Creating plots in R using ggplot2 - part 1: line plots

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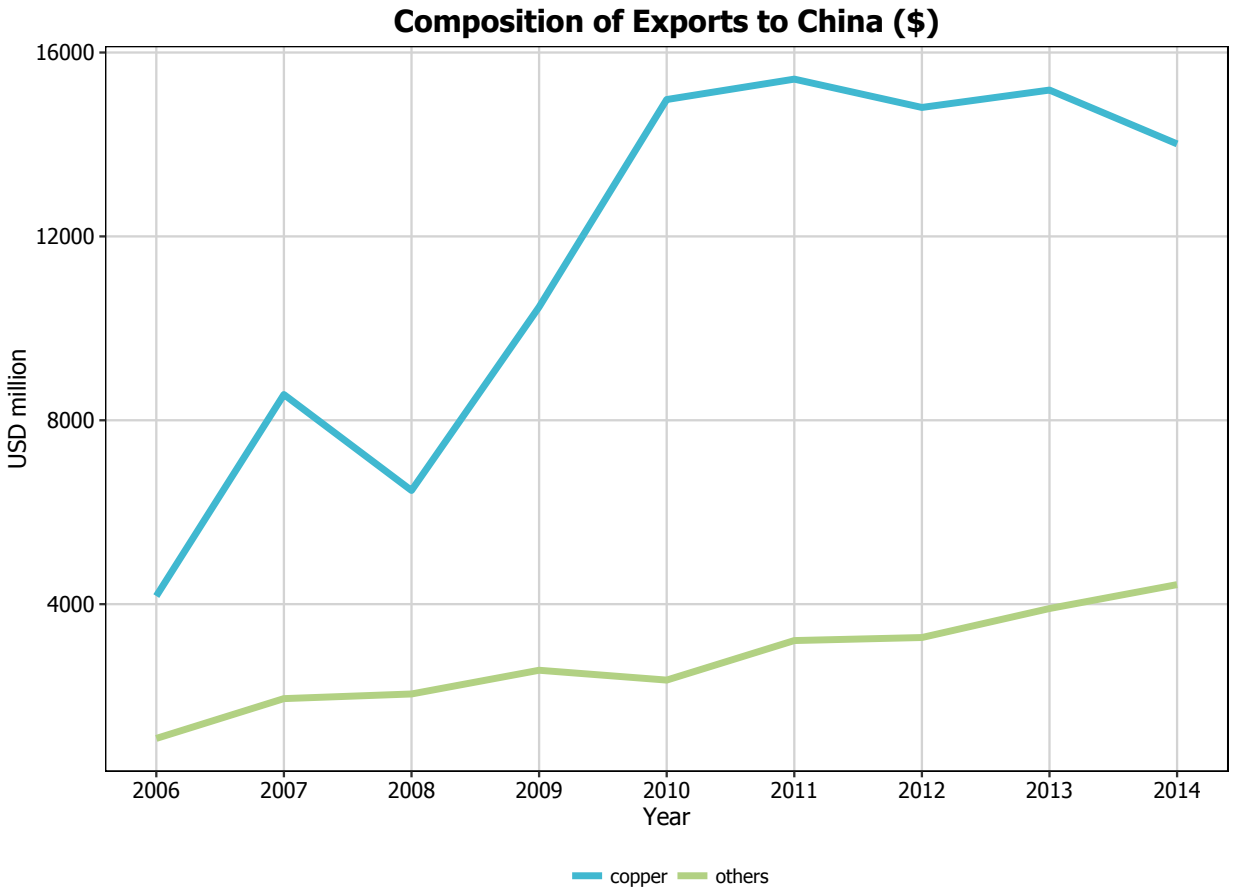
I recently teamed up with Mauricio Vargas Sepúlveda to create some graphing tutorials in R. In the coming weeks, we will be publishing a series of tutorials on how to use the `ggplot2` package to create beautiful and informative data visualisations. Each tutorial will explain how to create a different type of plot, and will take you step-by-step from a basic plot to a highly customised graph.

In this first tutorial, we will demonstrate some of the many options the `ggplot2` package has for creating and customising line plots. We will use an international trade dataset made by ourselves from different sources (Chile Customs, Central Bank of Chile and General Directorate of International Economic Relations).

The first thing to do is load in the data and libraries, as below:

```
library(ggplot2)
library(ggthemes)
library(extrafont)

charts.data <- read.csv("copper-data-for-tutorial.csv")
```

