Visualizing Inequalities in Life Expectancy

Datacamp Project Solution

03 jul, 2021

1 United Nations life expectancy data

Life expectancy at birth is a measure of the average a living being is expected to live. It takes into account several demographic factors like gender, country, or year of birth.

Life expectancy at birth can vary along time or between countries because of many causes: the evolution of medicine, the degree of development of countries, or the effect of armed conflicts. Life expectancy varies between gender, as well. The data shows that women live longer that men. Why? Several potential factors, including biological reasons and the theory that women tend to be more health conscious.

Let's create some plots to explore the inequalities about life expectancy at birth around the world. We will use a dataset from the United Nations Statistics Division, which is available here.

```
# Loading packages
library(dplyr)
library(tidyr)
library(ggplot2)
```

```
# Loading data
life_expectancy <- tibble(read.csv("datasets/UNdata.csv"))

# Taking a look at the first few rows
head(life_expectancy)
```

```
## # A tibble: 6 x 7
##   Country.or.Area Subgroup Year   Source             Unit  Value Value.Footnotes
##   <chr>           <chr>    <chr>  <chr>              <chr> <int>           <int>
## 1 Afghanistan     Female   2000-~ UNPD_World Popula~ Years    42              NA
## 2 Afghanistan     Female   1995-~ UNPD_World Popula~ Years    42              NA
## 3 Afghanistan     Female   1990-~ UNPD_World Popula~ Years    42              NA
## 4 Afghanistan     Female   1985-~ UNPD_World Popula~ Years    41              NA
## 5 Afghanistan     Male     2000-~ UNPD_World Popula~ Years    42              NA
## 6 Afghanistan     Male     1995-~ UNPD_World Popula~ Years    42              NA
```

2 Life expectancy of men vs. women by country

Let's manipulate the data to make our exploration easier. We will build the dataset for our first plot in which we will represent the average life expectancy of men and women across countries for the last period recorded in our data (2000-2005).

```
# Subsetting and reshaping the life expectancy data
subdata <- life_expectancy  %>%
  filter(Year == "2000-2005") %>%
  select(Country.or.Area, Subgroup, Value) %>%
  pivot_wider(names_from = Subgroup, values_from = Value)
```

```
# Taking a look at the first few rows
head(subdata)
```

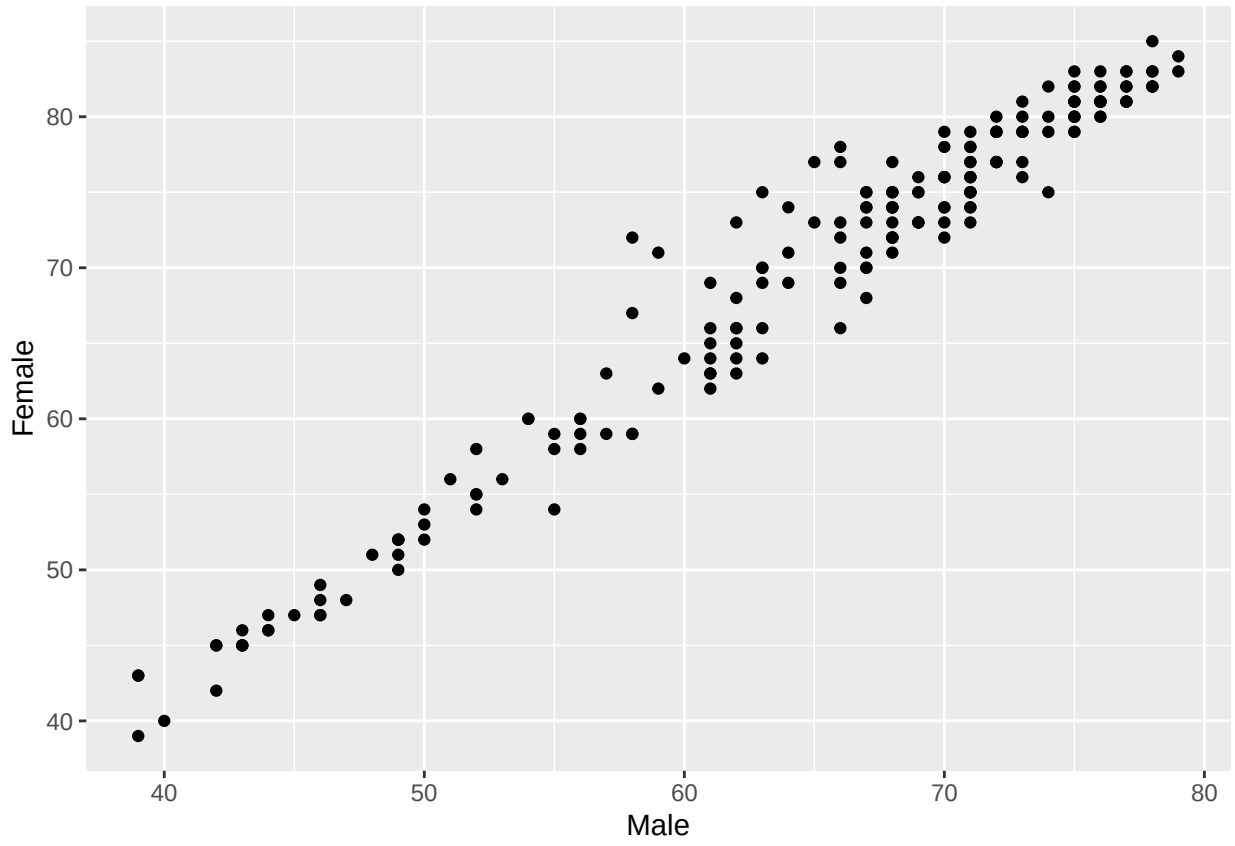
```
## # A tibble: 6 x 3
##   Country.or.Area Female  Male
##   <chr>            <int> <int>
## 1 Afghanistan         42    42
## 2 Albania             79    73
## 3 Algeria             72    70
## 4 Angola              43    39
## 5 Argentina           78    71
## 6 Armenia             75    68
```

