/BEARING FAILURESCLNAME: POL_120     |         | 0            | -33681.3742  |
| CLAIM_17 | CLNAME1/179141CLNAME2/<NA>                  | POL_122 | -24947.1133  | 0            |
| CLAIM_20 | CLNAME1/VARIOUS LOSSESCLNAME2/ POL_124      |         | -38664.29792 | -22712.11407 |
| CLAIM_20 | CLNAME1/VARIOUS LOSSESCLNAME2/ POL_124      |         | -316748.9026 | -322451.3416 |
| CLAIM_20 | CLNAME1/VARIOUS LOSSESCLNAME2/ POL_124      |         | -160432.4932 | -322088.2901 |
| CLAIM_20 | CLNAME1/VARIOUS LOSSESCLNAME2/ POL_124      |         | -163293.4372 | -456038.5427 |
| CLAIM_16 | CLNAME1/167420CLNAME2/<NA>                  | POL_129 | -2474.043404 | 0            |
| CLAIM_18 | CLNAME1/181675CLNAME2/<NA>                  | POL_129 | -36889.78842 | 0            |
| CLAIM_22 | CLNAME1/PERSONAL INJURY AT SSAFE POL_130    |         | 0            | -10000       |
| CLAIM_17 | CLNAME1/172080CLNAME2/<NA>                  | POL_132 | 0            | -402957.0225 |
| CLAIM_18 | CLNAME1/RECALL OF METAL BELT BEC POL_134    |         | -1296531.049 | -2.35E-10    |
| CLAIM_17 | CLNAME1/VARIOUS LOSSESCLNAME2/ POL_134      |         | -15370.49316 | -37597.53003 |
| CLAIM_18 | CLNAME1/VARIOUS CLAIMSCLNAME2/ POL_134      |         | -3126.619186 | -14675.79432 |
| CLAIM_20 | CLNAME1/VARIOUS LOSSESCLNAME2/ POL_134      |         | -8089.782772 | -24198.1363  |
| CLAIM_19 | CLNAME1/EMPLOYEE ACCIDENT WITH POL_137      |         | 0            | -3435.500168 |
| CLAIM_20 | CLNAME1/200339CLNAME2/<NA>                  | POL_137 | 0            | -37632.43516 |
| CLAIM_20 | CLNAME1/200400CLNAME2/<NA>                  | POL_137 | 0            | -44908.49893 |
| CLAIM_17 | CLNAME1/TRAIN CRASHCLNAME2/<NA> POL_141     |         | -949189.6157 | -703631.9412 |
| CLAIM_18 | CLNAME1/LOCOMOTIVE COLLISIONCLN POL_141     |         | -1340.208942 | -84203.4355  |
| CLAIM_18 | CLNAME1/TRAIN DERAILMENT AT BREN POL_141    |         | -15816.91396 | -153603.0313 |
| CLAIM_22 | CLNAME1/DERAILMENTCLNAME2/<NA> POL_141      |         | -7889.865267 | -8787.021444 |
| CLAIM_19 | CLNAME1/TRAIN DERAILING CAUSED B POL_141    |         | -49372.66711 | -4251482.587 |
| CLAIM_20 | CLNAME1/A TRAIN OR PART OF A TRAI POL_141   |         | -2708.364496 | -35457.0787  |
| CLAIM_21 | CLNAME1/212274CLNAME2/<NA>                  | POL_141 | 0            | -108903.1099 |
| CLAIM_21 | CLNAME1/HEAVY LOADING OF TRAIN CPOL_141     |         | 0            | -39294.93657 |
| CLAIM_21 | CLNAME1/PREMATURE WEAR FAILURE POL_141      |         | -569226.7844 | -1317109.015 |
| CLAIM_21 | CLNAME1/WHEEL FLANGE FAULTCLNA POL_141      |         | 0            | 0            |

**CLAIM\_ID** Unique claim identifier

**CLAIM\_DESC** Brief description of the claim  
(includes unpleasant redundant characters e.g.: 'CLAIMNAME1/')

**POL\_ID** Policy identifier that originated the loss

**PL, CR** Cumulative Paid Losses and Outstanding Case Reserves (same meaning as in the policy data) for each individual loss as at the valuation date

## RR's Database: Initial expectation and Meta data

### Initial expectation (T0)

Remarkable Re's data set includes the initial ultimate expected values for premium, acquisitions costs and losses

| POL_ID | UP       | UAC     | UL      |
|--------|----------|---------|---------|
| POL_20 | 1'239.73 | -185.96 | 0.00    |
| POL_21 | 783.94   | -195.98 | -331.46 |
| POL_21 | 783.94   | -195.98 | -331.46 |
| POL_19 | 5'613.56 | -196.47 | 0.00    |

**POL\_ID** Unique policy identifier

**UP, UAC, UL** Expected Ultimate Premium, Expected Ultimate Acquisitions Costs and Expected Ultimate Loss respectively at the time of issuing the policy

### Meta data

Each data set is available for two financial periods namely end of September 2020 and year end 2020, which is summarized in the small meta data set:

| financial period | date       | extraction date | extraction time |
|------------------|------------|-----------------|-----------------|
| cq               | 31/12/2019 | 23/01/2020      | 09:45:03        |
| lq               | 30/09/2019 | 23/01/2020      | 09:55:03        |

**Financial period** Label that identifies the valuation period where **cq** stands for 'current quarter' and **lq** for 'last quarter'

**date** Valuation date for each data set

**extraction date, extraction time** Date and time the report was extracted from the system

What type of reports can be produced with this data set?

# An example of a report in Word

<https://davidgohel.github.io/officer/>

<https://davidgohel.github.io/officedown/>

<https://davidgohel.github.io/flextable/>



# Remarkable Re's Overview as of Q4 2020

Claudio Rebelo

January 18, 2021

Document is  
formatted with  
the corporate  
branding: logo,  
font, colors...

## Table of Contents

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## 1 Introduction

Remarkable Re (RR) is a wholly fictional company part of the Remarkable Insurance Group (RIG) and it is one of the world's leading providers of Casualty (re)insurance.

Headquartered in Zurich, Switzerland, it was founded in February 2021 for the purpose of the 'EAA - Automating Reports with R Markdown' web session.