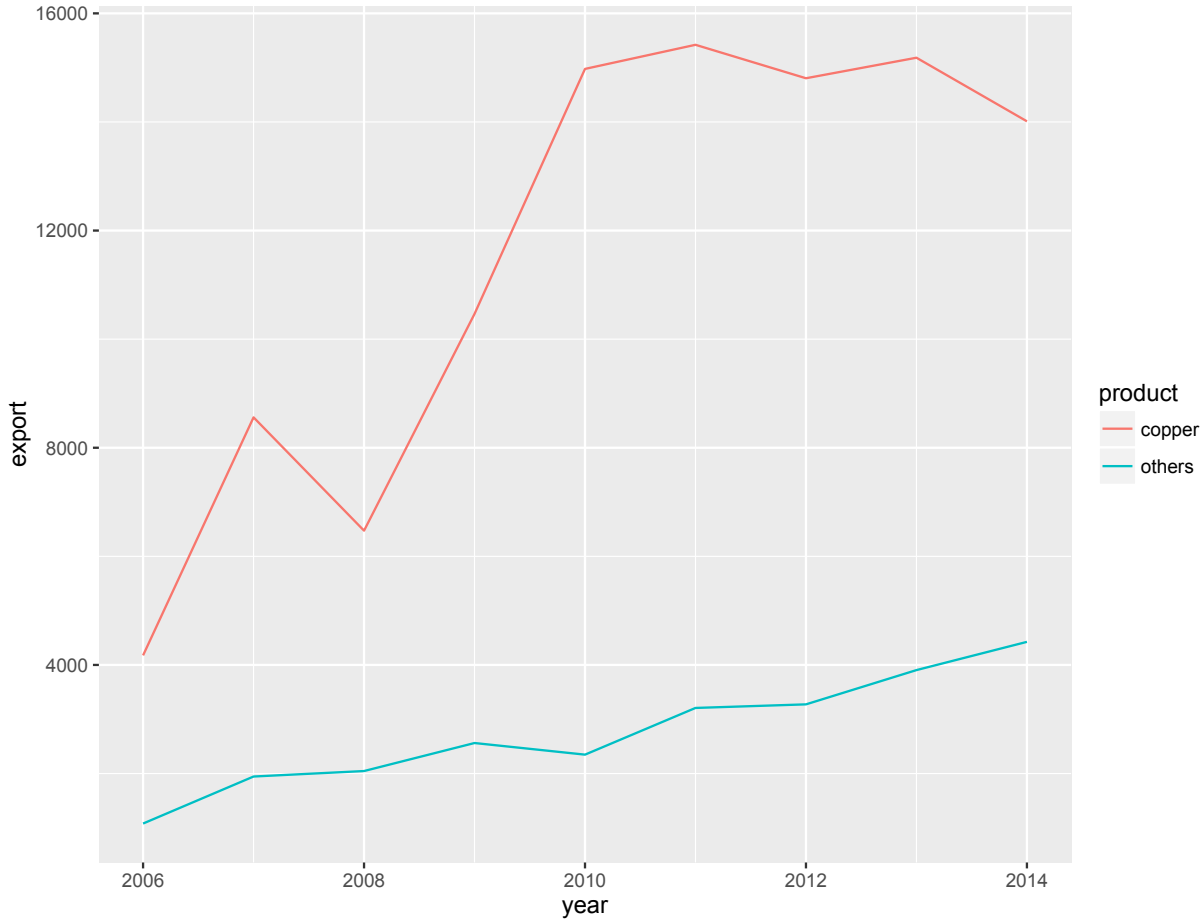
In this tutorial, we will work towards creating the line plot below. We will take you from a basic line plot and explain all the customisations we add to the code step-by-step.



Basic graph

In order to initialise a plot we tell ggplot that `charts.data` is our data, and specify the variables on each axis. We then instruct ggplot to render this as a line plot by adding the `geom_line` command.

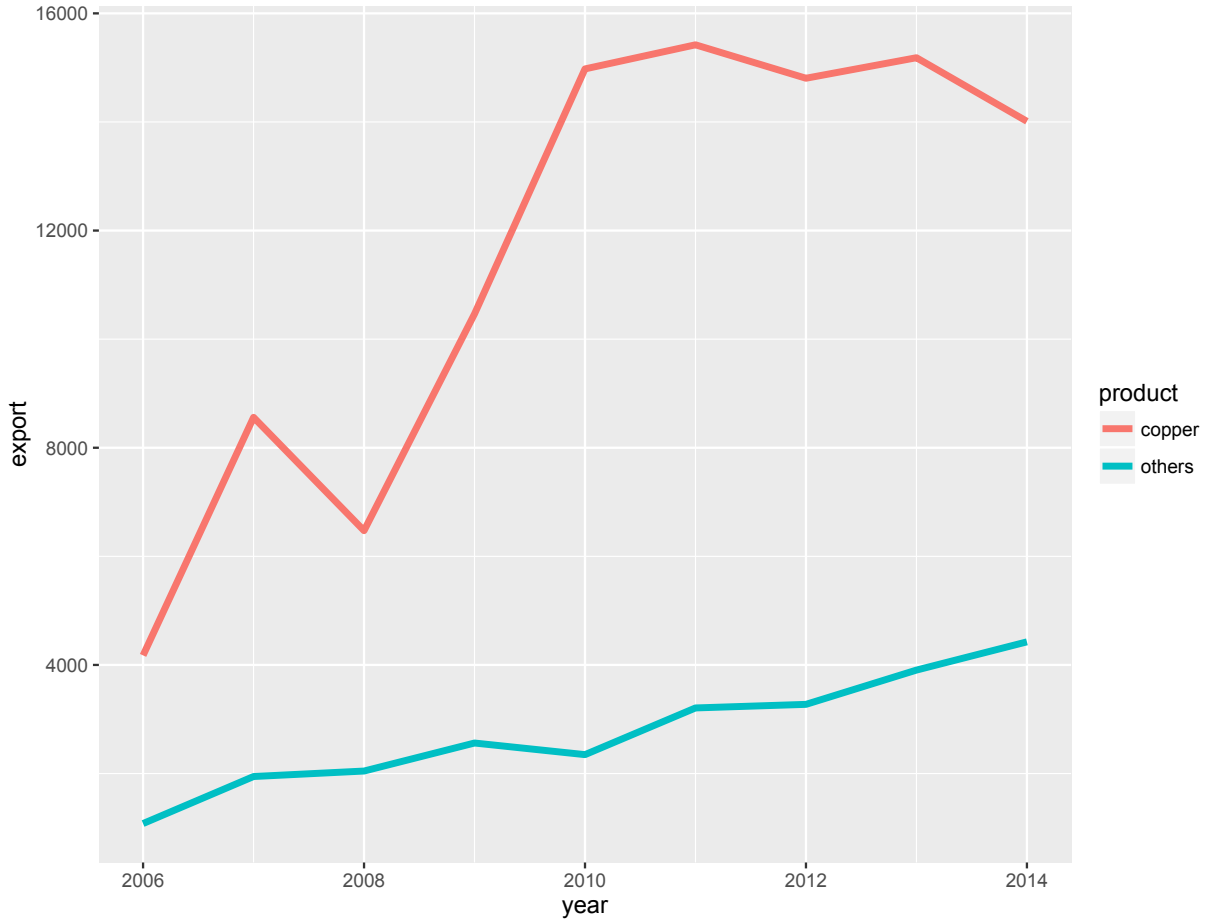
```
p1 <- ggplot() + geom_line(aes(y = export, x = year, colour = product),
                           data = charts.data, stat="identity")
p1
```



Adjusting line width

To change the line width, we add a `size` argument to `geom_line`.

