

# Feature Tour

By Benedict Escoto



This paper is produced mechanically as part of FAViR.  
See <http://www.favir.net> for more information.

## Abstract

This paper intended as an initial tour of the functions included in the FAViR package. It itself is an example of a FAViR paper that uses these functions.

## 1 Introduction

The R package component of FAViR includes several formatting functions which make writing FAViR papers more convenient. They are covered in the package manual pages but some only make sense inside a FAViR paper. This paper demonstrates each of these functions and can be used as a quick-reference or a feature tour of the FAViR package.

When reading the PDF version of this paper, please follow along in the associated Sweave (.Rnw) version.

## 2 LaTeX

LaTeX commands are available inside the LaTeX (non-R) sections of a FAViR paper. In particular:

- *text in italics*
- **boldface text**
- `typewriter font`
- tiny script footnote small normal large Large LARGE huge Huge

This text is centered.

1. This list is numbered.

2. And it has equations like  $3 \leq 4$  and  $1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots + \frac{1}{n^2} + \cdots = \sum_{i=1}^{\infty} \frac{1}{i^2} = \frac{\pi^2}{6}$

You can also have numbered, centered equations, like equation (1) below.

$$K(x) = \begin{cases} \frac{3}{4}(1 - x^2/5)/\sqrt{5} & |x| < \sqrt{5} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

LaTeX has far too many features to demonstrate here, so please consult the internet for general LaTeX help.

### 3 Sweave

Sweave allows R code to be included in a paper and automatically executed. Below is the most basic Sweave mode, where both R commands and their output are printed:

```
> 2 + 2
```

```
[1] 4
```

```
> 1:10
```

```
[1] 1 2 3 4 5 6 7 8 9 10
```

However, the output of this mode generally doesn't look very polished. A more powerful technique is not to display the R commands, but have them generate LaTeX output directly. This is how most code segments in FAViR papers are run.

This LaTeX is generated by R

$$\sum_{i=1}^{100} \log(i) \approx 363.739375555563$$

Note the double backslashes in the above R code. When that code is evaluated by R, each double backslash becomes a single backslash which is then evaluated by LaTeX.

It's also possible to run R without displaying the results or even in the *middle* of a sentence.

## 4 FAViR Data Frames

This section is about presenting tabular data in R data frames. First we'll define a simple data frame and then progressively refine its presentation by using FAViR functions.

An easy way to present a data frame is by using basic Sweave mode:

```
> df <- data.frame(year = 2000:2008, prem.a = 2e+05 * rnorm(9,
+   1, 0.1), loss.a = 130000 * rnorm(9, 1, 0.2), loss.ratio.a = 0,
+   prem.b = 50000 * rnorm(9, 1, 0.1), loss.b = 30000 * rnorm(9,
+   1, 0.2), loss.ratio.b = 0)
> df$loss.ratio.a <- df$loss.a/df$prem.a
> df$loss.ratio.b <- df$loss.b/df$prem.b
> df
```

	year	prem.a	loss.a	loss.ratio.a	prem.b	loss.b	loss.ratio.b
1	2000	190508.9	184119.42	0.9664610	48744.30	37722.71	0.7738897
2	2001	210817.6	157678.46	0.7479378	62646.58	30022.13	0.4792302
3	2002	192506.5	85794.46	0.4456705	56682.54	39112.96	0.6900354
4	2003	158264.9	86640.39	0.5474391	54376.34	32337.20	0.5946925
5	2004	209568.6	162503.76	0.7754205	55149.95	24298.56	0.4405908
6	2005	163896.5	165743.74	1.0112710	46583.83	21203.42	0.4551669
7	2006	176008.2	115132.86	0.6541334	52080.57	25722.04	0.4938893
8	2007	201431.2	138643.00	0.6882894	45182.51	31584.33	0.6990387
9	2008	227984.3	116597.24	0.5114267	45569.68	25310.71	0.5554288

