

# Income Inequality vs Index of Health and Social Problems

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## Data Reading

Equality Trust에서 기부금을 받고 제공하는 두 종류의 자료 중 23개 국가의 각종 지표를 비교한 자료에 World Bank에서 발표하는 GDP자료 ([https://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_GDP\\_\(PPP\)\\_per\\_capita](https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita))를 추가한 자료를 data 단계에서 읽어들이고 필요한 부분만 정리한 RData 파일을 읽어들이면,

```
library(knitr)
load("Inequality_Index_HS.RData")
# data.full <- read.csv("../data/international-inequality_GDP.csv", stringsAsFactors
= FALSE)
# data.full <- read.csv("../data/international-inequality_GDP.csv", stringsAsFactors
= TRUE)
str(data.full)
```

```
## 'data.frame': 23 obs. of 30 variables:
## $ Country : chr "Australia" "Austria" "Belgium" "Canada" ...
## $ Income.inequality : num 7 4.82 4.6 5.63 4.3 3.72 5.6 5.2 6.2 6.05 ...
## $ Trust : num 39.9 33.9 30.7 38.8 66.5 58 22.2 34.8 23.7 35.2 ...
## $ Life.expectancy : num 79.2 78.5 78.8 79.3 76.6 78 79 78.3 78.3 77 ...
## $ Infant.mortality : num 4.9 4.8 5 5.3 5.3 3.7 4.4 4.4 5 5.9 ...
## $ Obesity : num 18.4 14.5 13.5 12.8 15 ...
## $ Mental.illness : num 23 NA 12 19.9 NA NA 18.4 9.1 NA NA ...
## $ Maths.and.literacy.scores : num 524 498 518 530 503 ...
## $ Teenage.births : num 18.4 14 9.9 20.2 8.1 9.2 9.3 13.1 11.8 18.7 ...
## $ Homicides : num 16.9 11.6 13 17.3 12.7 28.2 21.5 13.7 13.9 8.6 ...
## $ Imprisonment.log. : num 4.61 4.52 4.28 4.77 4.17 4.11 4.5 4.51 3.33 4.17 ...
## $ Social.mobility : num NA NA NA 0.14 0.14 0.15 NA 0.17 NA NA ...
## $ Index.of.health...social_problems : num 0.07 0.01 -0.23 -0.07 -0.19 -0.43 0.05 -0.06 0.38 0.25 ...
## $ Child.overweight : num NA 11.9 10.4 19.5 10.3 13.3 11.2 11.3 16 12.1 ...
## $ Drugs.index : num 1.71 -0.02 -0.18 0.61 -0.09 -0.88 -0.35 -0.3 -0.99 -0.03 ...
## $ Calorie.intake : int 3142 3753 3632 3167 3405 3197 3576 3395 3687 3656 ...
## $ Public.health.expenditure : num 67.9 69.3 71.7 70.8 82.4 75.6 76 74.9 56 76 ...
## $ Child.wellbeing : num -0.21 -0.07 0.05 0.04 0.21 0.34 -0.17 -0.01 -0.04 -0.04 ...
## $ Maths.education.science.score : num 525 496 515 526 494 ...
## $ Child.conflict : num NA 0.31 0.33 0.24 -0.14 -1.25 0.59 -0.7 0.4 -0.06 ...
## $ Foreign.aid : num 0.25 0.52 0.53 0.34 0.81 0.47 0.47 0.35 0.24 0.41 ...
## $ Recycling : num 7.4 NA NA NA NA NA 6 3.4 NA NA ...
## $ Peace.index : num 1.66 1.48 1.49 1.48 1.38 1.45 1.73 1.52 1.79 1.4 ...
## $ Maternity.leave : int 0 16 15 17 18 18 16 14 17 18 ...
## $ Advertising : num 1.24 0.97 0.82 0.77 0.75 0.9 0.71 0.99 1.04 1 ...
## $ Police : int 304 305 357 186 192 160 NA 303 NA NA ...
## $ Social.expenditure : num 17.8 27.5 26.5 17.2 27.6 25.8 29 27.3 9.9 15.8 ...
## $ Women.s_status : num 0.46 -0.81 0.61 0.56 0.83 1.08 -0.17 -0.21 -0.85 -0.21 ...
## $ Lone.parents : int 21 15 12 17 22 19 12 21 3 14 ...
## $ GDP_WB : int 45926 47682 43435 45066 45537 40676 39328 46401 26851 49393 ...
```

```
str(data.21)
```

```
## 'data.frame': 21 obs. of 4 variables:
## $ Country : chr "Australia" "Austria" "Belgium" "Canada" ...
## $ Income.inequality: num 7 4.82 4.6 5.63 4.3 3.72 5.6 5.2 6.2 6.05 ...
## $ Index.HS : num 0.07 0.01 -0.23 -0.07 -0.19 -0.43 0.05 -0.06 0.38 0.25
## ...
## $ GDP_WB : int 45926 47682 43435 45066 45537 40676 39328 46401 26851 4
9393 ...
```

```
## [1] "Australia" "Austria" "Belgium" "Canada" "Denmark"
## [6] "Finland" "France" "Germany" "Greece" "Ireland"
## [11] "Italy" "Japan" "Netherlands" "New Zealand" "Norway"
## [16] "Portugal" "Spain" "Sweden" "Switzerland" "UK"
## [21] "USA"
```

```
barplot(fifth, names.arg = Country)
```