The scope of this study is to provide a monthly helicopter overview of RR's financial situation to its internal key stakeholders.

This report should be read in conjunction with the non-existing detailed document describing RIG's Swiss Solvency Test (SST) and its internal model.

The current version is only a draft and is not suitable for any other purpose than the set out above.

This **remarkable** report should not be quoted or referred to any third parties other than FINMA's and RR's independent auditors.

All figures are in USD unless stated otherwise.

Data as of December 31, 2020 was extracted on 23/01/2021 at 09:45:03 while data as of September 30, 2020 was extracted on 23/01/2021 at 09:55:03.

inline coloring is not  
supported by  
'markdown' this is  
accomplished via the  
`officedown` package

Table 1: Quarterly Technical Result in USD millions

| USD millions             | Underwriting Years |              |            |
|--------------------------|--------------------|--------------|------------|
|                          | 2020               | 2019 & prior | Total      |
| <b>Premium:</b>          |                    |              |            |
| Written Premium          | 0.7                | 0.1          | 0.8        |
| Acquisition Costs        | -0.1               | 0.0          | -0.1       |
| <b>Net Premium</b>       | <b>0.6</b>         | <b>0.1</b>   | <b>0.6</b> |
| <b>Losses:</b>           |                    |              |            |
| Paid Losses              | -0.3               | -0.8         | -1.0       |
| Case Reserves            | -1.0               | 1.5          | 0.5        |
| IBNR                     | 1.1                | 3.4          | 4.5        |
| <b>Ultimate Losses</b>   | <b>-0.1</b>        | <b>4.2</b>   | <b>4.0</b> |
| <b>Technical Results</b> | <b>0.4</b>         | <b>4.2</b>   | <b>4.7</b> |

i) Tech. Results =  
 Net Premium + Ultimate Loss

The book experienced a **positive technical result of  
**4.7m****

for contract years 2013 to 2020.

The result is mainly driven by IBNR releases due to low loss emergence whereof the largest 10 loss movements are:

With the package **flextable** we can convert data frames into word editable tables

Let R do the talking! Add adverbs & adjectives according to predefined rules to make it sound human.

The chart compares the costed (predicted) expected loss with the reserved (latest estimate) loss offering plenty of detail without being cluttered.

It is part of a package I am developing for P&C insurance visualization called pcplot.

## By Underwriting Year



Because the difference is just 0.7% the adverb 'only' is added to humanize the text.

Figure 1: Costed vs Reserved by Underwriting Year

The average **costed loss ratio** is **67.7%** compared to the current average reserved of **68.4%**, a difference of only 0.7%, for contract years 2013 to 2020.

As an alternative to `flextable` we can define tables with `knitr::kable()` and `kableExtra()` by saving it as an image with `save_kable()` and import the image with `knitr::include_graphics()`, all during the knitting process. Of course, these tables can no longer be edited as with `flextable`.

There are several other packages to export tables as images such as:

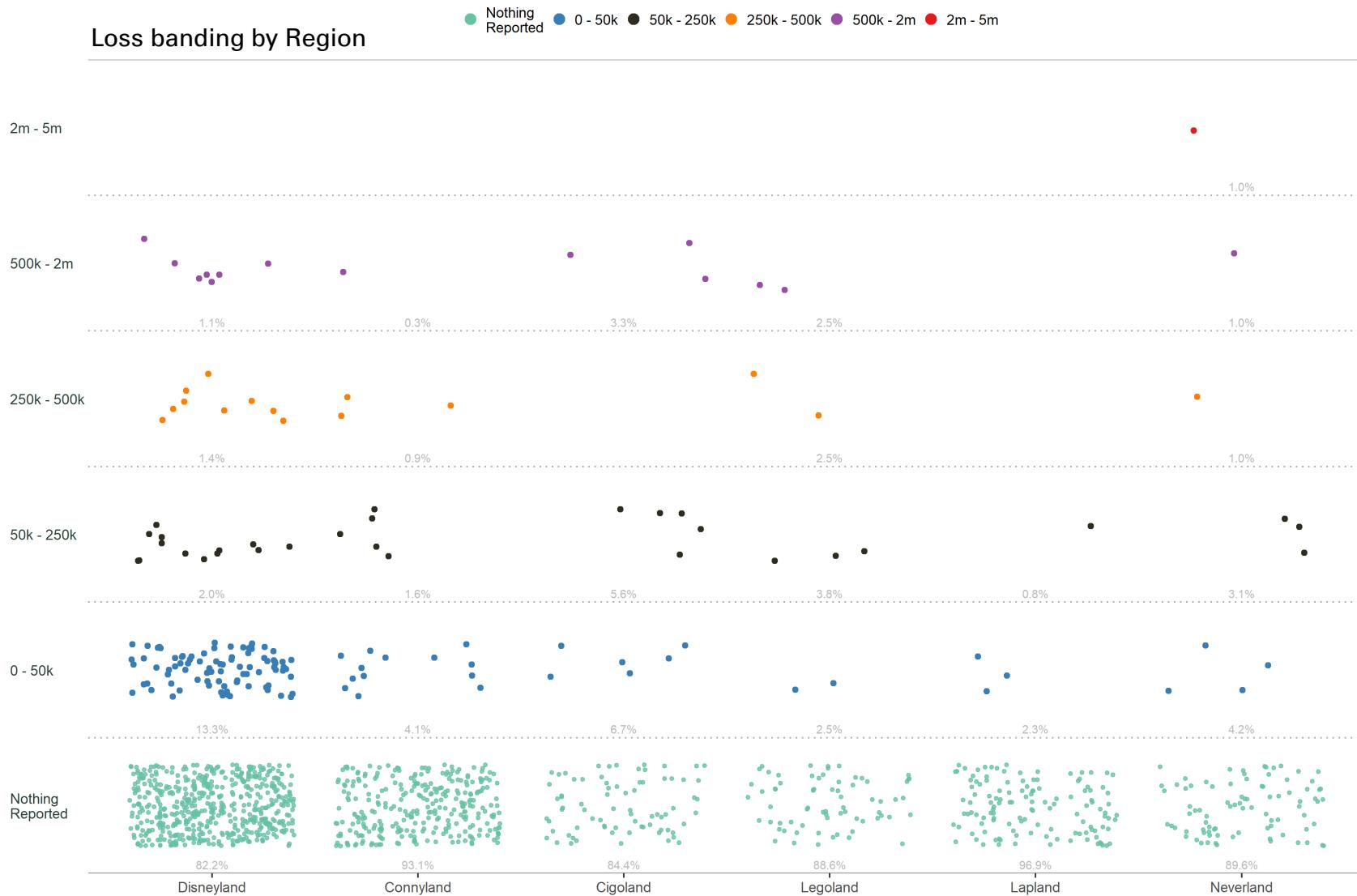
- `huxtable`
- `gt`
- `formattable`
- `xtable`