3 Visualize I

A scatter plot is a useful way to visualize the relationship between two variables. It is a simple plot in which points are arranged on two axes, each of which represents one of those variables.

Let's create a scatter plot using ggplot2 to represent life expectancy of males (on the x-axis) against females (on the y-axis). We will create a straightforward plot in this task, without many details. We will take care of these kinds of things shortly.

```
# Plotting male and female life expectancy
ggplot(subdata) +
  aes(x = Male, y = Female) +
  geom_point()
```



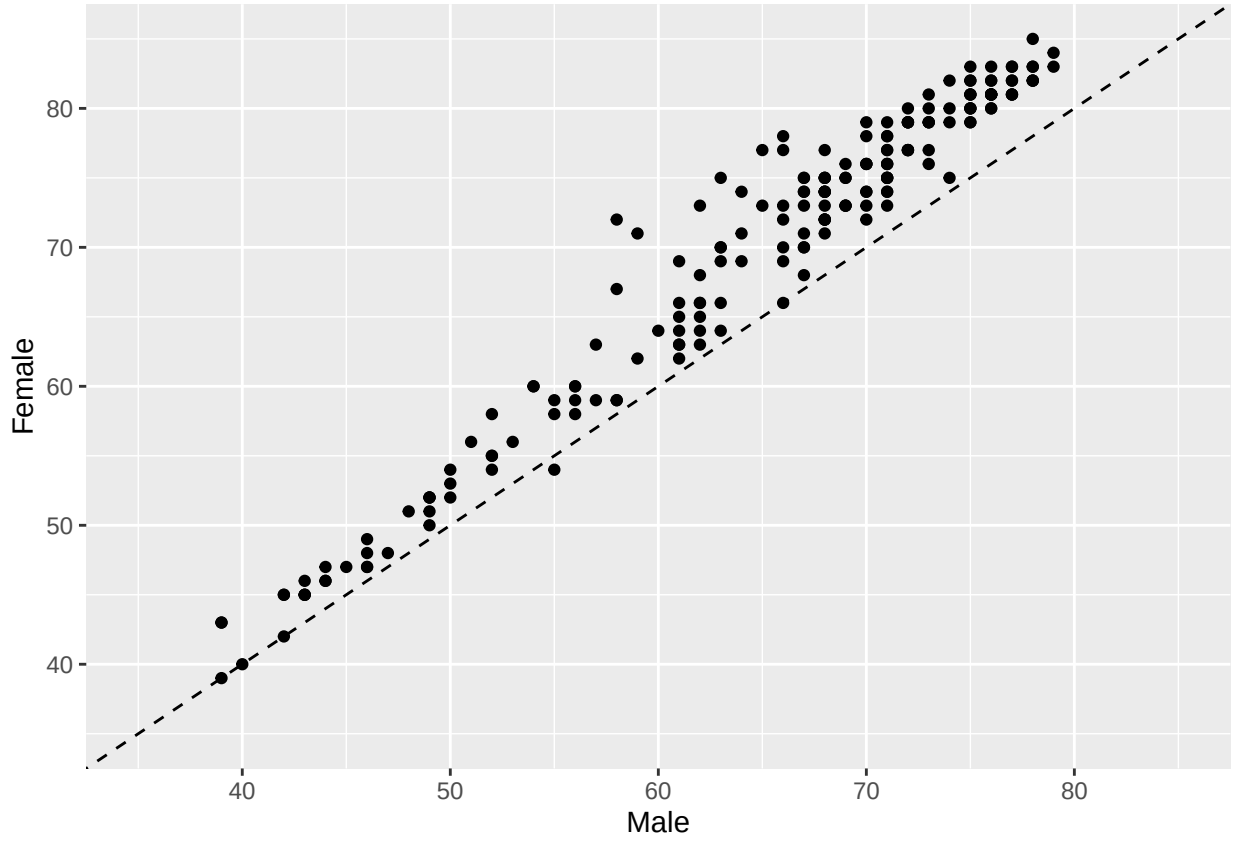
4 Reference lines I

A good plot must be easy to understand. There are many tools in ggplot2 to achieve this goal and we will explore some of them now. Starting from the previous plot, let's set the same limits for both axes as well as place a diagonal line for reference. After doing this, the difference between men and women across countries will be easier to interpret.

After completing this task, we will see how most of the points are arranged above the diagonal and how there is a significant dispersion among them. What does this all mean?

```
# Adding an abline and changing the scale of axes of the previous plots

ggplot(subdata) +
  aes(x = Male, y = Female) +
  geom_point() +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(limits = c(35, 85)) +
  scale_y_continuous(limits = c(35, 85))
```