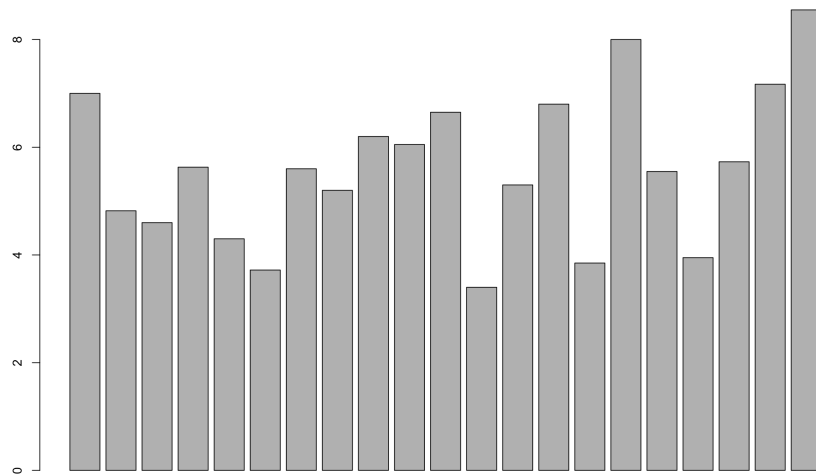
## Plots

### Barplots for Income Inequalities

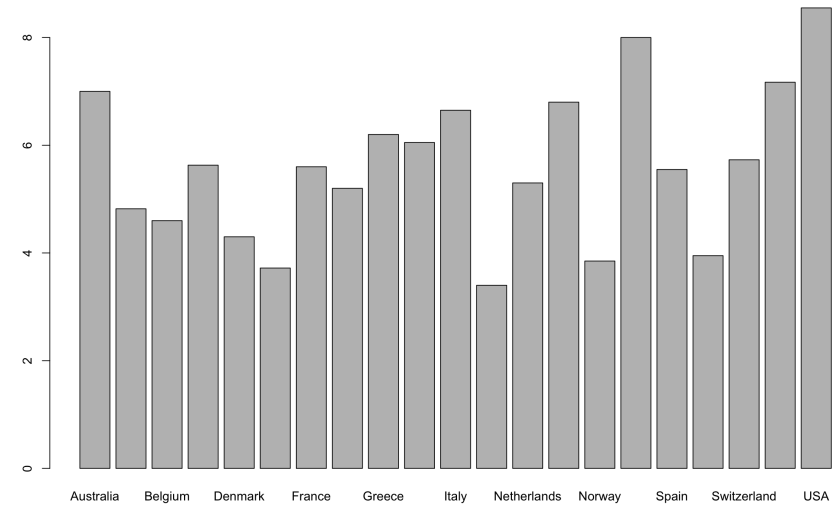
```
# par(mai = c(2.0, 0.8, 0.8, 0.4) + 0.2)
(fifth <- data.21$Income.inequality)
```

```
## [1] 7.00 4.82 4.60 5.63 4.30 3.72 5.60 5.20 6.20 6.05 6.65 3.40 5.30 6.80
## [15] 3.85 8.00 5.55 3.95 5.73 7.17 8.55
```

```
barplot(fifth)
```



```
(Country <- data.21$Country)
```



```
(o.fifth <- order(fifth))
```

```
## [1] 12 6 15 18 5 3 2 8 13 17 7 4 19 10 9 11 14 1 20 16 21
```

```
data.frame(Country, fifth, o.fifth, fifth[o.fifth], Country[o.fifth])
```

##	Country	fifth	o.fifth	fifth.o.fifth.	Country.o.fifth.
## 1	Australia	7.00	12	3.40	Japan
## 2	Austria	4.82	6	3.72	Finland
## 3	Belgium	4.60	15	3.85	Norway
## 4	Canada	5.63	18	3.95	Sweden
## 5	Denmark	4.30	5	4.30	Denmark
## 6	Finland	3.72	3	4.60	Belgium
## 7	France	5.60	2	4.82	Austria
## 8	Germany	5.20	8	5.20	Germany
## 9	Greece	6.20	13	5.30	Netherlands
## 10	Ireland	6.05	17	5.55	Spain
## 11	Italy	6.65	7	5.60	France
## 12	Japan	3.40	4	5.63	Canada
## 13	Netherlands	5.30	19	5.73	Switzerland
## 14	New Zealand	6.80	10	6.05	Ireland
## 15	Norway	3.85	9	6.20	Greece
## 16	Portugal	8.00	11	6.65	Italy
## 17	Spain	5.55	14	6.80	New Zealand
## 18	Sweden	3.95	1	7.00	Australia
## 19	Switzerland	5.73	20	7.17	UK
## 20	UK	7.17	16	8.00	Portugal
## 21	USA	8.55	21	8.55	USA

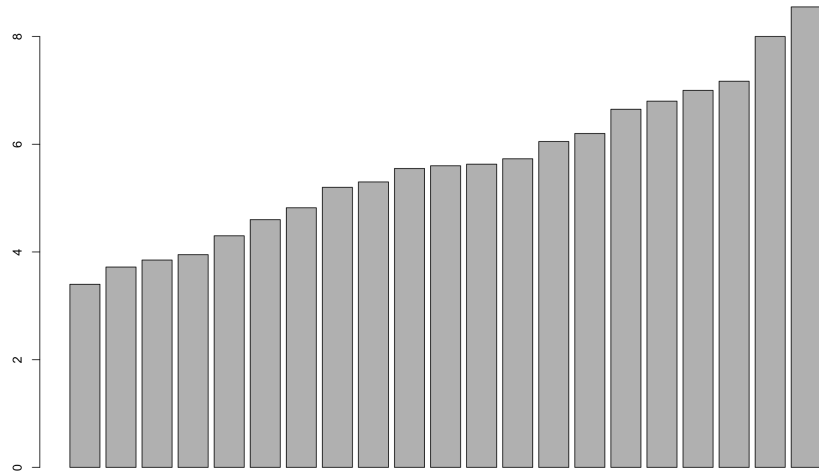
```
rev.o.fifth <- order(fifth, decreasing = TRUE)
data.frame(Country, fifth, o.fifth, rev.o.fifth, fifth[rev.o.fifth], Country[rev.o.fifth])
```