## By most profitable insured

| Insured          | Region     | Line of Business  | Legal Entity         | Industry                  | Underwriting Years             | Written Premium | Technical Result |
|------------------|------------|-------------------|----------------------|---------------------------|--------------------------------|-----------------|------------------|
| Arturo Vidal     | Connyland  | General Liability | Remarkable Solutions | Fishery                   | 13, 14, 15, 16, 17, 18, 19, 20 | 3'204'495       | 1'465'977        |
| Thibaut Courtois | Connyland  | General Liability | Remarkable Solutions | Government Administration | 15, 16, 17                     | 1'915'298       | 1'227'676        |
| Luka Modric      | Disneyland | General Liability | RR International     | Fishery                   | 13, 14, 15, 16, 17, 18, 19     | 2'802'174       | 1'189'076        |
| Sergio Busquets  | Legoland   | General Liability | RR International     | Sports                    | 13, 14, 15, 16, 17, 18, 19, 20 | 1'677'351       | 1'146'233        |
| Alexis Sánchez   | Connyland  | General Liability | Remarkable Solutions | Banking/Mortgage          | 14, 15, 16, 17, 18, 19, 20     | 1'885'000       | 1'001'215        |

## By least profitable insured

| Insured              | Region     | Line of Business  | Legal Entity         | Industry                       | Underwriting Years | Claim Ratio | Written Premium | Technical Result |
|----------------------|------------|-------------------|----------------------|--------------------------------|--------------------|-------------|-----------------|------------------|
| Jérôme Boateng       | Neverland  | General Liability | Remarkable Solutions | Sports                         | 18, 19, 20         | 8/6         | 1'655'850       | -5'728'808       |
| Paul Pogba           | Cigoland   | General Liability | Remarkable Solutions | Automotive                     | 18, 19, 20         | 2/3         | 1'117'721       | -1'518'722       |
| Claudio Marchisio    | Connyland  | General Liability | Remarkable Solutions | Entertainment/Movie Production | 17, 18, 19, 20     | 1/4         | 398'498         | -1'176'192       |
| Toni Kroos           | Disneyland | General Liability | RR International     | Computer Software/Engineering  | 18                 | 8/1         | 332'972         | -1'163'318       |
| Carlos Idriss Kameni | Disneyland | General Liability | RR International     | Computer Software/Engineering  | 18, 19             | 1/2         | 42'259          | -896'395         |



Each dot represents a policy, and it is allocated to each band (y-axis) according to the total loss amount that it generated.

The view is sliced by region. Moreover, the corresponding percentage that makes up each band is displayed, for example: Lapland contains the highest percentage of policies that are loss free with 96.9%.

This chart is also part of the `pcplot` package.

## Focus only on the non-automated sections



### 6 Changes in Actuarial assumptions

Analyst please fill this section.....

#### 6.1 Apriori Loss Ratio adjustments

Analyst please fill this section.....

#### 6.2 Pattern Adjustments

Analyst please fill this section.....

#### 6.3 Data quality issues and other topics

Analyst please fill this section.....

With Word it is easy for any user to modify or add any sections as needed.

Challenge:  
What can be done to (partially) automate this section?

HTML provides a rich format for communication that supports a variety of features

# An example of a report in HTML



# Remarkable Re

- 1 Introduction
- 2 Remarkable's Technical Results
- 3 Costed Loss Ratios versus Reserved Loss Ratios
- 4 Top 5 list
- 5 Further claims insights

# 1 Introduction

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## Remarkable Re

- 1 Introduction
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### ▼ Description of main quarterly loss movements

Underwriting year 2020:

- USD -0.92m new loss on Dejan Lovren (Region: Disneyland, Industry: Computer Software/Engineering, Entity: Remarkable Solutions)
- USD -0.17m new loss on Cristiano Ronaldo (Region: Connyland, Industry: Package/Freight Delivery, Entity: Remarkable Solutions)
- USD +0.13m loss improvement on Stefan Savic (total to date: 0.00m, Region: Disneyland, Industry: Law Practice/Law Firms, Entity: Remarkable Solutions)

Underwriting year 2019:

- USD +0.60m loss improvement on Claudio Marchisio (total to date: -1.30m, Region: Connyland, Industry: Entertainment/Movie Production, Entity: Remarkable Solutions)
- USD -0.56m loss worsening on Carlos Idriss Kameni (total to date: -0.92m, Region: Disneyland, Industry: Computer Software/Engineering, Entity: Remarkable Solutions)
- USD +0.56m loss improvement on Manuel Neuer (total to date: -0.02m, Region: Cigoland, Industry: Banking/Mortgage, Entity: Remarkable Solutions)
- USD -0.13m loss worsening on Marcelo (total to date: -0.18m, Region: Disneyland, Industry: Sports, Entity: Remarkable Solutions)
- USD -0.11m loss worsening on Bernd Leno (total to date: -0.22m, Region: Cigoland, Industry: Automotive, Entity: Remarkable Solutions)
- USD -0.11m loss worsening on Robert Lewandowski (total to date: -0.40m, Region: Disneyland, Industry: Law Practice/Law Firms, Entity: Remarkable Solutions)

Underwriting year 2016:

- USD +0.64m loss improvement on Thibaut Courtois (total to date: 0.00m, Region: Connyland, Industry: Government Administration, Entity: Remarkable Solutions)

A collapsible section formatted with CSS to simulate a claims database system:

```
div.clms { background-color:#f3f2f3;
border-radius: 0px;
padding: 20px;
font-family: Lucida Console !important;
line-height: 1.5; padding-top: 3px;
padding-bottom: 3px;
}
```

Create a division in the R Markdown file using html syntax

```
<div class = "clms">
 body of the text
</div>
```

Hover the mouse over the table header to see the computation, which is aesthetically more pleasant than adding footnotes.