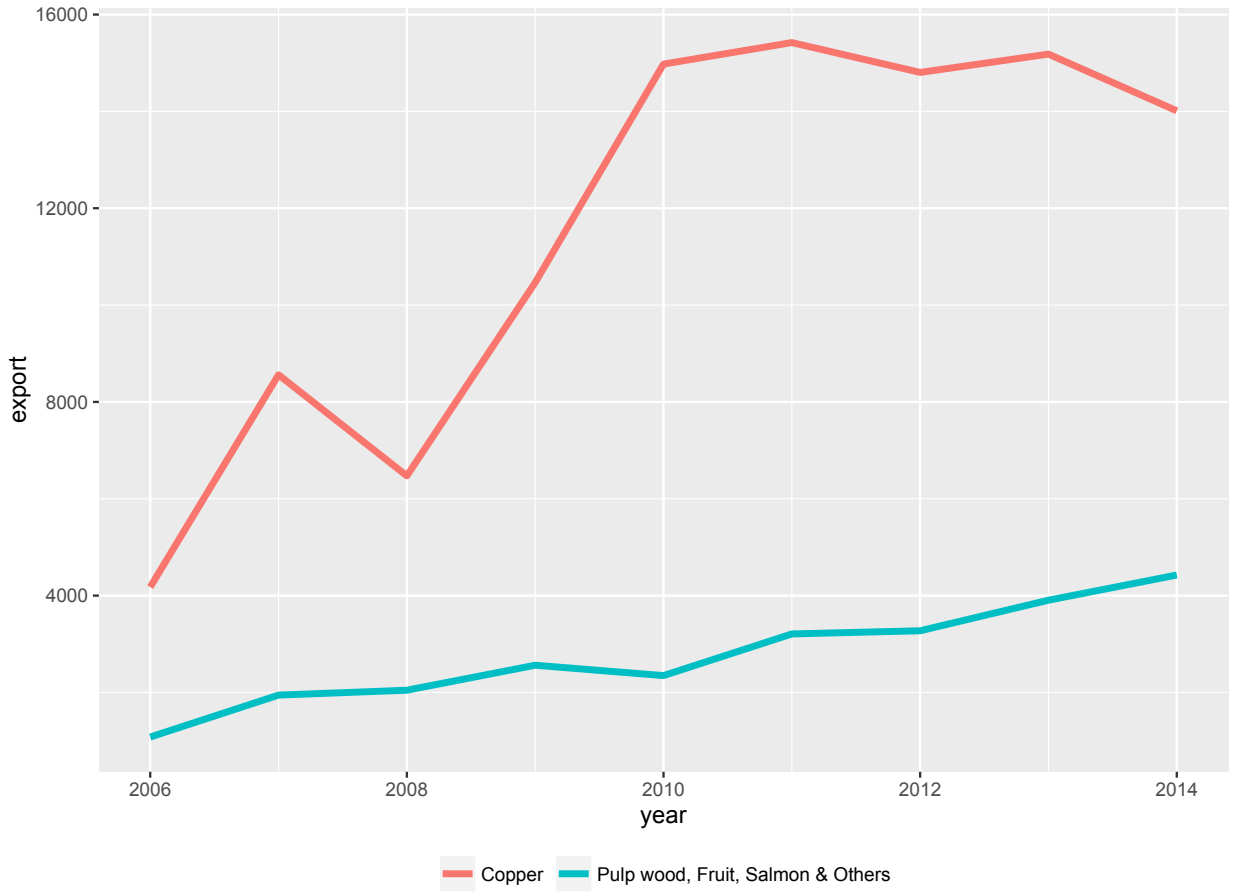
```
p1 <- ggplot() + geom_line(aes(y = export, x = year, colour = product), size=1.5,
                           data = charts.data, stat="identity")
p1
```



Changing variables display

To change the variables displayed name, we need to re-factor our data labels in `charts.data` data frame. Then we move the legend to the bottom using the `theme` command.