##	Country	fifth	o.fifth	rev.o.fifth	fifth.rev.o.fifth.
## 1	Australia	7.00	12	21	8.55
## 2	Austria	4.82	6	16	8.00
## 3	Belgium	4.60	15	20	7.17
## 4	Canada	5.63	18	1	7.00
## 5	Denmark	4.30	5	14	6.80
## 6	Finland	3.72	3	11	6.65
## 7	France	5.60	2	9	6.20
## 8	Germany	5.20	8	10	6.05
## 9	Greece	6.20	13	19	5.73
## 10	Ireland	6.05	17	4	5.63
## 11	Italy	6.65	7	7	5.60
## 12	Japan	3.40	4	17	5.55
## 13	Netherlands	5.30	19	13	5.30
## 14	New Zealand	6.80	10	8	5.20
## 15	Norway	3.85	9	2	4.82
## 16	Portugal	8.00	11	3	4.60
## 17	Spain	5.55	14	5	4.30
## 18	Sweden	3.95	1	18	3.95
## 19	Switzerland	5.73	20	15	3.85
## 20	UK	7.17	16	6	3.72
## 21	USA	8.55	21	12	3.40

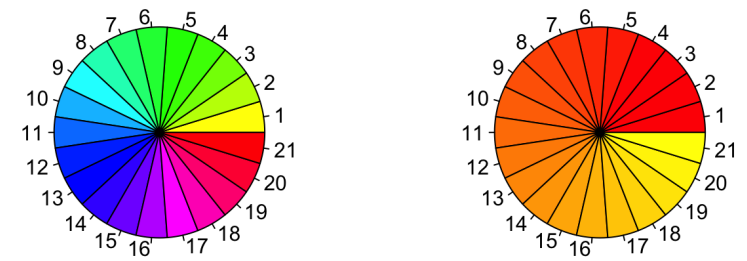
  

##	Country.rev.o.fifth.
## 1	USA
## 2	Portugal
## 3	UK
## 4	Australia
## 5	New Zealand
## 6	Italy
## 7	Greece
## 8	Ireland
## 9	Switzerland
## 10	Canada
## 11	France
## 12	Spain
## 13	Netherlands
## 14	Germany
## 15	Austria
## 16	Belgium
## 17	Denmark
## 18	Sweden
## 19	Norway
## 20	Finland
## 21	Japan

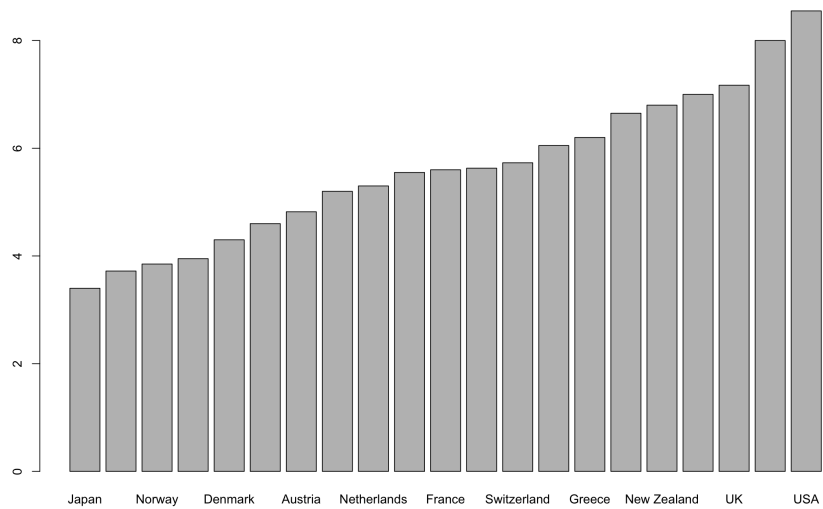
```
barplot(fifth[o.fifth])
```



```
N <- nrow(data.21)
par(mfrow = c(1, 2))
pie(rep(1, N), col = rainbow(N, start = 1/6, end = 1))
pie(rep(1, N), col = rainbow(N, start = 0, end = 1/6))
```

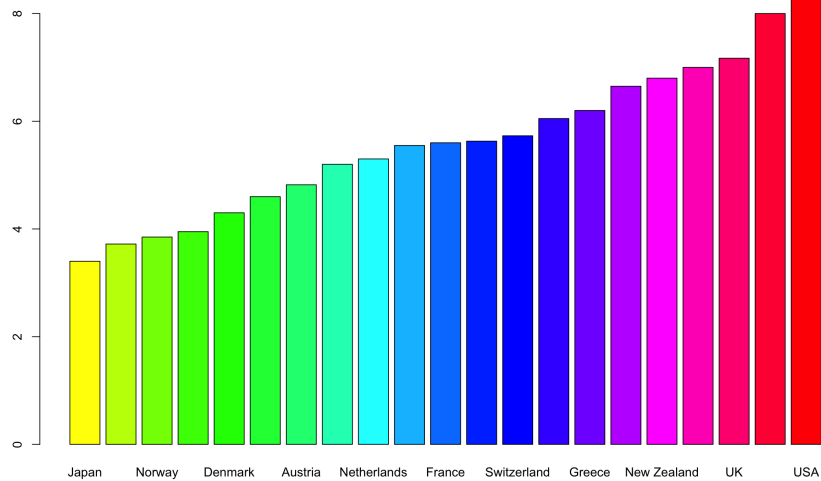


```
barplot(fifth[o.fifth], names.arg = Country[o.fifth])
```