However the results are obviously rough. We can improve on this by using a FavirDF object:

year	prem.a	loss.a	loss.ratio.a	prem.b	loss.b	loss.ratio.b
2,000	190,509	184,119	1	48,744	37,723	1
2,001	210,818	157,678	1	62,647	30,022	0
2,002	192,506	85,794	0	56,683	39,113	1
2,003	158,265	86,640	1	54,376	32,337	1
2,004	209,569	162,504	1	55,150	24,299	0
2,005	163,896	165,744	1	46,584	21,203	0
2,006	176,008	115,133	1	52,081	25,722	0
2,007	201,431	138,643	1	45,183	31,584	1
2,008	227,984	116,597	1	45,570	25,311	1

Figure 1:

The results are now displayed in a figure. LaTeX does not necessarily display figures where they are defined—it uses an algorithm to place them where it thinks they will fit. It's good practice to add labels and captions to each FavirDF, so it's clear which table is being referred to.

year	prem.a	loss.a	loss.ratio.a	prem.b	loss.b	loss.ratio.b
2,000	190,509	184,119	1	48,744	37,723	1
2,001	210,818	157,678	1	62,647	30,022	0
2,002	192,506	85,794	0	56,683	39,113	1
2,003	158,265	86,640	1	54,376	32,337	1
2,004	209,569	162,504	1	55,150	24,299	0
2,005	163,896	165,744	1	46,584	21,203	0
2,006	176,008	115,133	1	52,081	25,722	0
2,007	201,431	138,643	1	45,183	31,584	1
2,008	227,984	116,597	1	45,570	25,311	1

Figure 2: This FavirDF has a label and caption.

Figure 2 has a label and caption. It arguably looks better than the simple Sweave version, but the headers are chosen for R programming convenience and are not ideal for presentation.

## 4.1 Table Headings

We can change the headings by using the `FieldHeadings` function. Figure 3 has better column headings.

In figure 4 we do even better by grouping the lines of business.

Calendar Year	Earned Premium Line A	Ultimate Loss Line A	Loss Ratio Line A	Earned Premium Line B	Ultimate Loss Line B	Loss Ratio Line B
2,000	190,509	184,119	1	48,744	37,723	1
2,001	210,818	157,678	1	62,647	30,022	0
2,002	192,506	85,794	0	56,683	39,113	1
2,003	158,265	86,640	1	54,376	32,337	1
2,004	209,569	162,504	1	55,150	24,299	0
2,005	163,896	165,744	1	46,584	21,203	0
2,006	176,008	115,133	1	52,081	25,722	0
2,007	201,431	138,643	1	45,183	31,584	1
2,008	227,984	116,597	1	45,570	25,311	1

Figure 3: Table with better column headings

Calendar Year	Line of Business A			Line of Business B		
	Earned Premium	Ultimate Loss	Loss Ratio	Earned Premium	Ultimate Loss	Loss Ratio
2,000	190,509	184,119	1	48,744	37,723	1
2,001	210,818	157,678	1	62,647	30,022	0
2,002	192,506	85,794	0	56,683	39,113	1
2,003	158,265	86,640	1	54,376	32,337	1
2,004	209,569	162,504	1	55,150	24,299	0
2,005	163,896	165,744	1	46,584	21,203	0
2,006	176,008	115,133	1	52,081	25,722	0
2,007	201,431	138,643	1	45,183	31,584	1
2,008	227,984	116,597	1	45,570	25,311	1

Figure 4: Table with group headings

## 4.2 Entry Formatting

This table is starting to look decent, but the numbers are not formatted correctly. You can specify arbitrary formatting functions per field, but several standard ones are built into the FAViR package. In figure 5 the loss ratio and years columns have been reformatted.

Calendar Year	Line of Business A			Line of Business B		
	Earned Premium	Ultimate Loss	Loss Ratio (%)	Earned Premium	Ultimate Loss	Loss Ratio (%)
2000	190,509	184,119	96.6	48,744	37,723	77.4
2001	210,818	157,678	74.8	62,647	30,022	47.9
2002	192,506	85,794	44.6	56,683	39,113	69.0
2003	158,265	86,640	54.7	54,376	32,337	59.5
2004	209,569	162,504	77.5	55,150	24,299	44.1
2005	163,896	165,744	101.1	46,584	21,203	45.5
2006	176,008	115,133	65.4	52,081	25,722	49.4
2007	201,431	138,643	68.8	45,183	31,584	69.9
2008	227,984	116,597	51.1	45,570	25,311	55.5

Figure 5: Table with formatted entries

Note also that LaTeX moved some of the earlier figures onto other pages because there were “too many” figures and not enough text. At the start of this section we have manually forced all figures to be placed in order to start fresh.