Combined loss ratios above 100% are conditionally formatted with a yellow background.

## 2.2 Inception to date results

The tables below display Remarkable Re's Technical Results from inception to date as of December 31, 2020.

### By Underwriting Year

Table 2.2: Inception to date Technical Result in USD millions

UW Year	Premium	Acquisition Costs	Reported Losses	IBNR	Ultimate Loss	Technical Result	Ultimate Loss Ratio	Combined Loss Ratio
2013	3.7	-0.2	0.0	-0.4	-0.4	3.0	11%	17%
2014	5.3	-0.4	0.0	-0.7	-0.7	4.2	14%	20%
2015	9.4	-0.6	-0.3	-2.2	-2.5	6.3	26%	33%
2016	9.8	-1.0	-0.5	-2.8	-3.3	5.5	34%	44%
2017	11.6	-1.4	-1.4	-4.7	-6.0	4.1	52%	64%
2018	15.3	-2.4	-6.6	-6.5	-13.1	-0.1	86%	101%
2019	23.0	-3.7	-15.4	-10.6	-26.0	-6.7	113%	129%
2020	34.9	-5.4	-4.4	-20.9	-25.2	4.2	72%	88%
Total	112.9	-15.2	-28.5	-48.7	-77.3	20.5	68%	82%

= (Ultimate Loss Ratio) + (-Acquisition Costs) / Premium

The **combined loss ratio** is

**82%**

for contract years 2013 to 2020.

The average loss ratio is 68% for the same period while the worst performing year is 2019 with a combined loss ratio of 129%.

By Reported Loss

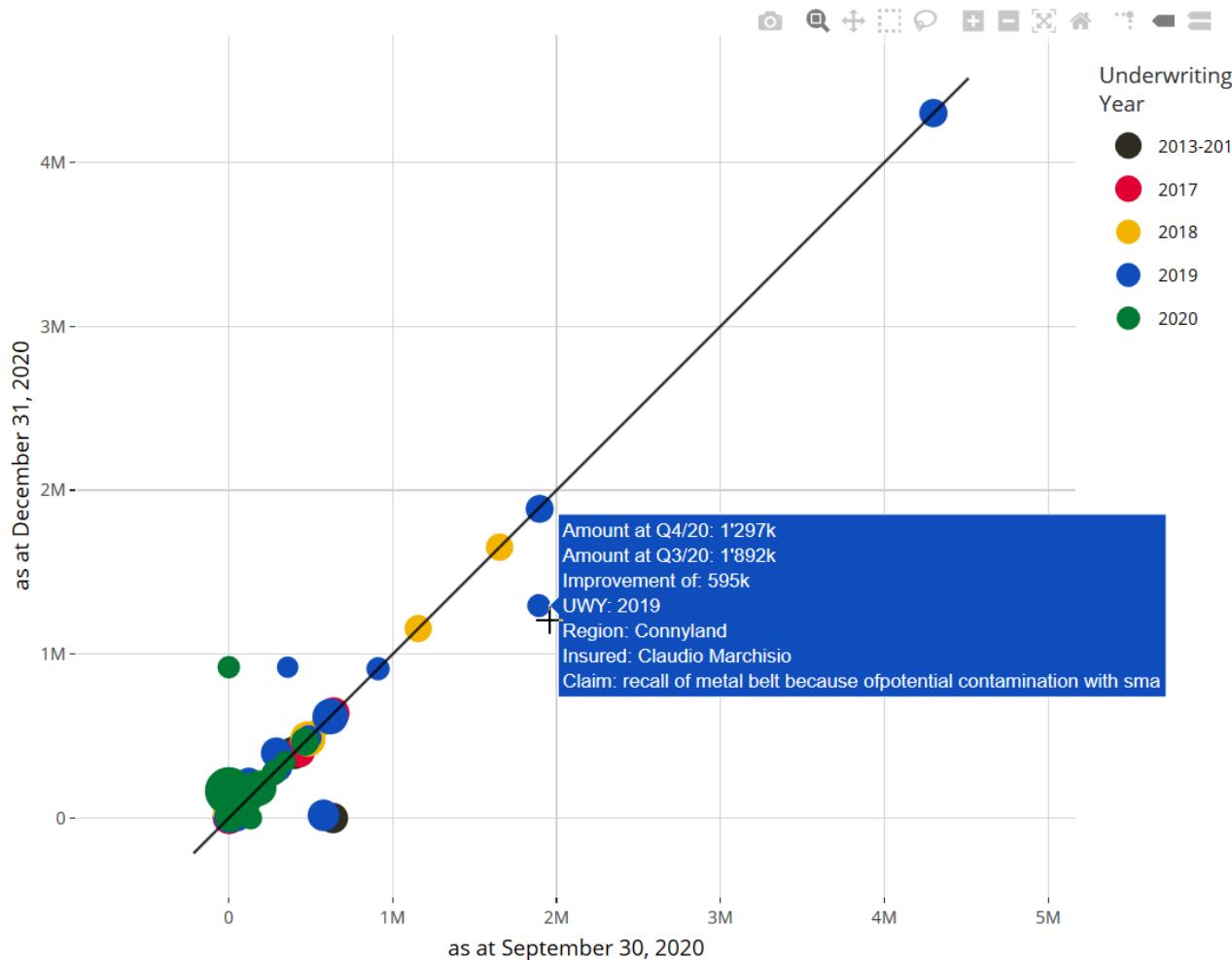


Figure 5.1: Reported Losses as at prior and current quarter

The main advantage of html is the ability to react to the reader's actions. Another plus, is that it can be read with any browser regardless of the device and operating system.

Hovering the cursor over each dot provides additional information. We can also zoom in or out while the legend provides the option to slice the data.

Now you have all the quarterly movements and total values at your fingertips!

The chart was designed with `ggplot2` and wrapped with `ggplotly()` from the `plotly` package and is also part of the `pcplot` package.

**TIP:** `ggplotly()` does not render the additional information nicely by default. To control what is displayed, create the information in the underlying data frame and select what to show with 'tooltip'. Remember to include the aesthetic 'text' in your ggplot.