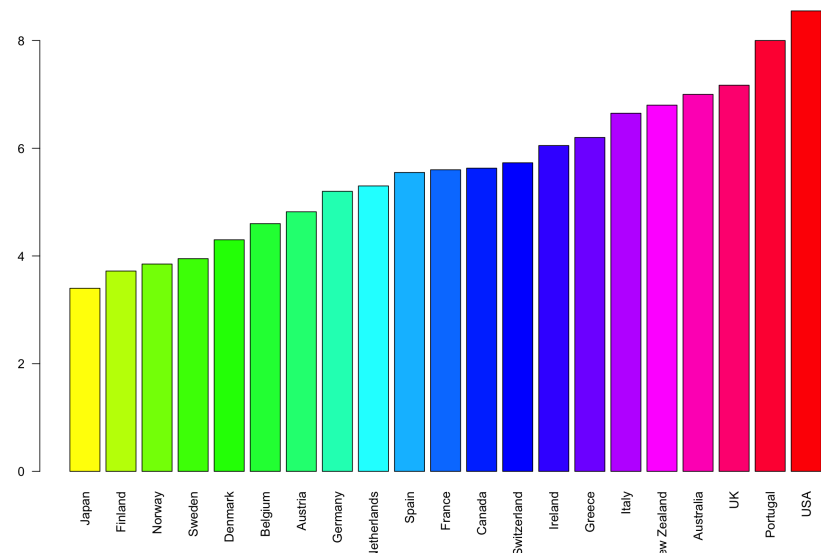


```
par(mfrow = c(1, 1))
```

```
barplot(fifth[o.fifth], names.arg = Country[o.fifth], col = rainbow(N, start = 1/6, end = 1))
```

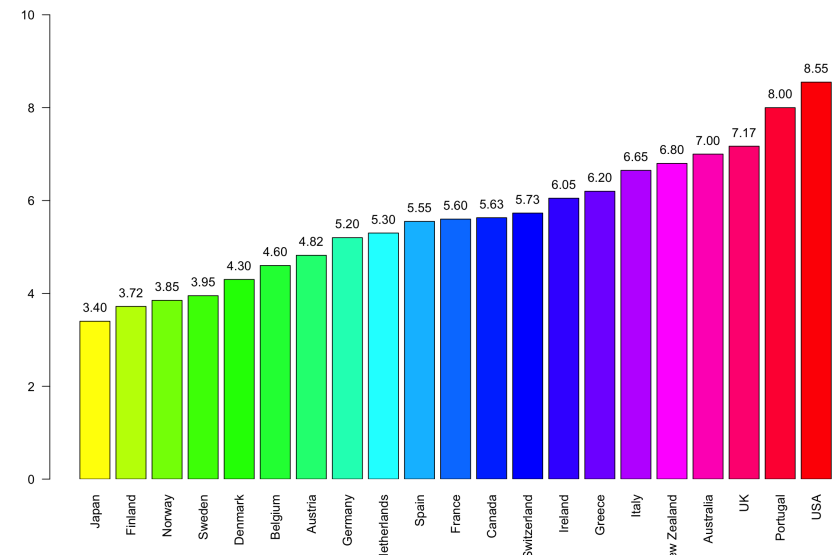


```
barplot(fifth[o.fifth], names.arg = Country[o.fifth], col = rainbow(N, start = 1/6,
end = 1), las = 2)
```



```
b.fifth <- barplot(fifth[o.fifth], names.arg = Country[o.fifth], col = rainbow(N, sta
rt = 1/6, end = 1), ylim = c(0, 10), xpd = FALSE, las = 2)
text(x = b.fifth, y = fifth[o.fifth] + 0.3, labels = format(fifth[o.fifth], digits =
3))
# text(x = b.fifth, y = fifth[o.fifth], labels = format(fifth[o.fifth], digits = 3))
# text(x = b.fifth[c(1, 11, 21)], y = fifth[o.fifth][c(1, 11, 21)] + 0.3, labels = fo
rmat(fifth[o.fifth][c(1, 11, 21)], digits = 3))
title(main = "Fifth Ratios of Selected Countries", cex.main = 2)
```

## Fifth Ratios of Selected Countries



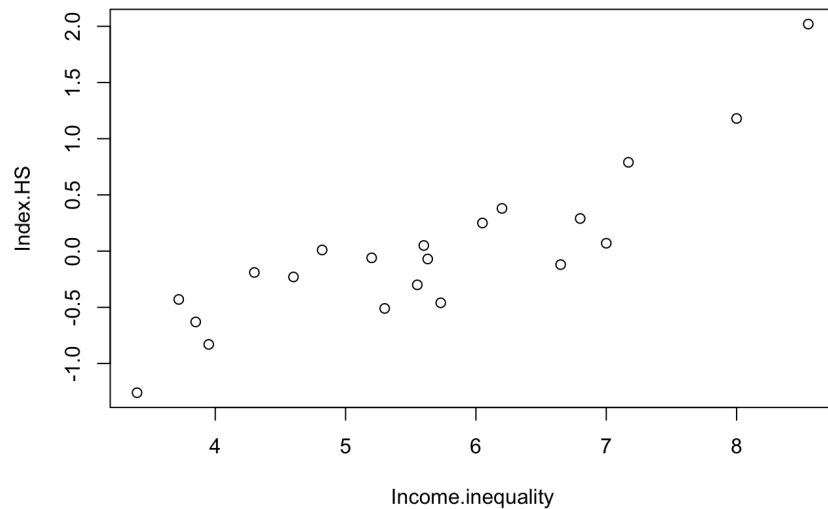
## Scatter Diagram

우선 소득불평등과 건강 및 사회문제 지표의 관계를 대략적으로 살펴보면,

```
Index_inequality.df <- data.21[c("Income.inequality", "Index.HS")]
str(Index_inequality.df)
```

```
## 'data.frame': 21 obs. of 2 variables:
## $ Income.inequality: num 7 4.82 4.6 5.63 4.3 3.72 5.6 5.2 6.2 6.05 ...
## $ Index.HS : num 0.07 0.01 -0.23 -0.07 -0.19 -0.43 0.05 -0.06 0.38 0.25 ...
```

```
plot(Index_inequality.df)
```



```
cor(Index_inequality.df)
```

```
##           Income.inequality  Index.HS
## Income.inequality      1.0000000 0.8735785
## Index.HS                0.8735785 1.0000000
```

```
cor.1 <- cor(data.21["Income.inequality"], data.21["Index.HS"])
cor.1
```

```
##           Index.HS
## Income.inequality 0.8735785
```