## 4.3 Final Table

The last change we will make is to add a summary row. Figure 6 demonstrates this.

Calendar Year	Line of Business A			Line of Business B		
	Earned Premium	Ultimate Loss	Loss Ratio (%)	Earned Premium	Ultimate Loss	Loss Ratio (%)
2000	190,509	184,119	96.6	48,744	37,723	77.4
2001	210,818	157,678	74.8	62,647	30,022	47.9
2002	192,506	85,794	44.6	56,683	39,113	69.0
2003	158,265	86,640	54.7	54,376	32,337	59.5
2004	209,569	162,504	77.5	55,150	24,299	44.1
2005	163,896	165,744	101.1	46,584	21,203	45.5
2006	176,008	115,133	65.4	52,081	25,722	49.4
2007	201,431	138,643	68.8	45,183	31,584	69.9
2008	227,984	116,597	51.1	45,570	25,311	55.5
Total	1,730,987	1,212,853	70.1	467,016	267,314	57.2

Figure 6: Final table with summary row

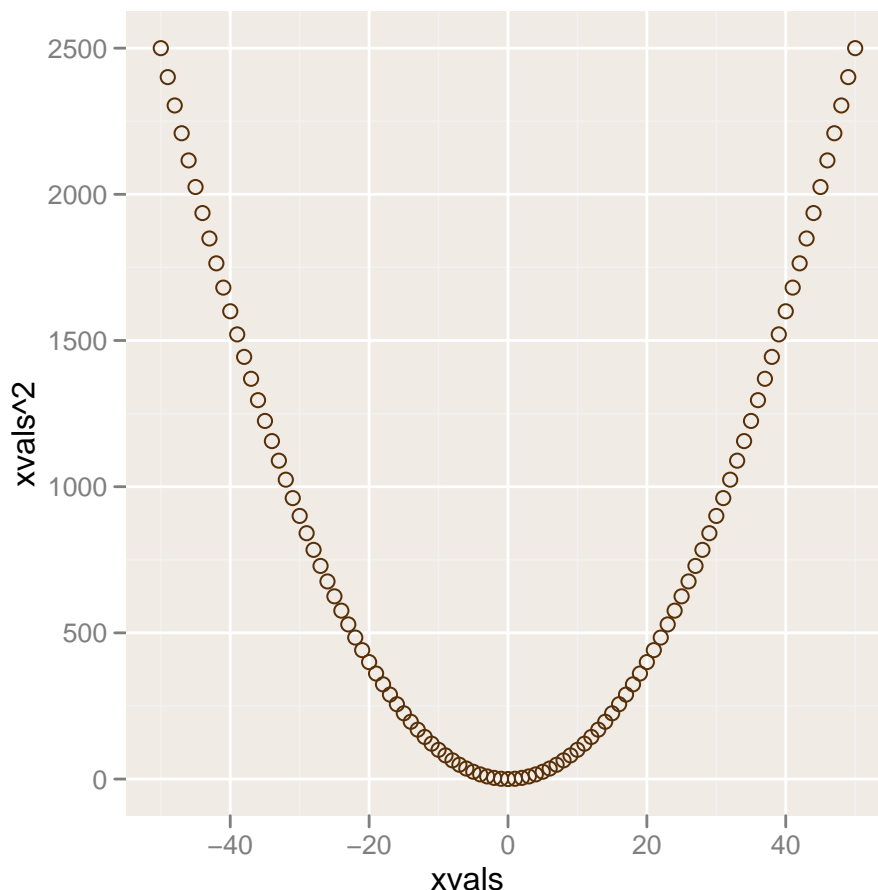


Figure 7: Basic graph with ggplot2

## 5 Graphics

*ggplot2* is an advanced graphing package for R. The “gg” stands for “grammar of graphics”. The idea is that you just need to learn a few basic graphing concepts (such as geoms, aesthetics, and scales) and then you can combine them in myriad ways to create great custom plots. There is lots of documentation for *ggplot2*; this paper just demonstrates the FAViR functions which include them into a paper.