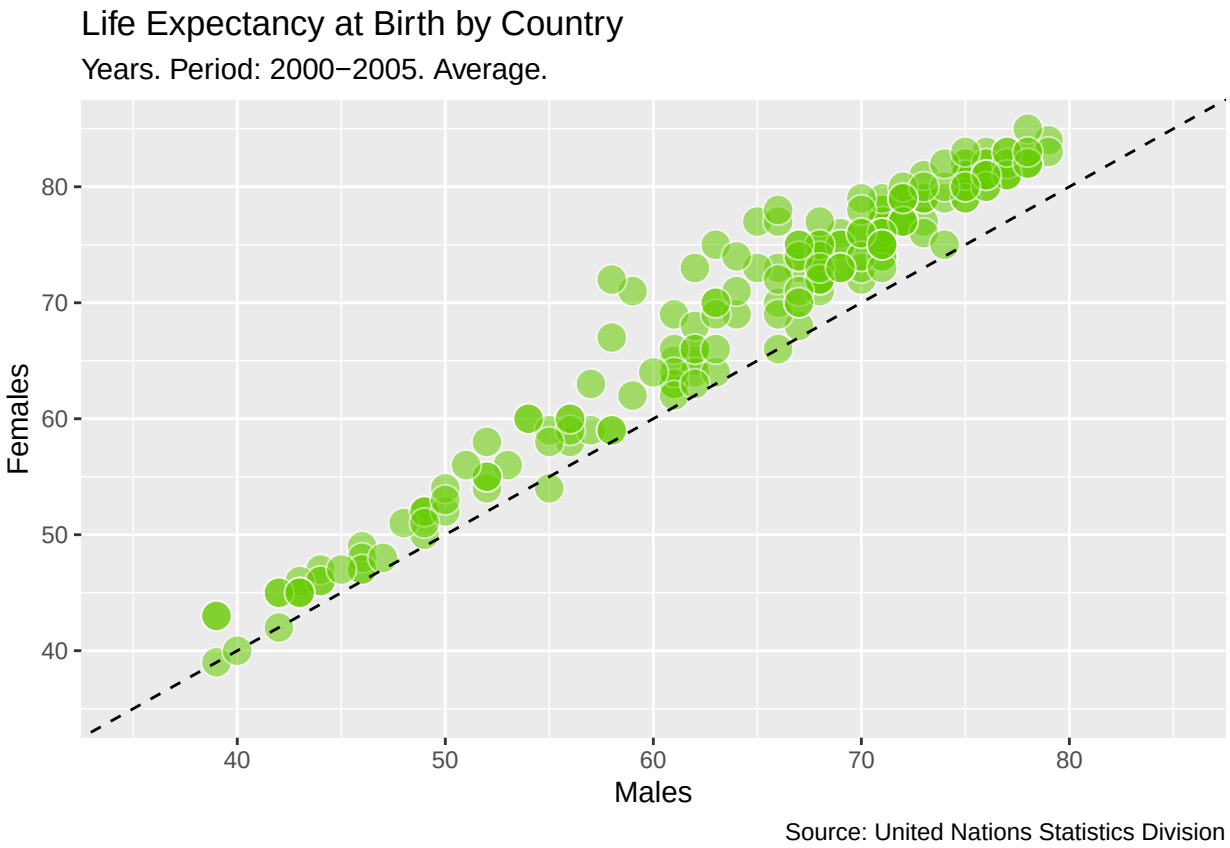


5 Plot titles and axis labels

A key point to make a plot understandable is placing clear labels on it. Let's add titles, axis labels, and a caption to refer to the source of data. Let's also change the appearance to make it clearer.

```
# Adding labels to previous plot
ggplot(subdata) +
  aes(x = Male, y = Female) +
```

```
geom_point(
  colour = "white",
  fill = "chartreuse3",
  shape = 21,
  alpha = .55,
  size = 5
) +
geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
scale_x_continuous(limits = c(35, 85)) +
scale_y_continuous(limits = c(35, 85)) +
labs(
  title = "Life Expectancy at Birth by Country",
  subtitle = "Years. Period: 2000-2005. Average.",
  caption = "Source: United Nations Statistics Division",
  x = "Males",
  y = "Females"
)
```



6 Highlighting remarkable countries I

Now, we will label some points of our plot with the name of its corresponding country. We want to draw attention to some special countries where the gap in life expectancy between men and women is significantly high. These will be the final touches on this first plot.

```r
# Subseting data to obtain countries of interest
top_male <- subdata %>%
  arrange(Male - Female) %>%
  head(3)

top_male
```