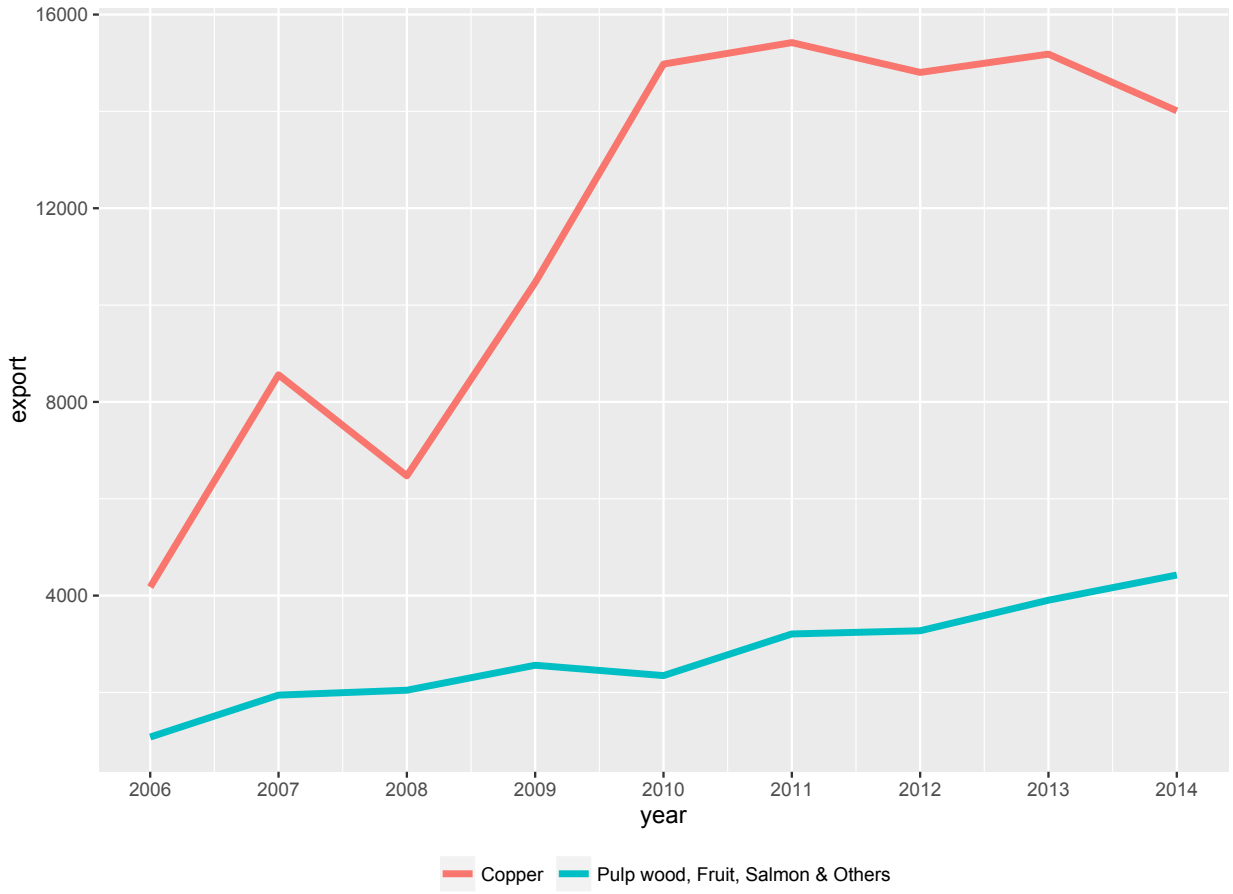
```
charts.data <- as.data.frame(charts.data)
charts.data$product <- factor(charts.data$product, levels = c("copper","others"),
                              labels = c("Copper ","Pulp wood, Fruit, Salmon & Others"))

p1 <- ggplot() +
  geom_line(aes(y = export, x = year, colour = product), size=1.5, data = charts.data,
            stat="identity") +
  theme(legend.position="bottom", legend.direction="horizontal",
        legend.title = element_blank())
p1
```



Adjusting x-axis scale

To change the axis tick marks, we use the `scale_x_continuous` and/or `scale_y_continuous` commands.

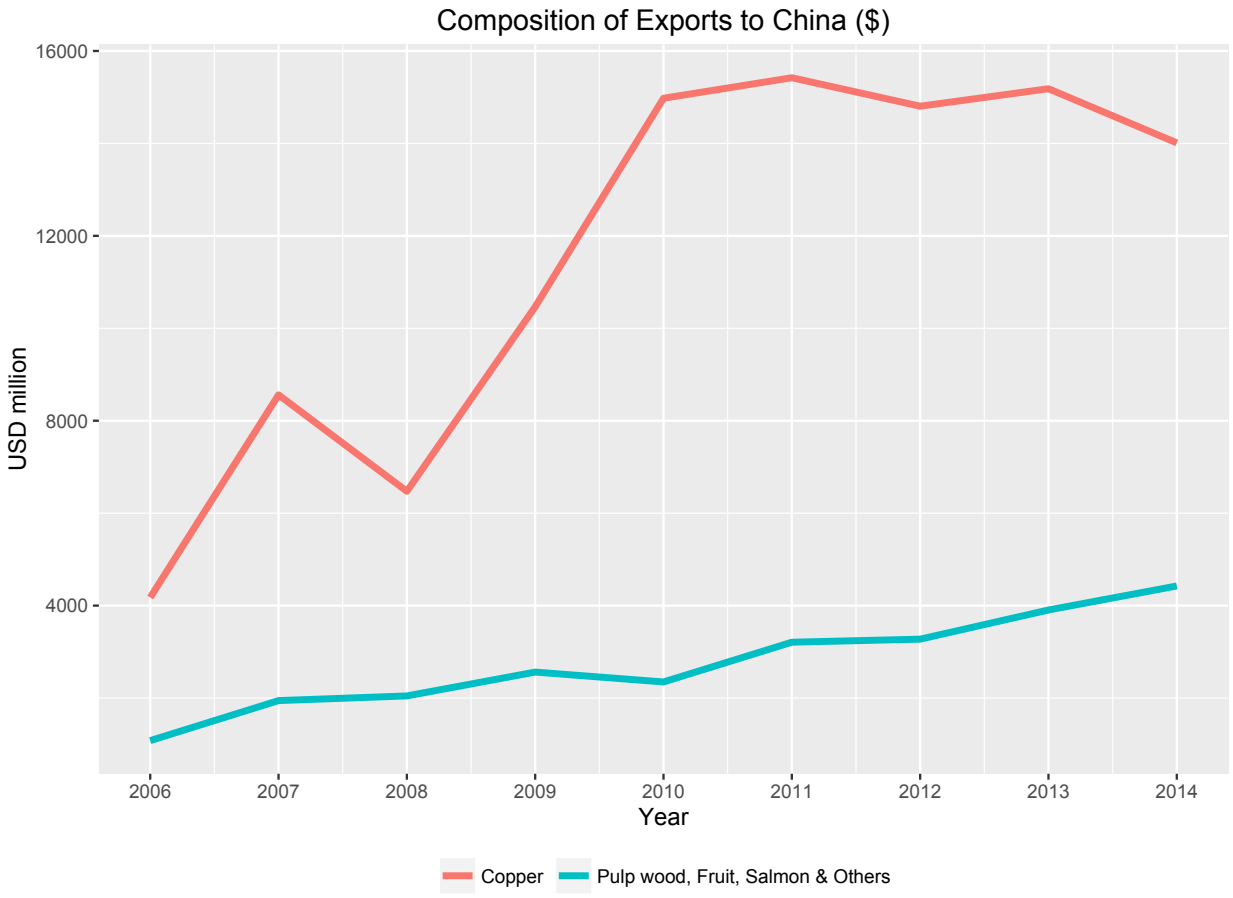
```
p1 <- p1 + scale_x_continuous(breaks=seq(2006,2014,1))
p1
```



Adjusting axis labels & adding title

To add a title, we include the option `ggtitle` and include the name of the graph as a string argument, and to change the axis names we use the `labs` command.