Figure 7 is a simple graph made with *ggplot2*.

The size can be adjusted with the **height** and **width** parameters as shown in figure 8.

Figure 9 shows how you can easily put multiple graphs into different viewports with the **IncludeGrid** function. However, if the graphs all have comparable values in them, it’s probably better to use *ggplot2*’s powerful faceting functionality.

Our final feature demonstration is to automatically include some legal boilerplate in the



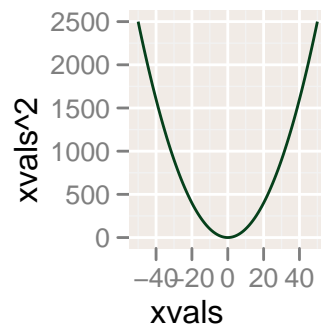


Figure 8: Smaller Graph

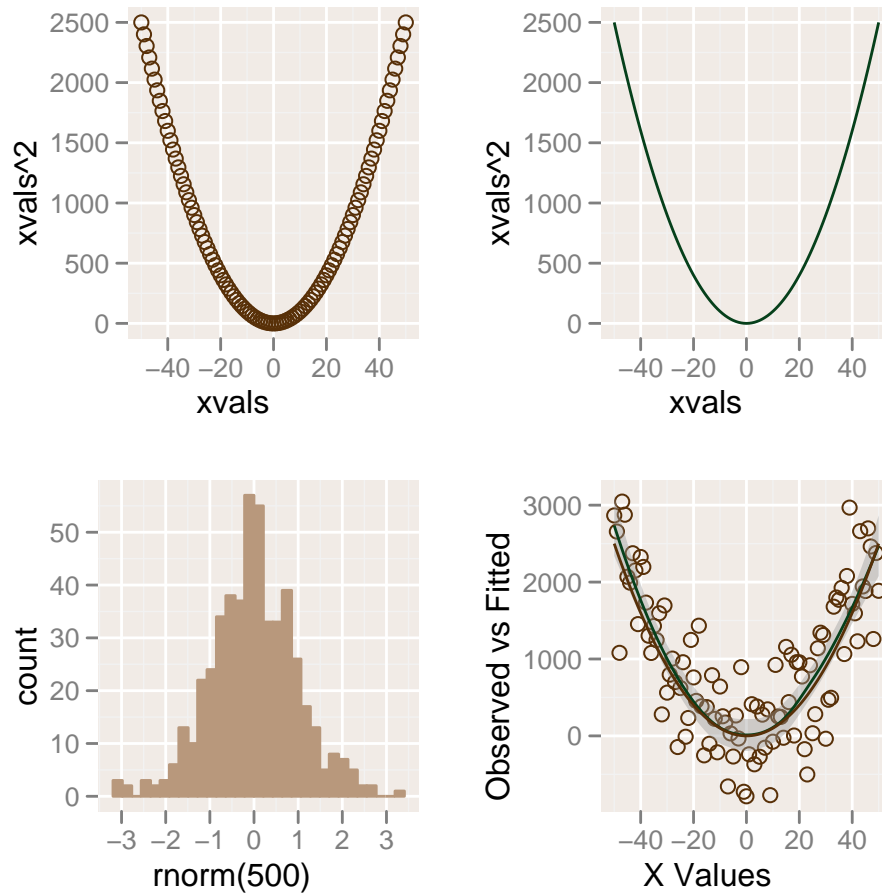


Figure 9: Four separate plots in one grid

next section.

## 6 Legal

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This paper is part of the FAViR project. All the R source code used to produce it is freely distributable under the GNU General Public License. See <http://www.favir.net> for more information on FAViR or to download the source code for this paper.

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