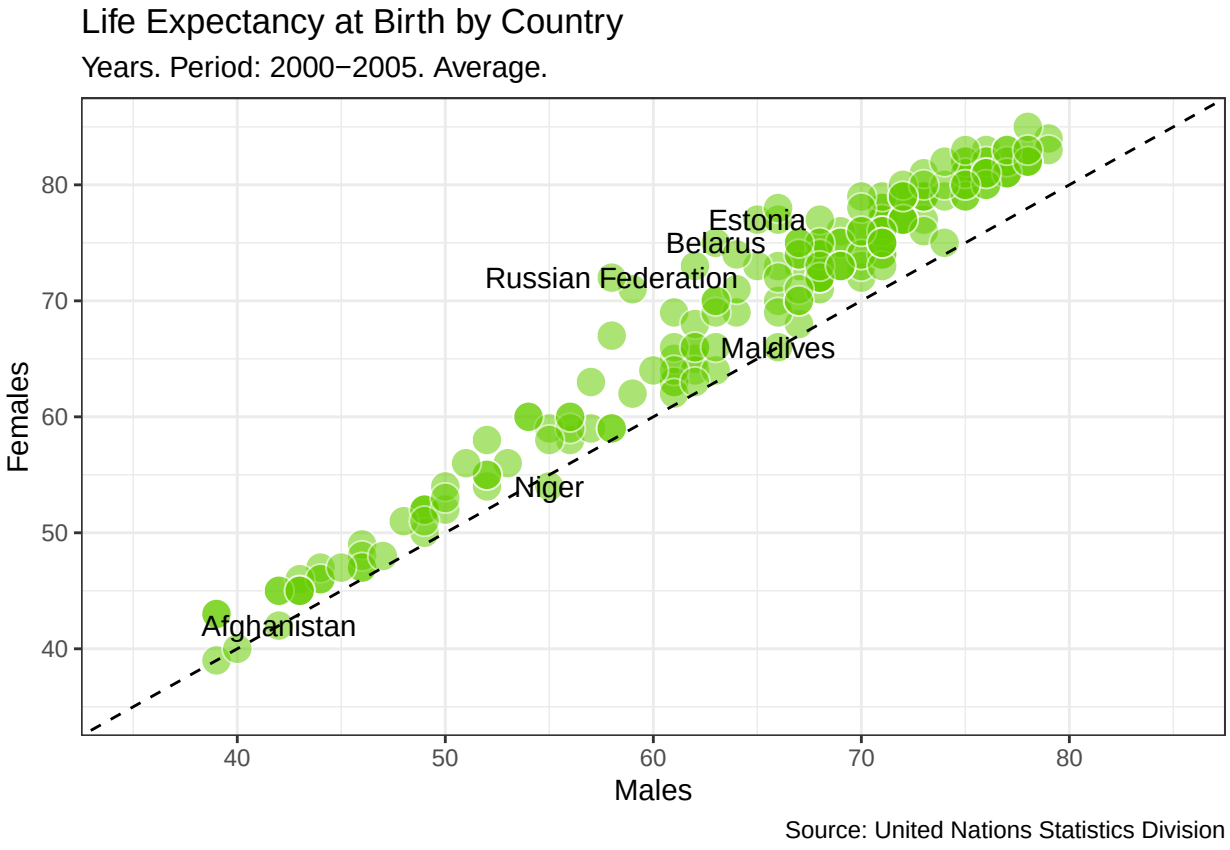
```
## # A tibble: 3 x 3
##   Country.or.Area    Female  Male
##   <chr>               <int> <int>
## 1 Russian Federation     72    58
## 2 Belarus                75    63
## 3 Estonia                77    65
```

```r
top_female <- subdata %>%
  arrange(Female - Male) %>%
  head(3)

top_female
```

```
## # A tibble: 3 x 3
##   Country.or.Area Female  Male
##   <chr>            <int> <int>
## 1 Niger               54    55
## 2 Afghanistan         42    42
## 3 Maldives            66    66
```

```r
# Adding text to the previous plot to label countries of interest
ggplot(subdata) +
  aes(x = Male, y = Female, label = Country.or.Area) +
  geom_point(
    colour = "white",
    fill = "chartreuse3",
    shape = 21,
    alpha = .55,
    size = 5
  ) +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(limits = c(35,85)) +
  scale_y_continuous(limits = c(35,85)) +
  labs(
    title = "Life Expectancy at Birth by Country",
    subtitle = "Years. Period: 2000-2005. Average.",
    caption = "Source: United Nations Statistics Division",
    x = "Males",
    y = "Females"
  ) +
  geom_text(top_male, mapping = aes(label = Country.or.Area)) +
  geom_text(top_female, mapping = aes(label = Country.or.Area)) +
  theme_bw()
```