매우 높은 양의 상관관계( $r = 0.8735785$ )가 관찰됨을 알 수 있다. 자주 사용하는 `data.21[c("Income.inequality", "Index.HS")]`를 간단한 R 오브젝트로 assign하여 반복 사용하고 있다. `cor()`에도 data frame을 사용하면 어떻게 되는지 다음 결과와 비교해 보자.

```
cor(Index_inequality.df)
```

```
##           Income.inequality  Index.HS
## Income.inequality      1.0000000 0.8735785
## Index.HS                0.8735785 1.0000000
```

각 점이 어느 나라를 나타내는지 표시하기 위하여 `text()`를 활용하자. 동그라미 대신 까만 점으로 표시하고, 나라 이름을 올려보자.

```
(Country <- data.21[, "Country"])
```

```
## [1] "Australia" "Austria"    "Belgium"    "Canada"    "Denmark"
## [6] "Finland"   "France"     "Germany"    "Greece"    "Ireland"
## [11] "Italy"     "Japan"      "Netherlands" "New Zealand" "Norway"
## [16] "Portugal"  "Spain"      "Sweden"     "Switzerland" "UK"
## [21] "USA"
```

```
(Country.2 <- data.21["Country"])
```

```
##      Country
## 1 Australia
## 2 Austria
## 3 Belgium
## 4 Canada
## 5 Denmark
## 6 Finland
## 7 France
## 8 Germany
## 9 Greece
## 10 Ireland
## 12 Italy
## 13 Japan
## 14 Netherlands
## 15 New Zealand
## 16 Norway
## 17 Portugal
## 19 Spain
## 20 Sweden
## 21 Switzerland
## 22 UK
## 23 USA
```

```
(Country.3 <- data.21["Country"]$Country)
```

```
## [1] "Australia" "Austria"    "Belgium"    "Canada"    "Denmark"
## [6] "Finland"   "France"     "Germany"    "Greece"    "Ireland"
## [11] "Italy"     "Japan"      "Netherlands" "New Zealand" "Norway"
## [16] "Portugal"  "Spain"      "Sweden"     "Switzerland" "UK"
## [21] "USA"
```

```
(Country.4 <- data.21[["Country"]])
```

```
## [1] "Australia" "Austria"    "Belgium"    "Canada"    "Denmark"
## [6] "Finland"   "France"     "Germany"    "Greece"    "Ireland"
## [11] "Italy"     "Japan"      "Netherlands" "New Zealand" "Norway"
## [16] "Portugal"  "Spain"      "Sweden"     "Switzerland" "UK"
## [21] "USA"
```

```
str(Country)
```

```
## chr [1:21] "Australia" "Austria" "Belgium" "Canada" "Denmark" ...
```

```
str(Country.2)
```

```
## 'data.frame': 21 obs. of 1 variable:  
## $ Country: chr "Australia" "Austria" "Belgium" "Canada" ...
```

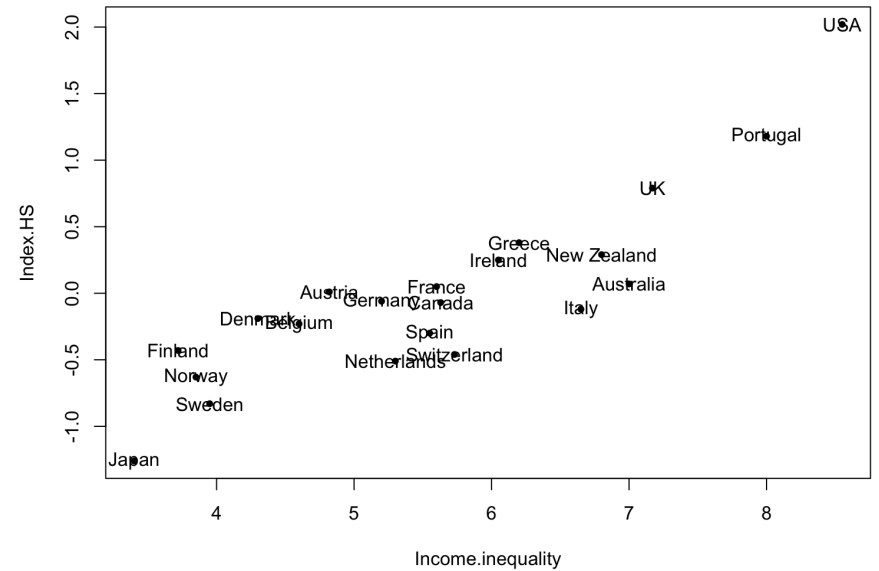
```
str(Country.3)
```

```
## chr [1:21] "Australia" "Austria" "Belgium" "Canada" "Denmark" ...
```

```
str(Country.4)
```