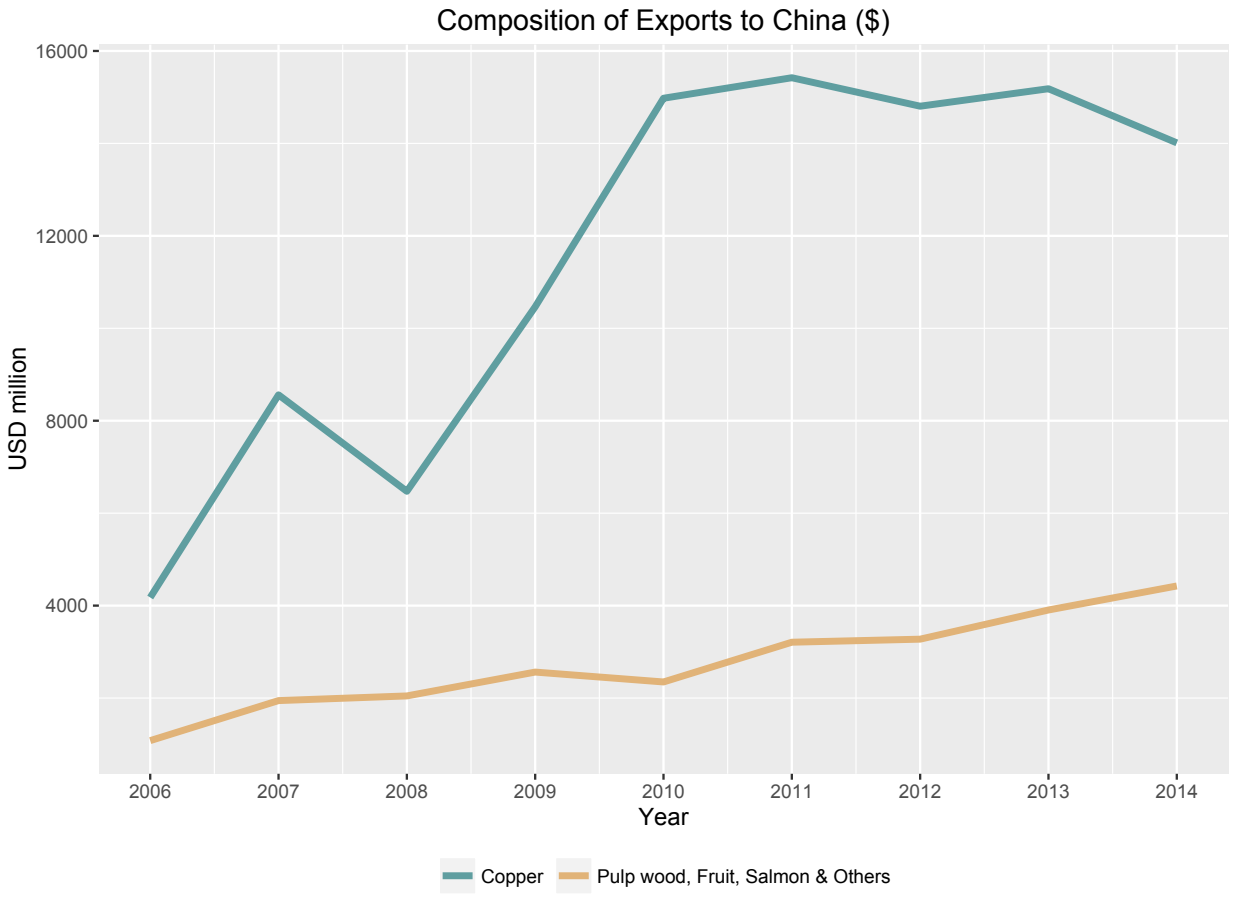
```
p1 <- p1 + ggtitle("Composition of Exports to China ($)") +
  labs(x="Year", y="USD million")
p1
```



Adjusting color palette

To change the colours, we use the `scale_colour_manual` command.