## Appendix - Data set

The following table shows key figures for each policy holder for and it is included for completeness. All values in USD as of December 31, 2020.

Show 10 entries

Search:

Inured	LE	Land	Written Premium	Costs	Paid Losses	Case Reserves	IBNR	Ult. Loss	Tech. Result	Ult. loss ratio	Combined ratio
A	A	A	1 	A	A	A	A	A	A	A	A
Aaron Ramsey	Remarkable Solutions	Neverland	1977222.51	4527553.00	0	0	-46928	-46928	16450	0.58	0.8
Adam Lallana	Remarkable Solutions	Neverland	75084	-1853	-163	0	-38201	-38364	34867	0.51	0.54
Adán	Remarkable Solutions	Connyland	29087	-7961	0	0	-8323	-8323	12802	0.29	0.56
Adil Rami	Remarkable Solutions	Cigoland	89843	-17969	0	0	-37525	-37525	34349	0.42	0.62
Adrián	RR International	Disneyland	27743	-6936	-121359	-190861	176400	-135821	-115013	4.9	5.15
Adrien Rabiot	Remarkable Solutions	Lapland	58025	0	0	0	-11010	-11010	47014	0.19	0.19
Adrien Silva	Remarkable Solutions	Connyland	78394	-15679	0	0	-52994	-52994	9721	0.68	0.88
Aduriz	RR International	Legoland	108631	0	0	-22454	-74760	-97214	11417	0.89	0.89
Alan Dzagoev	RR International	Disneyland	57161	-14290	0	0	-20739	-20739	22131	0.36	0.61
Alassane Pléa	Remarkable Solutions	Connyland	5094	0	0	0	-3881	-3881	1213	0.76	0.76

Showing 1 to 10 of 636 entries

Previous [1](#) [2](#) [3](#) [4](#) [5](#) ... [64](#) Next

It is possible to include large searchable tables with filters via `DT::datatable()`.

This table contains the results for each policy holder with 636 entries in 64 pages.

It is possible to include much larger datasets and still provide a good user experience.

Normally, I would only include such a table in the appendix.

With R you can write web applications with Shiny thus, the question to be asked is:

Can we incorporate Shiny in an R Markdown html document?

# Mark meets Shiny



# Add in the YAML section

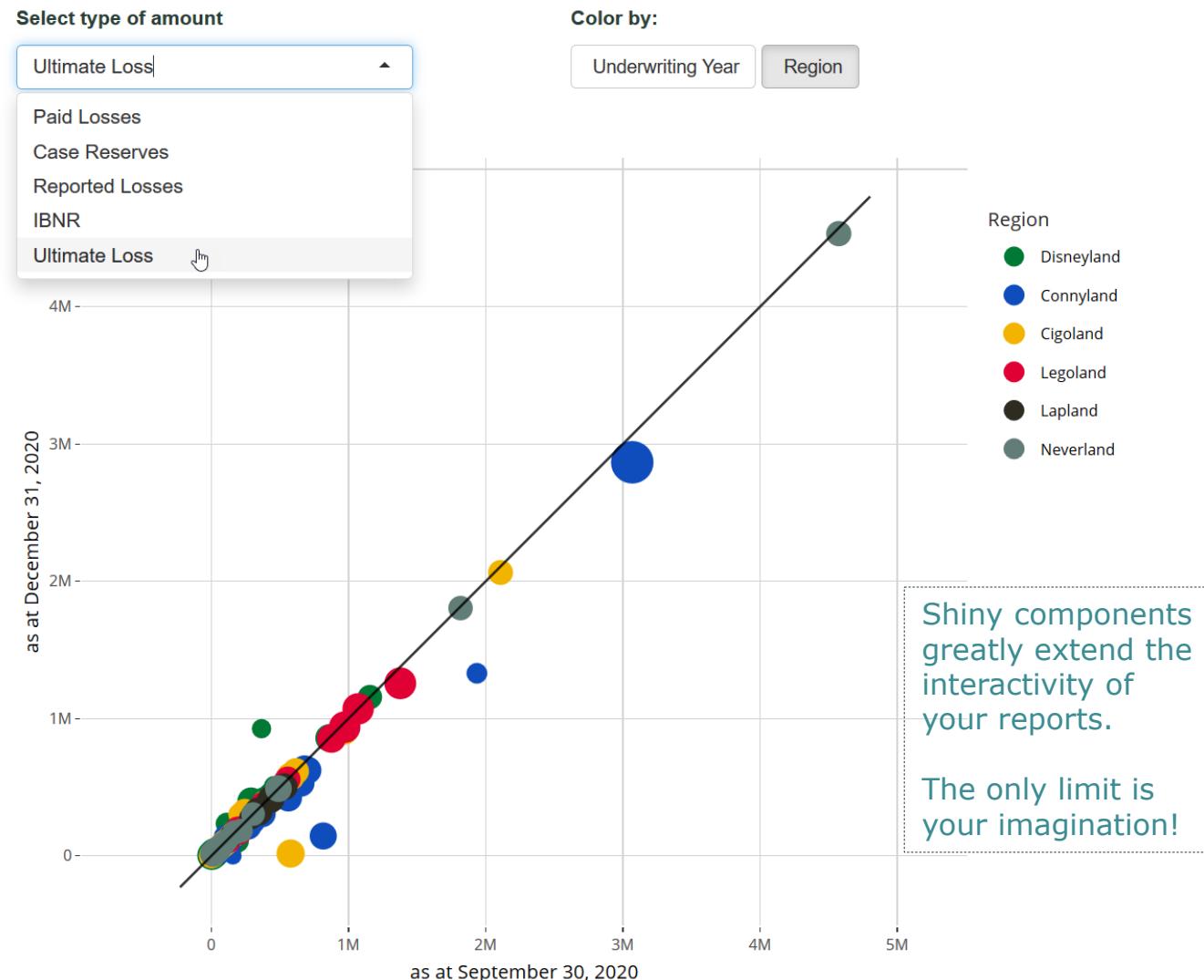
## runtime: shiny

```
1 ---
2 author: "Claudio Rebelo"
3 date: ``r format(Sys.Date(), '%B %d, %Y') ``
4 output:
5 bookdown::html_document2:
6 toc: true
7 toc_float: true
8 toc_depth: 3
9 collapsed: false
10 number_sections: true
11 css: template.css
12 fig_caption: true
13 editor_options:
14 chunk_output_type: console
15 runtime: shiny
16 ---
```