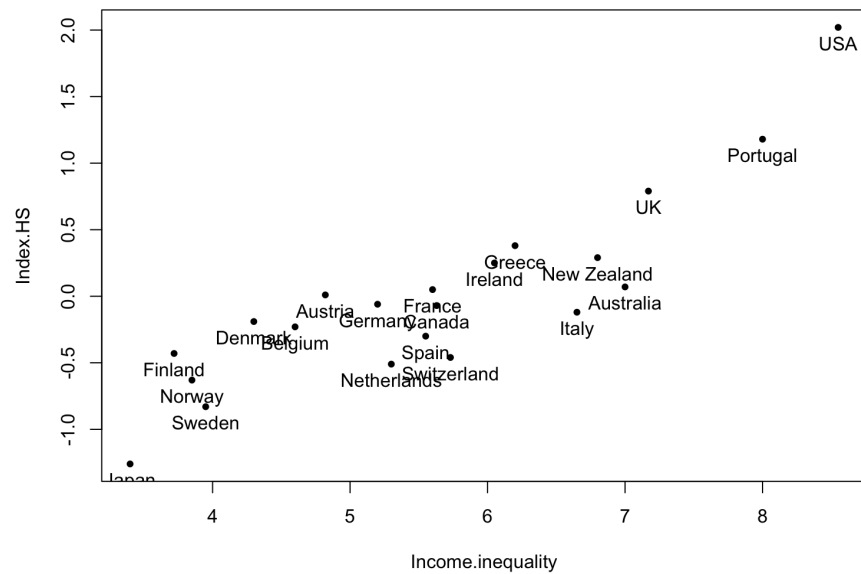
```
## chr [1:21] "Australia" "Austria" "Belgium" "Canada" "Denmark" ...
```

```
plot(Index_inequality.df, pch = 20)  
text(Index_inequality.df, labels = Country)
```

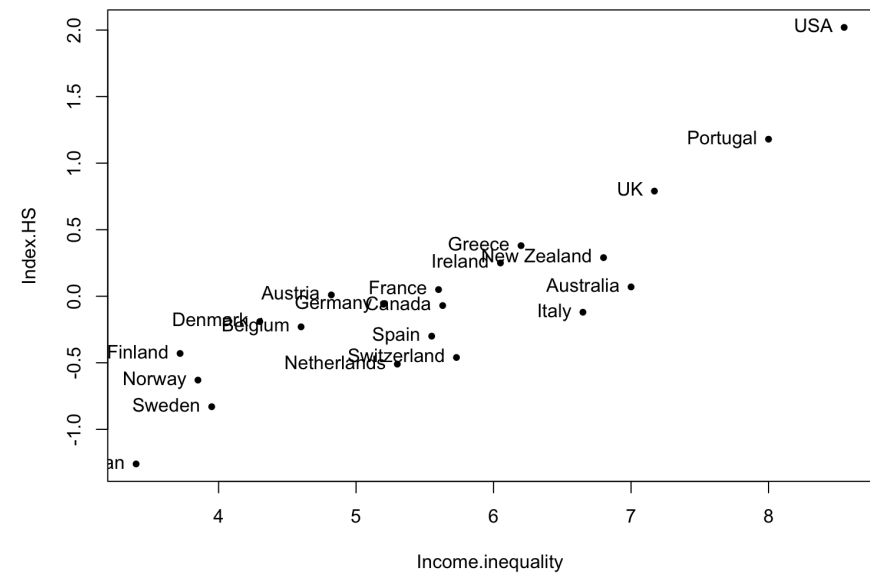


text label의 위치 기본값은 바로 점 위임을 알 수 있다. 위치 선정에 가능한 값들을 넣어보자.

```
plot(Index_inequality.df, pch = 20)  
text(Index_inequality.df, labels = Country, pos = 1)
```

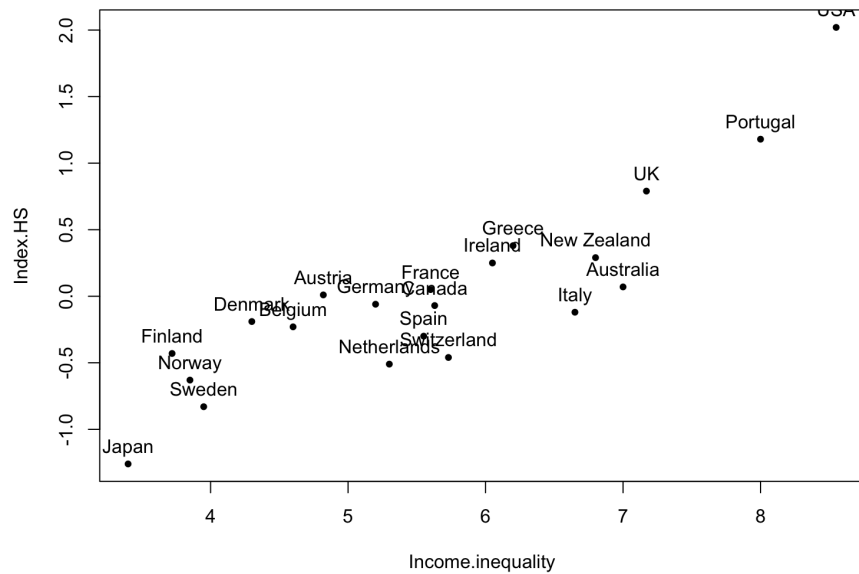


```
plot(Index_inequality.df, pch = 20)
text(Index_inequality.df, labels = Country, pos = 2)
```