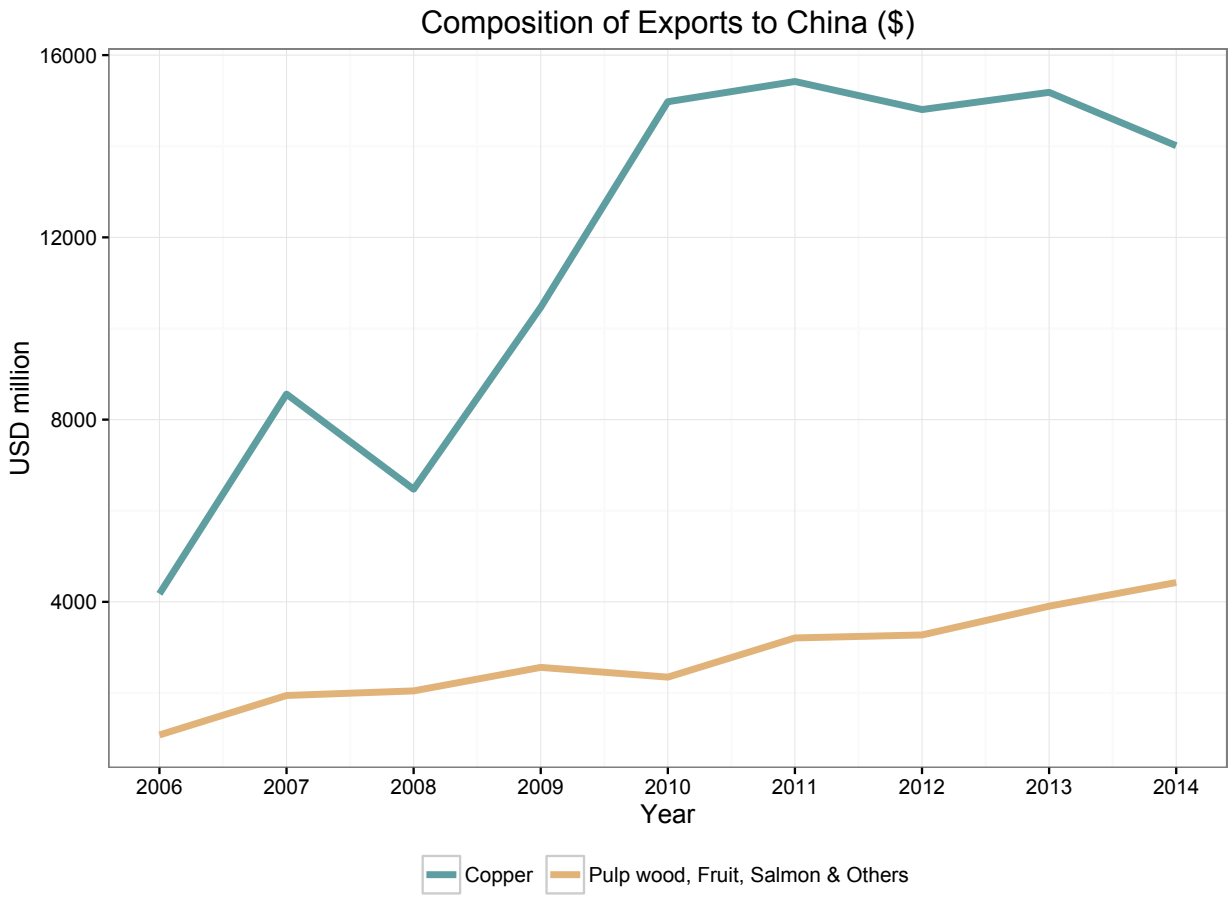
```
colour <- c("#5F9EA0", "#E1B378")
p1 <- p1 + scale_colour_manual(values=colour)
p1
```



Using the white theme

We'll start using a simple theme customisation made adding `theme_bw()` after `ggplot()`. That theme argument can be modified to use different themes.

```
p1 <- ggplot() +
  geom_line(aes(y = export, x = year, colour = product), size=1.5, data = charts.data,
            stat="identity") +
  scale_x_continuous(breaks=seq(2006,2014,1)) +
  labs(x="Year", y="USD million") +
  ggtitle("Composition of Exports to China ($)") +
  scale_colour_manual(values=colour) +
  theme_bw() +
  theme(legend.position="bottom",
        legend.direction="horizontal",
        legend.title = element_blank())
p1
```