### Select number of words to display

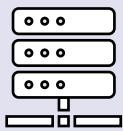


### 3.1 Quarterly movement by Ultimate Loss





Remember, once a **Shiny** component is added to an R Markdown document it can no longer be saved locally



Due to its reactive nature, any document containing a **Shiny** component requires a server side



However, you can share the document like any other shiny app

## My two cents about adding Shiny to an R Markdown report

Keep Shiny components fairly simple

A report is like a story: you as the writer should be in control of the narrative

Too many Shiny components is likely to distract the reader from the message you are trying to convey: **it should still be a report – not a dashboard**

As a suggestion: add a Shiny component (e.g.: dashboard) in the appendix

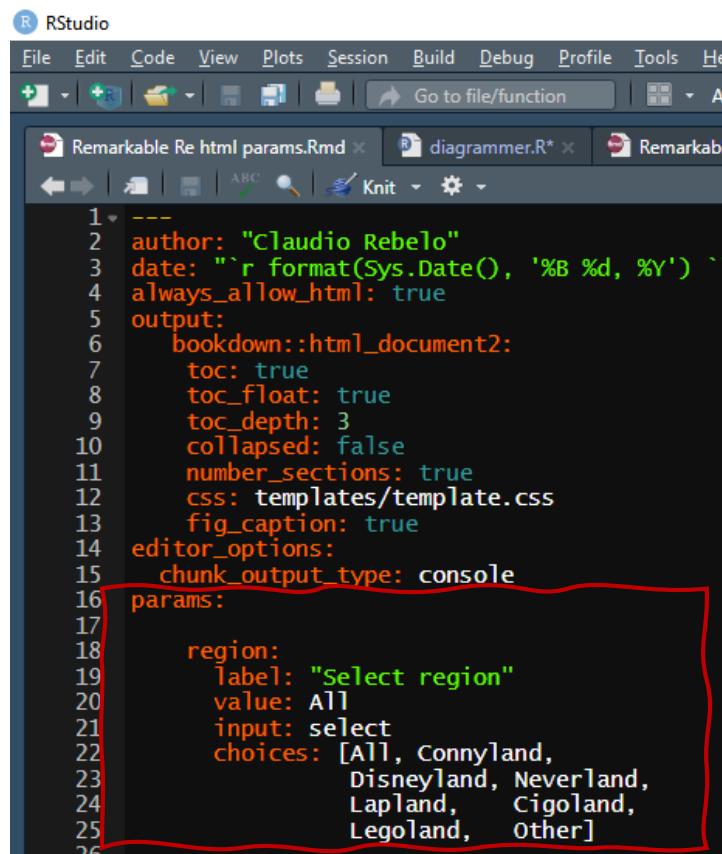


# Parameterized reports

## The road to full automation

## Reach the next level of automation with parameterized reports

Add `params` to the YAML header (line 16)



```
1 ---
2 author: "Claudio Rebelo"
3 date: "`r format(Sys.Date(), '%B %d, %Y')`"
4 always_allow_html: true
5 output:
6 bookdown::html_document2:
7 toc: true
8 toc_float: true
9 toc_depth: 3
10 collapsed: false
11 number_sections: true
12 css: templates/template.css
13 fig_caption: true
14 editor_options:
15 chunk_output_type: console
16 params:
17
18 region:
19 label: "Select region"
20 value: All
21 input: select
22 choices: [All, Connyland,
23 Disneyland, Neverland,
24 Lapland, Cigoland,
25 Legoland, Other]
26
```

Adjust your code by replacing the variable of interest with `params$region`

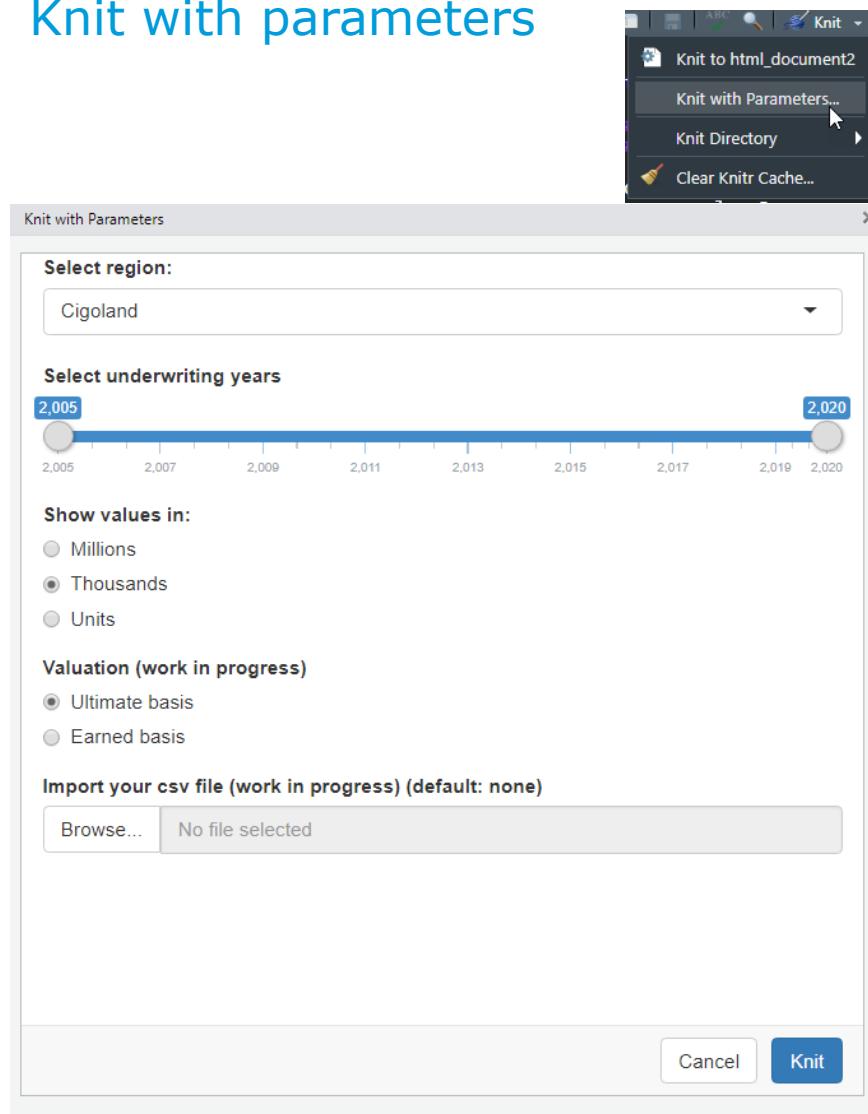
Before:

```
filter(df_RR, Region == "Cigoland")
```