7 How has life expectancy by gender evolved?

Since our data contains historical information, let's see now how life expectancy has evolved in recent years. Our second plot will represent the difference between men and women across countries between two periods: 2000-2005 and 1985-1990.

Let's start building a dataset called subdata2 for our second plot.

```
# Subsetting, mutating and reshaping the life expectancy data
subdata2 <- life_expectancy %>%
  filter(Year %in% c("1985-1990", "2000-2005")) %>%
  mutate(Sub_Year = paste(Subgroup, Year, sep = "_")) %>%
  mutate(Sub_Year = gsub("-", "_", Sub_Year)) %>%
  select(-Subgroup, -Year) %>%
  pivot_wider(names_from = Sub_Year, values_from = Value) %>%
  mutate(
    diff_Female = Female_2000_2005 - Female_1985_1990,
    diff_Male = Male_2000_2005 - Male_1985_1990
  )

# Taking a look at the first few rows
head(subdata2)
```

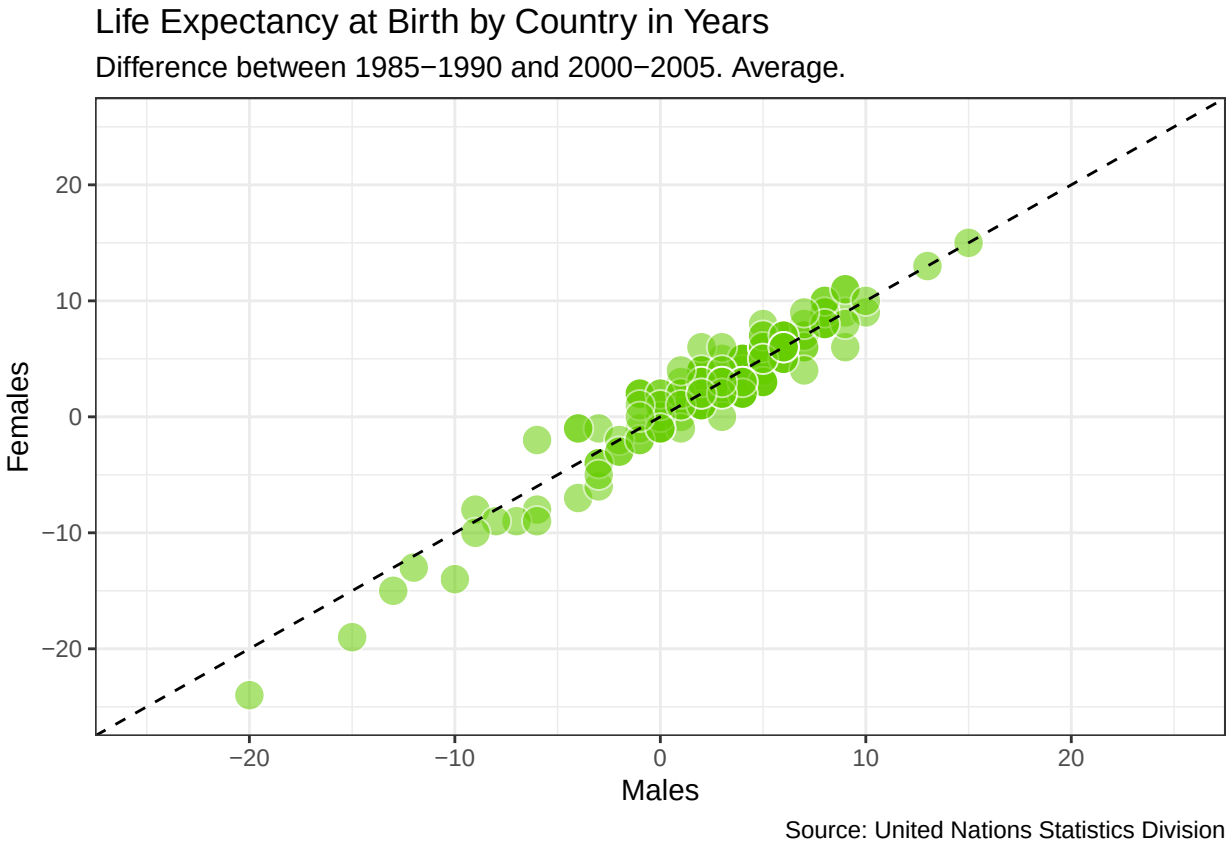
```
## # A tibble: 6 x 10
##   Country.or.Area Source Unit  Value.Footnotes Female_2000_2005 Female_1985_1990
##   <chr>           <chr>  <chr>           <int>            <int>            <int>
## 1 Afghanistan     UNPD_~ Years              NA               42               41
```

```
## 2 Albania         UNPD_~ Years              NA               79               75
## 3 Algeria         UNPD_~ Years              NA               72               67
## 4 Angola          UNPD_~ Years              NA               43               42
## 5 Argentina       UNPD_~ Years              NA               78               75
## 6 Armenia         UNPD_~ Years              NA               75               71
## # ... with 4 more variables: Male_2000_2005 <int>, Male_1985_1990 <int>,
## #   diff_Female <int>, diff_Male <int>
```

8 Visualize II

Now let's create our second plot in which we will represent average life expectancy differences between "1985-1990" and "2000-2005" for men and women.

```
# Doing a nice first version of the plot with abline, scaling axis and adding labels
ggplot(subdata2) +
  aes(x = diff_Male, y = diff_Female, label = Country.or.Area) +
  geom_point(
    colour = "white",
    fill = "chartreuse3",
    shape = 21,
    alpha = .55,
    size = 5
  ) +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(limits = c(-25, 25)) +
  scale_y_continuous(limits = c(-25, 25)) +
  labs(
    title = "Life Expectancy at Birth by Country in Years",
    subtitle = "Difference between 1985-1990 and 2000-2005. Average.",
    caption = "Source: United Nations Statistics Division",
    x = "Males",
    y = "Females"
  ) +
  theme_bw()
```