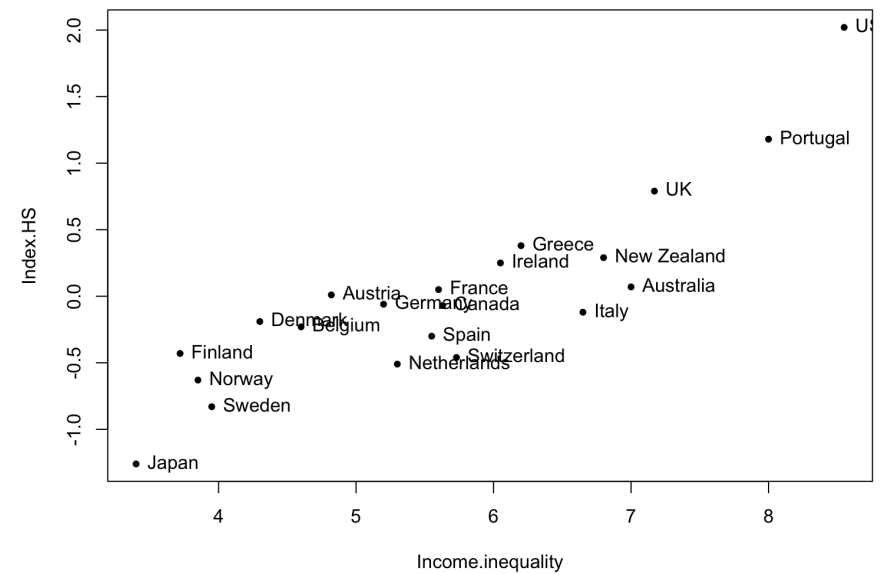


```
plot(Index_inequality.df, pch = 20)
text(Index_inequality.df, labels = Country, pos = 3)
```



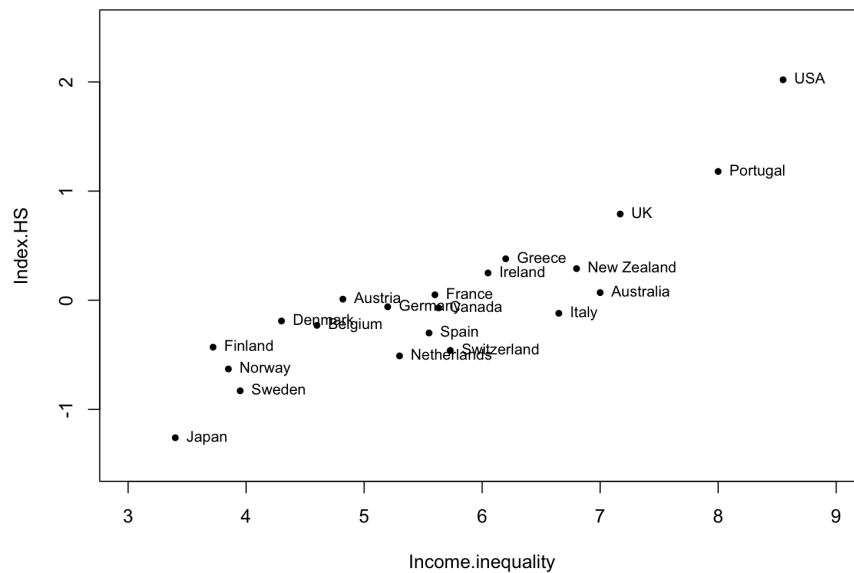


```
plot(Index_inequality.df, pch = 20)
text(Index_inequality.df, labels = Country, pos = 4)
```



우선 x-축과 y-축의 범위를 `xlim = c(3, 9)`, `ylim = c(-1.5, 2.5)` 로 하여 미국과 일본의 라벨이 도표 밖으로 나가 지 않게 하자. `pos = 4` 로 하고 `cex = 0.8` 로 하여 글자 크기를 줄여보면,

```
plot(Index_inequality.df, pch = 20, xlim = c(3, 9), ylim = c(-1.5, 2.5))
text(Index_inequality.df, labels = Country, pos = 4, cex = 0.8)
```



오스트리아, 덴마크, 독일, 네덜란드의 라벨만 점 왼편에 위치시켜 보자. 각 인덱스를 찾아보면,

```
which(Country %in% c("Austria", "Denmark", "Germany", "Netherlands"))
```

```
## [1] 2 5 8 13
```

```
text.left <- which(Country %in% c("Austria", "Denmark", "Germany", "Netherlands"))
text.left
```

```
## [1] 2 5 8 13
```

```
text.right <- setdiff(1:nrow(data.21), text.left)
text.right
```

```
## [1] 1 3 4 6 7 9 10 11 12 14 15 16 17 18 19 20 21
```

```
pos.text <- ifelse(1:nrow(data.21) %in% text.left, 2, 4)
```

```
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5))
text(Index_inequality.df, labels = Country, pos = pos.text, cex = 0.8)
```



독일의 라벨을 위로 붙이면 보기가 나아질 것으로 생각되므로,

```
which(Country %in% "Germany")
```

```
## [1] 8
```

```
text.up <- which(Country %in% "Germany")
text.up
```

```
## [1] 8
```

```
text.left <- setdiff(1:nrow(data.21), c(text.right, text.up))
text.left
```

```
## [1] 2 5 13
```

```
pos.text <- ifelse(1:nrow(data.21) %in% text.up, 3, ifelse(1:nrow(data.21) %in% text.
left, 2, 4))
pos.text
```

```
## [1] 4 2 4 4 2 4 4 3 4 4 4 2 4 4 4 4 4 4 4 4
```