After:

```
filter(df_RR, Region == params$region)
```

## Knit with parameters



The document is now a Cigoland report

## 2 Cigoland's Technical Results

### 2.1 Quarterly results

The table below displays the quarterly technical result as of December 31, 2020.

Note that all values are according to their financial impact for example, negative losses represent an increase in loss amount.

Table 2.1: Quarterly Technical Result in USD thousands

USD thousands	Underwriting Year		Total
	2020	2019 & prior	
<b>Premium:</b>			
- Written Premium	11k	0k	11k
- Acquisition Costs	0k	0k	0k
<b>Net Premium</b>	<b>11k</b>	<b>0k</b>	<b>11k</b>
<b>Losses:</b>			
- Paid Losses	-1k	-602k	-604k
- Case Reserves	10k	941k	951k
- IBNR	-10k	343k	333k
<b>Ultimate Losses</b>	<b>-1k</b>	<b>682k</b>	<b>681k</b>
<b>Technical Results</b>	<b>10k</b>	<b>682k</b>	<b>691k</b>

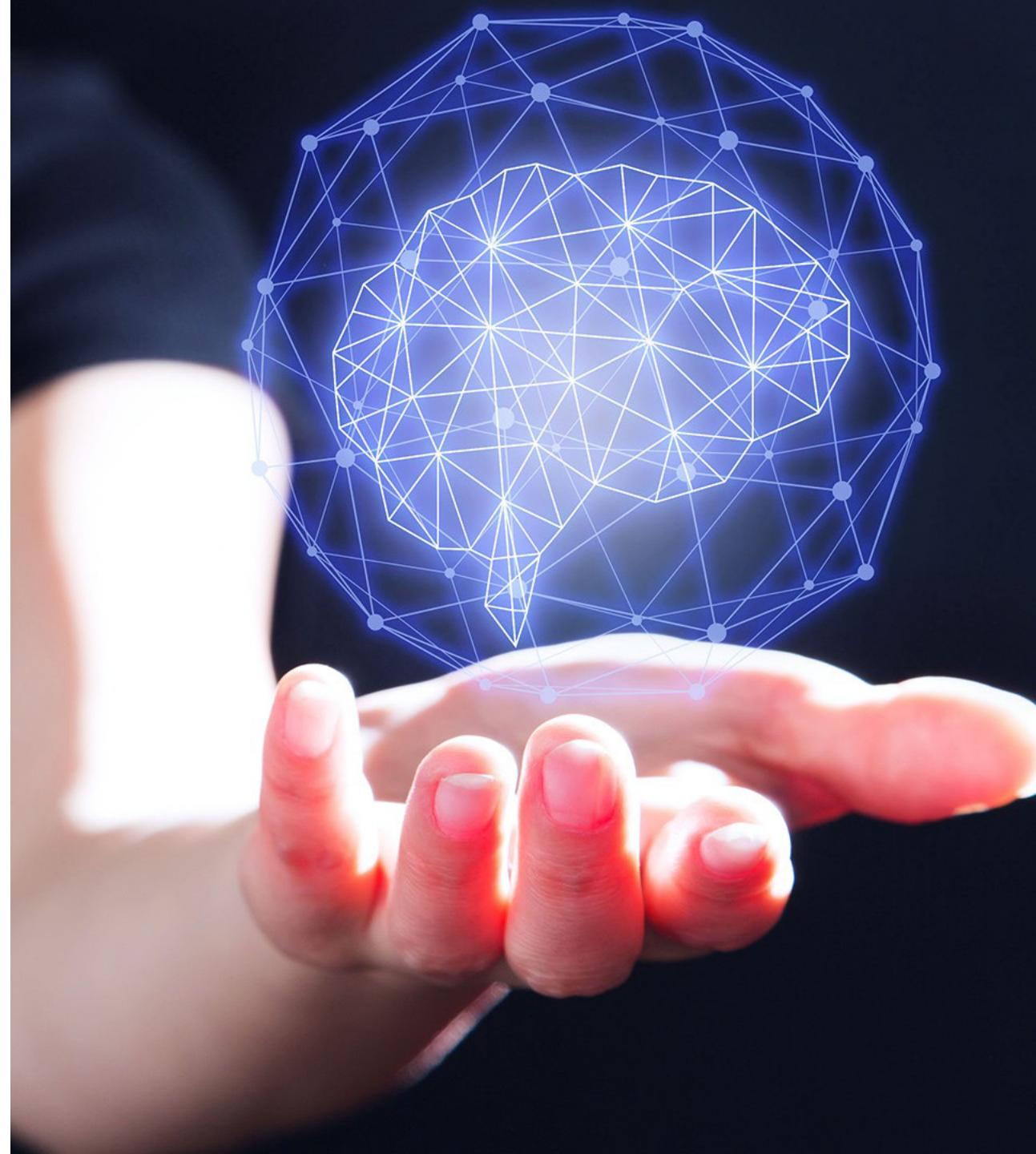
The book of business experienced a positive result of 691k for contract years 2013 to 2020.

The result is mainly driven by improvement in Reported Losses and by IBNR releases.