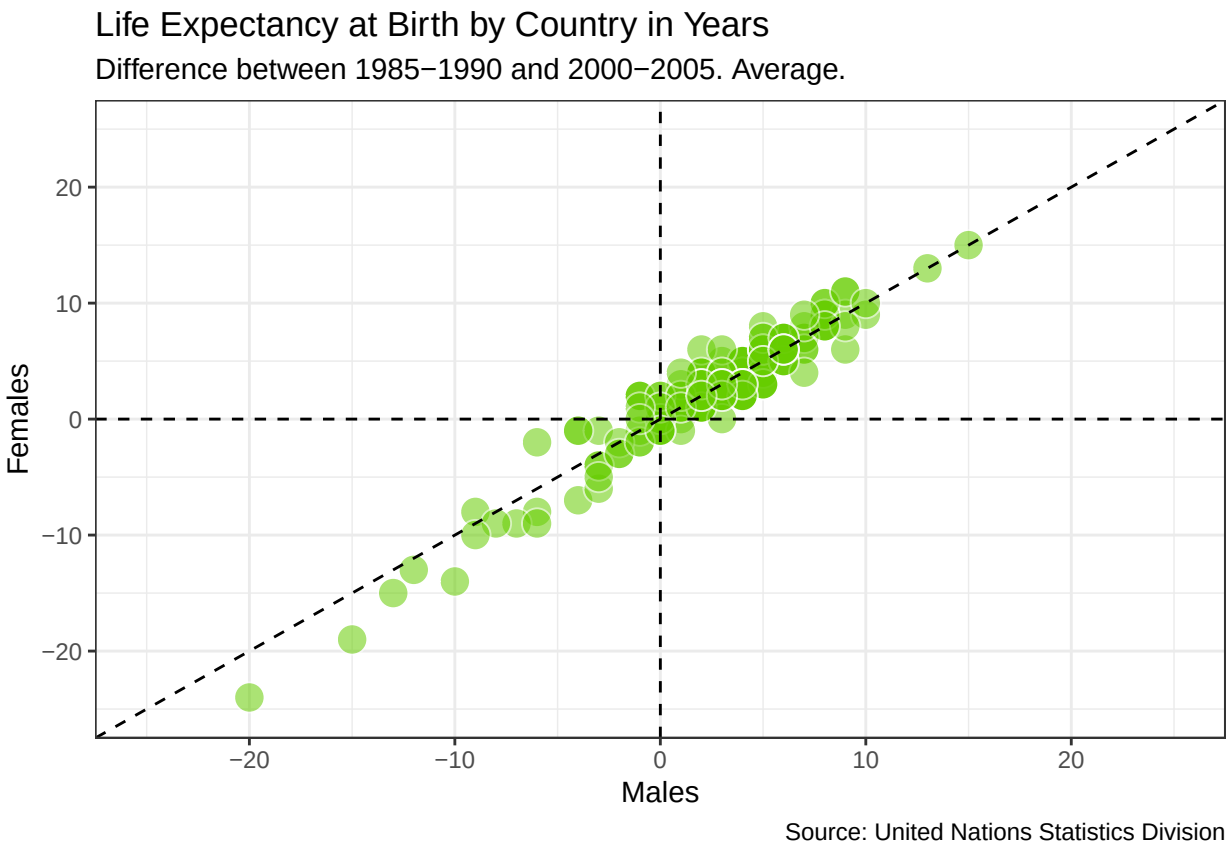


9 Reference lines II

Adding reference lines can make plots easier to understand. We already added a diagonal line to visualize differences between men and women more clearly. Now we will add two more lines to help to identify in which countries people increased or decreased their life expectancy in the period analyzed.

```
# Adding an hline and vline to previous plots
ggplot(subdata2) +
  aes(x = diff_Male, y = diff_Female, label = Country.or.Area) +
  geom_point(
    colour = "white",
    fill = "chartreuse3",
    shape = 21,
    alpha = .55,
    size = 5
  ) +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(limits = c(-25, 25)) +
  scale_y_continuous(limits = c(-25, 25)) +
  geom_hline(yintercept = 0, linetype = "dashed") +
  geom_vline(xintercept = 0, linetype = "dashed") +
  labs(
    title = "Life Expectancy at Birth by Country in Years",
    subtitle = "Difference between 1985-1990 and 2000-2005. Average.",
    caption = "Source: United Nations Statistics Division",
    x = "Males",
```

```
    y = "Females"
  ) +
  theme_bw()
```



10 Highlighting remarkable countries II

As we did in the first plot, let's label some points. Concretely, we will point those three where the aggregated average life expectancy for men and women increased most and those three where decreased most in the period.

```
# Subseting data to obtain countries of interest
top <- subdata2 %>%
  arrange(diff_Male + diff_Female) %>%
  select(-Source, -Unit, - Value.Footnotes) %>%
  head(3)

top
```