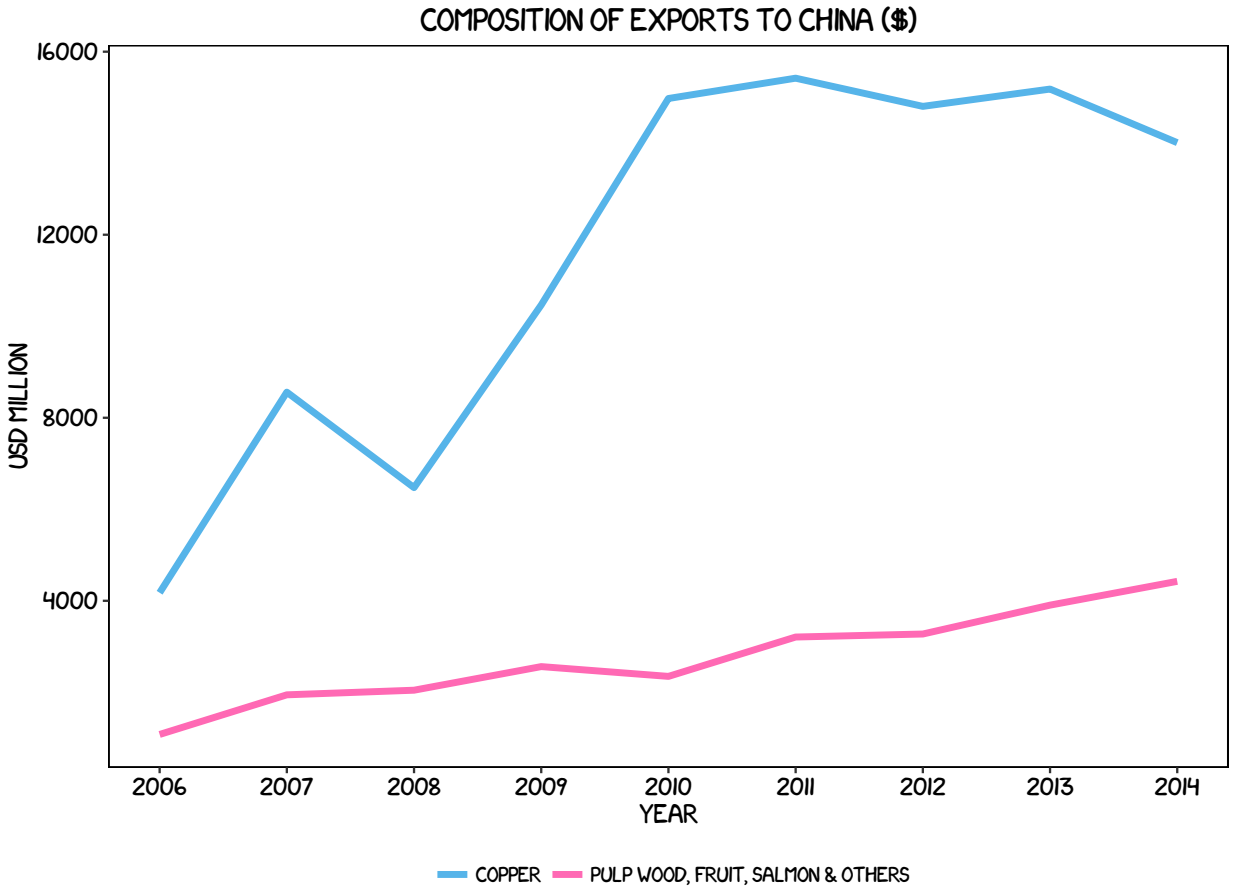
Creating an XKCD style chart

Of course, you may want to create your own themes as well. `ggplot2` allows for a very high degree of customisation, including allowing you to use imported fonts. Below is an example of a theme Mauricio was able to create which mimics the visual style of XKCD. In order to create this chart, you first need to import the XKCD font, install it on your machine and load it into R using the `extrafont` package. These instructions are taken from here:

```
library(extrafont)

download.file("http://simonsoftware.se/other/xkcd.ttf",
              dest="xkcd.ttf", mode="wb")
system("mkdir ~/.fonts")
system("cp xkcd.ttf  ~/.fonts")
font_import(paths = "~/.fonts", pattern="[X/x]kcd")
fonts()
loadfonts()
```

You can then create your graph:

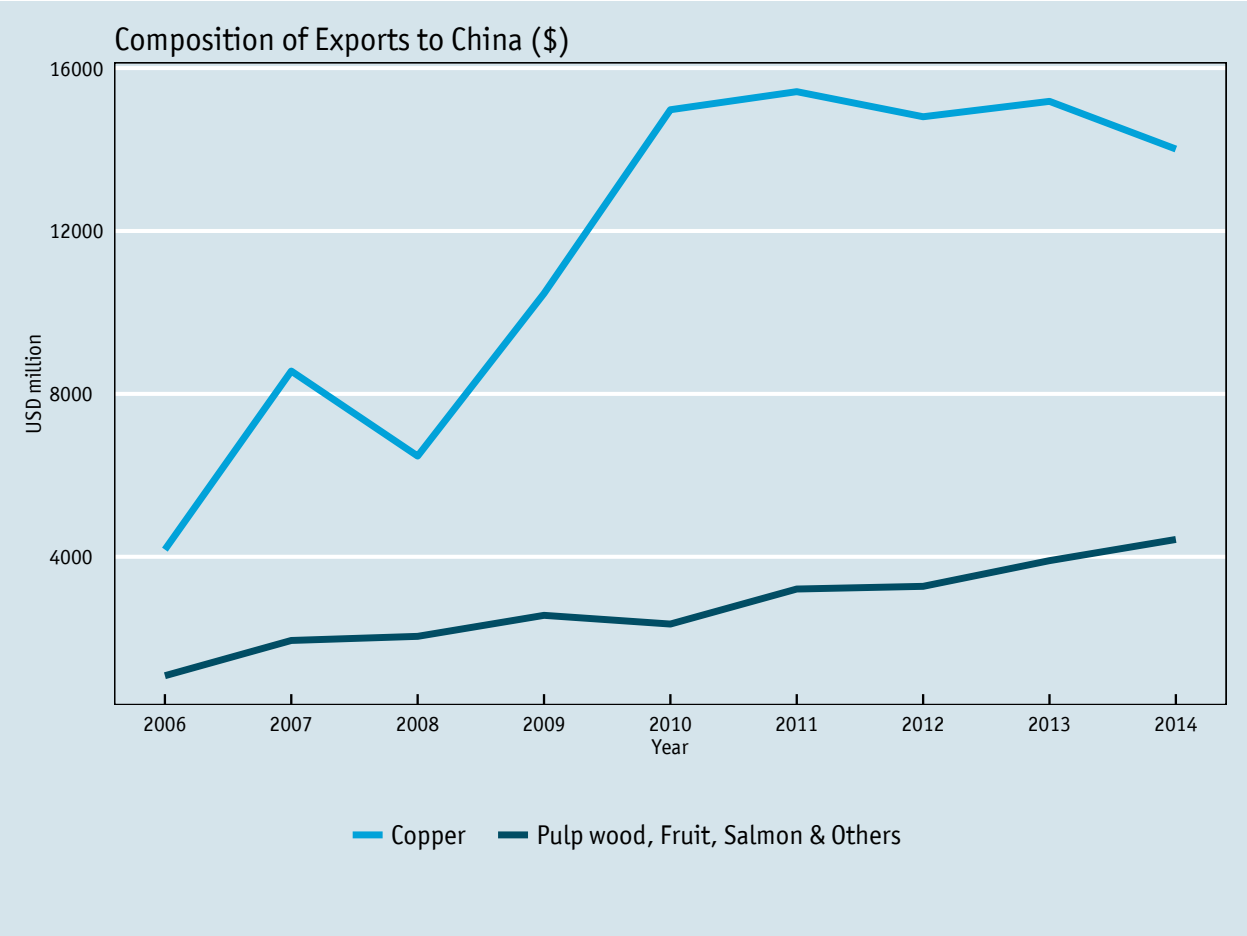
```
fill <- c("#56B4E9", "#ff69b4")

p1 <- ggplot() +
  geom_line(aes(y = export, x = year, colour = product), size=1.5, data = charts.data,
            stat="identity") +
  scale_x_continuous(breaks=seq(2006,2014,1)) +
  labs(x="Year", y="USD million") +
  ggtitle("Composition of Exports to China ($)") +
  scale_color_manual(values=fill) +
  theme(axis.text.x=element_text(colour="black", size = 10),
        axis.text.y=element_text(colour="black", size = 10),
        panel.border = element_rect(colour = "black", fill=NA, size=.5),
        legend.key=element_rect(fill="white", colour="white"),
        legend.position="bottom", legend.direction="horizontal",
        legend.title = element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(), panel.border = element_blank(),
        panel.background = element_blank(),
        plot.title=element_text(family="xkcd-Regular"),
        text=element_text(family="xkcd-Regular"))
p1
```



Using 'The Economist' theme

There are a wider range of pre-built themes available as part of the `ggthemes` package (more information on these here). Below we've applied `theme_economist()`, which approximates graphs in the Economist magazine. It is also important that the font change argument inside `theme` is optional and it's only to obtain a more similar result compared to the original. For an exact result you need 'Officina Sans' which is a commercial font and is available here.