- ▶ Description of main quarterly loss movements

The comment explaining the financial result is updated accordingly based on predefined rules

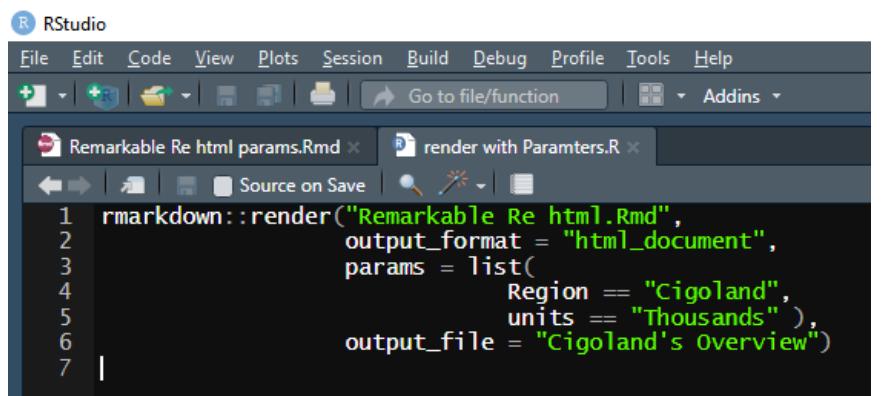
# Can we automate the process even further?



# Can we automate the process even further?

## YES!

With the `params` argument of the `render()` function it is possible to pass the parameters as a list

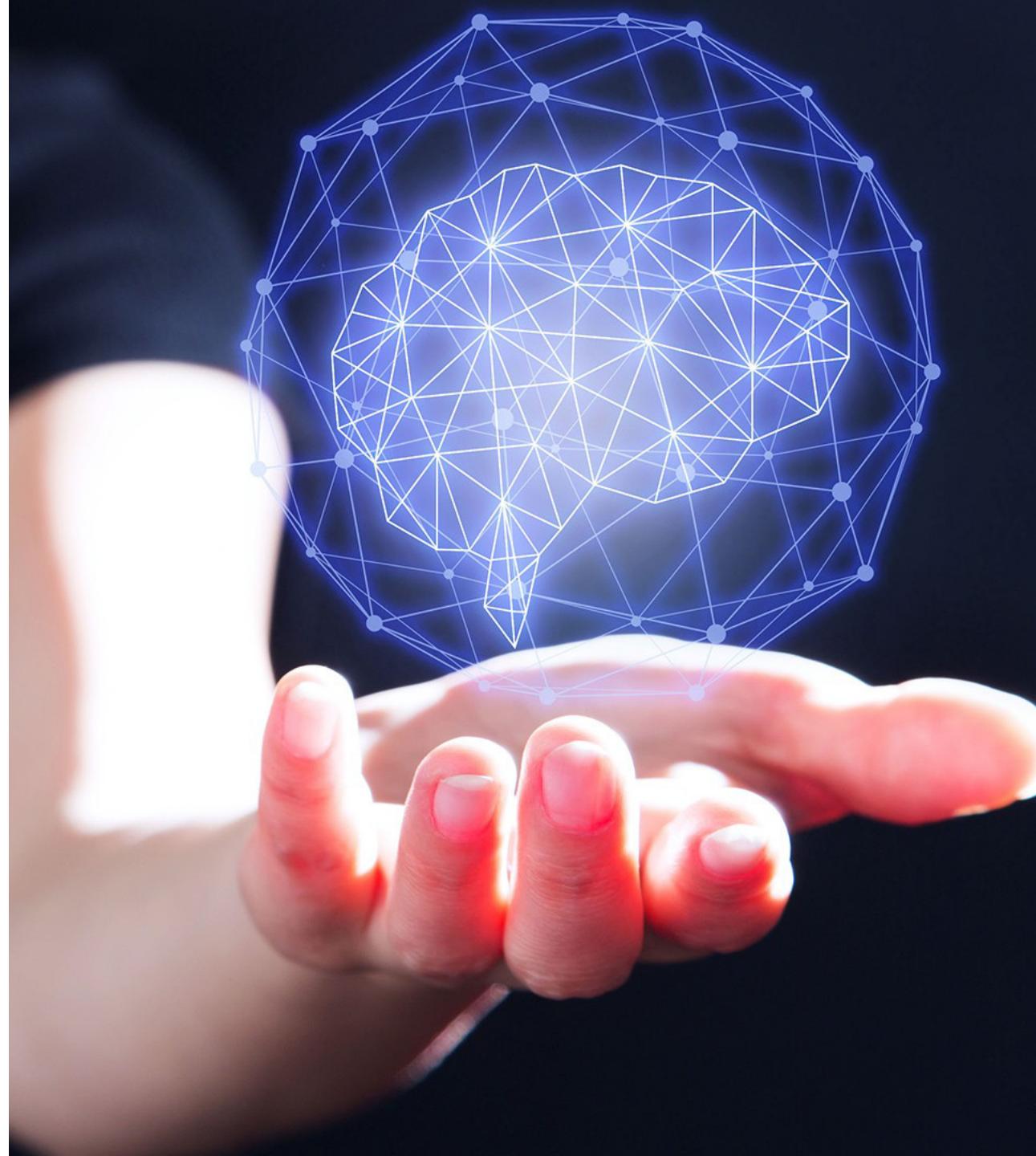


RStudio

```
File Edit Code View Plots Session Build Debug Profile Tools Help
+ - Go to file/function Addins

Remarkable Re html params.Rmd render with Paramters.R
Source on Save | 1 rmarkdown::render("Remarkable Re html.Rmd",
2 output_format = "html_document",
3 params = list(
4 Region == "Cigoland",
5 units == "Thousands"),
6 output_file = "Cigoland's Overview")
7 |
```

Next step: create a function inside a ‘for loop’ routine to **run as many reports as needed in one go!**





## Follow the BBC approach

Develop dedicated corporate packages for:

- Corporate Branding
- Data Extraction
- Visualizations
- ...

to facilitate the implementation of the "R Markdown" workflow.

<https://bbc.github.io/rcookbook>

## With RStudio Connect

RStudio Connect is a paid publishing platform.

Each parameterized report can be saved on the platform.

We can **add a mailing** list to each saved report and instruct RStudio Connect to run **and email the reports according to a predefined schedule!**

That is full automation!

## Faster & Better

From the Messy Workflow to the **R Markdown** approach we created reports:

- much **faster**
- with **less resources**
- and more importantly, delivered a significantly **better product!**



,,

If cars can drive  
themselves, so can  
your reports

Claudio Rebelo  
Actuary

This concludes part 1 of the web session

Part 2 consists of a live R Markdown demo