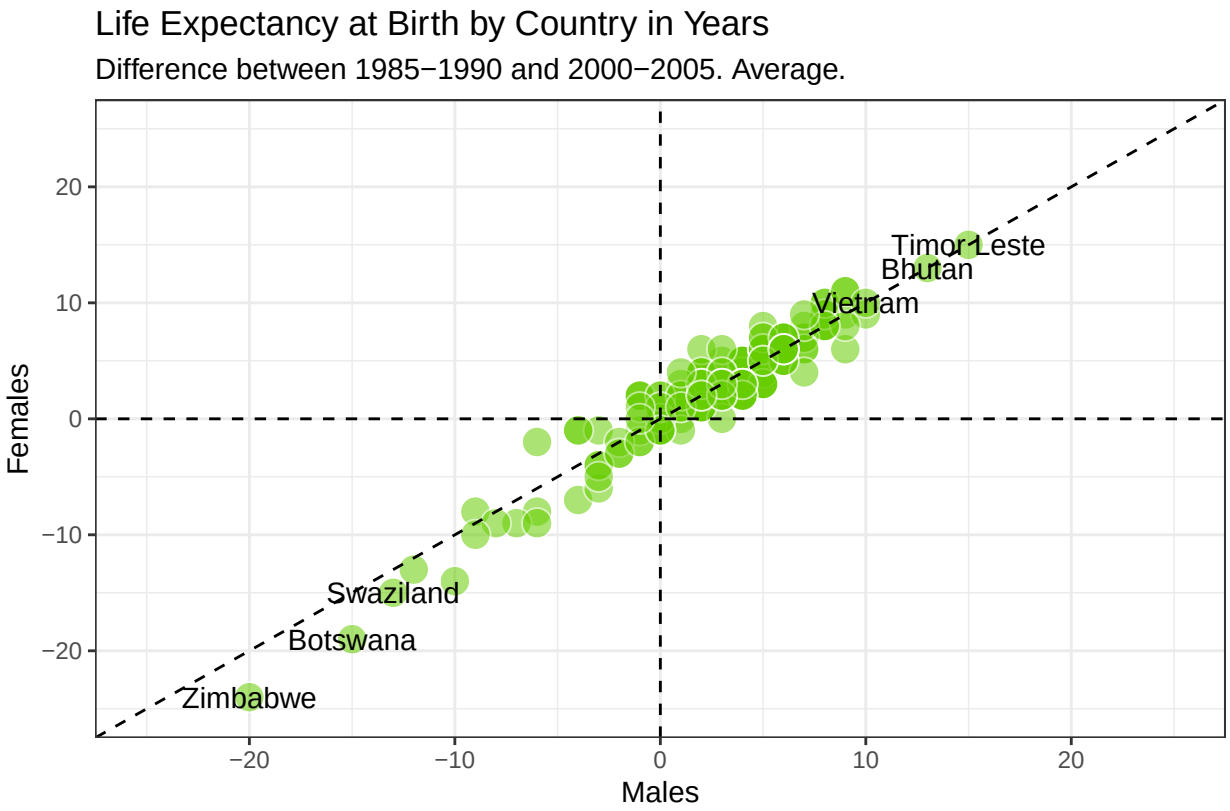
```
## # A tibble: 3 x 7
##   Country.or.Area Female_2000_2005 Female_1985_1990 Male_2000_2005
##   <chr>                      <int>            <int>          <int>
## 1 Zimbabwe                      40               64             40
## 2 Botswana                      47               66             46
## 3 Swaziland                     45               60             43
## # ... with 3 more variables: Male_1985_1990 <int>, diff_Female <int>,
## #   diff_Male <int>
```

```r
bottom <- subdata2 %>%
  arrange(diff_Male + diff_Female) %>%
  select(-Source, -Unit, - Value.Footnotes) %>%
  tail(3)

bottom
```

```
## # A tibble: 3 x 7
##   Country.or.Area Female_2000_2005 Female_1985_1990 Male_2000_2005
##   <chr>                      <int>            <int>          <int>
## 1 Vietnam                       75               65             71
## 2 Bhutan                        65               52             62
## 3 Timor Leste                   59               44             58
## # ... with 3 more variables: Male_1985_1990 <int>, diff_Female <int>,
## #   diff_Male <int>
```

```r
# Adding text to the previous plot to label countries of interest
ggplot(subdata2, guide = FALSE) +
  aes(x = diff_Male, y = diff_Female, label = Country.or.Area) +
  geom_point(
    colour = "white",
    fill = "chartreuse3",
    shape = 21,
    alpha = .55,
    size = 5
  ) +
  geom_abline(intercept = 0, slope = 1, linetype = "dashed") +
  scale_x_continuous(limits = c(-25, 25)) +
  scale_y_continuous(limits = c(-25, 25)) +
  geom_hline(yintercept = 0, linetype = "dashed") +
  geom_vline(xintercept = 0, linetype = "dashed") +
  labs(
    title = "Life Expectancy at Birth by Country in Years",
    subtitle = "Difference between 1985-1990 and 2000-2005. Average.",
    caption = "Source: United Nations Statistics Division",
    x = "Males",
    y = "Females"
  ) +
  geom_text(top, mapping = aes(label = Country.or.Area)) +
  geom_text(bottom, mapping = aes(label = Country.or.Area)) +
  theme_bw()
```


Life Expectancy at Birth by Country in Years
Difference between 1985−1990 and 2000−2005. Average.
Females
Males
20
10
0
−10
−20
−20
−10
0
10
20
Timor−Leste
Bhutan
Vietnam
Swaziland
Botswana
Zimbabwe
Source: United Nations Statistics Division