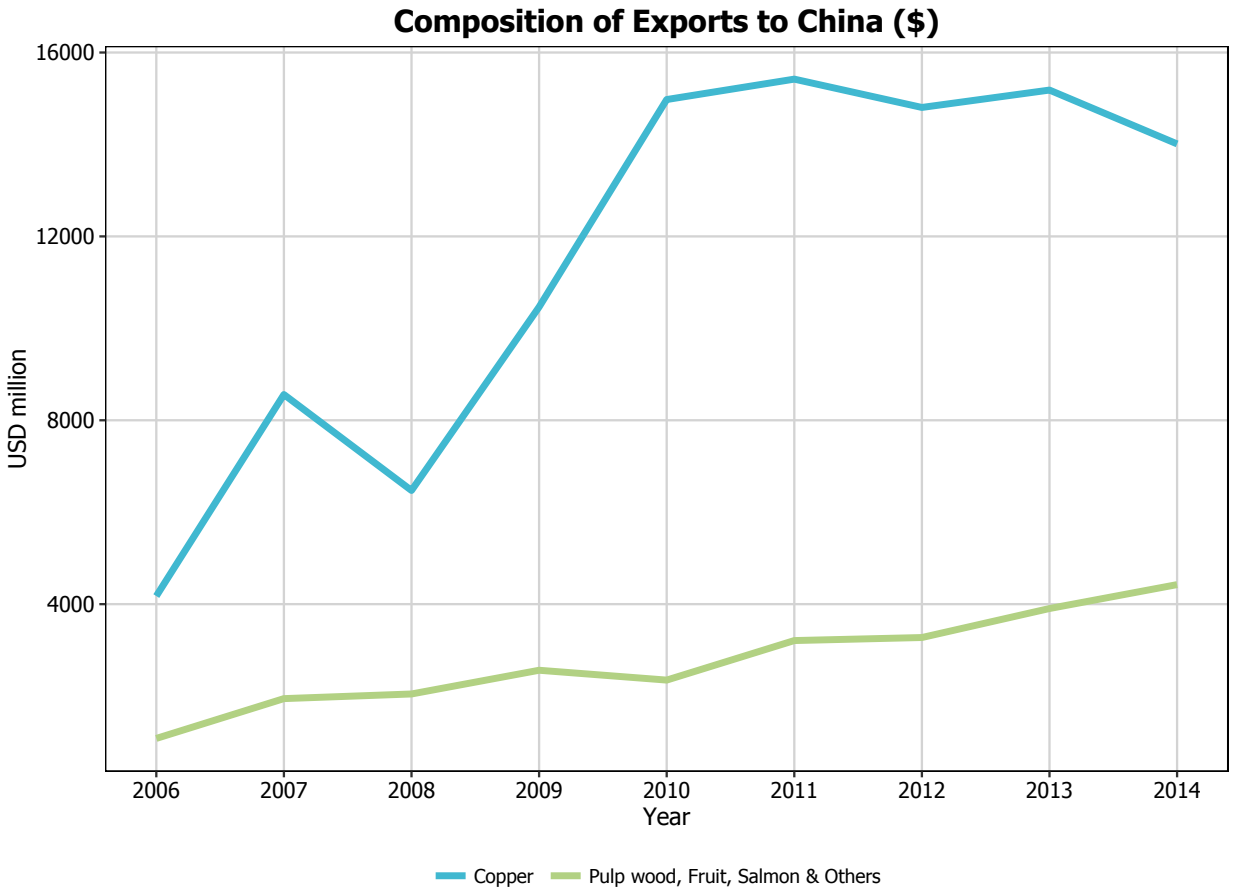
```
p1 <- ggplot() +
  geom_line(aes(y = export, x = year, colour = product), size=1.5, data = charts.data,
            stat="identity") +
  scale_x_continuous(breaks=seq(2006,2014,1)) +
  labs(x="Year", y="USD million") +
  ggtitle("Composition of Exports to China ($)") +
  theme_economist() + scale_colour_economist() +
  theme(panel.border = element_rect(colour = "black", fill=NA, size=.5),
        legend.position="bottom",
        legend.direction="horizontal",
        legend.title = element_blank(),
        plot.title=element_text(family="OfficinaSanITC-Book"),
        text=element_text(family="OfficinaSanITC-Book"))
p1
```



Creating your own theme

As before, you can modify your plots a lot as `ggplot2` allows many customisations. Here we present our original result shown at the top of page.

```
colour <- c("#40b8d0", "#b2d183")

p1 <- ggplot() +
  geom_line(aes(y = export, x = year, colour = product), size=1.5, data = charts.data,
            stat="identity") +
  scale_x_continuous(breaks=seq(2006,2014,1)) +
  labs(x="Year", y="USD million") +
  ggtitle("Composition of Exports to China ($)") +
  scale_colour_manual(values=colour) +
  theme(panel.border = element_rect(colour = "black", fill=NA, size=.5),
        axis.text.x=element_text(colour="black", size = 10),
        axis.text.y=element_text(colour="black", size = 10),
        legend.key=element_rect(fill="white", colour="white"),
        legend.position="bottom", legend.direction="horizontal",
        legend.title = element_blank(),
        panel.grid.major = element_line(colour = "#d3d3d3"),
        panel.grid.minor = element_blank(),
        panel.border = element_blank(),
        panel.background = element_blank(),
        plot.title = element_text(size = 14, family = "Tahoma", face = "bold"),
        text=element_text(family="Tahoma"))
p1
```


Composition of Exports to China ($)
16000
12000
8000
4000
USD million
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year
Copper
Pulp wood, Fruit, Salmon & Others