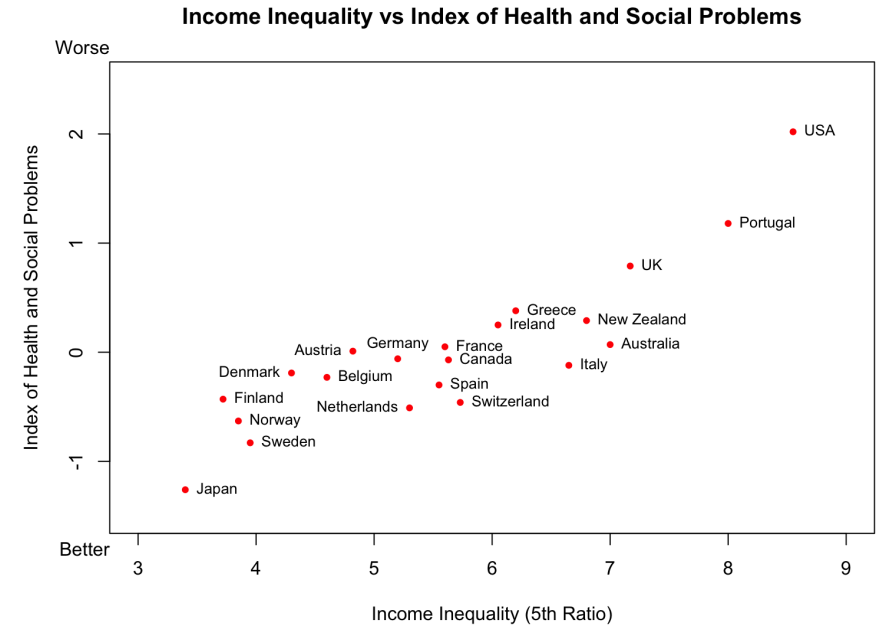
이제 조정된 text 외에 x-축과 y-축에 적절한 라벨과 메인 타이틀을 넣어보자.

```
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
     ann = FALSE)
text(Index_inequality.df, labels = Country, pos = pos.text, cex = 0.8)
main.title <- "Income Inequality vs Index of Health and Social Problems"
x.lab <- "Income Inequality (5th Ratio)"
y.lab <- "Index of Health and Social Problems"
title(main = main.title, xlab = x.lab, ylab = y.lab)
```



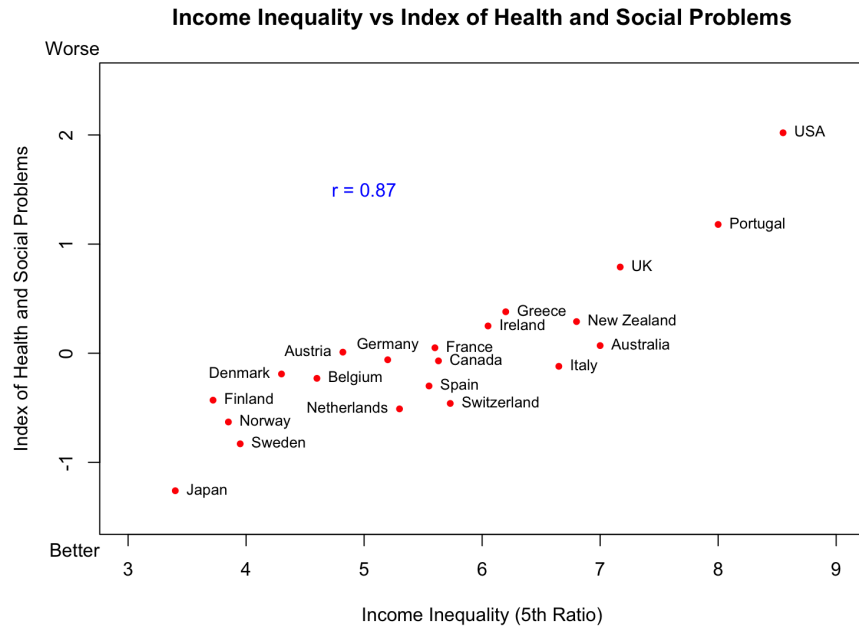
건강 및 사회문제 지표의 경우 어느 방향이 좋은지 알 수 없으므로 친절하게 도표의 주변에(margin)에 알려주려면,

```
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
     ann = FALSE)
text(Index_inequality.df, labels = Country, pos = pos.text, cex = 0.8)
main.title <- "Income Inequality vs Index of Health and Social Problems"
x.lab <- "Income Inequality (5th Ratio)"
y.lab <- "Index of Health and Social Problems"
title(main = main.title, xlab = x.lab, ylab = y.lab)
mtext(c("Better", "Worse"), side = 2, at = c(-1.8, 2.8), las = 1)
```



상관계수를 텍스트로 그림 안에 넣어주고 여기까지 작업한 내용을 별도의 파일로 저장해 놓으려면,

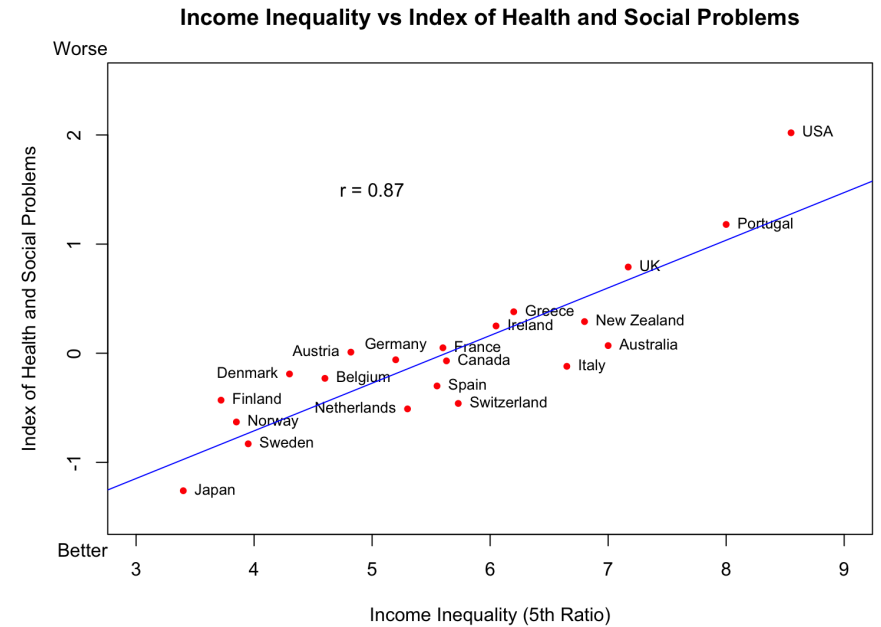
```
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
     ann = FALSE)
text(Index_inequality.df, labels = Country, pos = pos.text, cex = 0.8)
main.title <- "Income Inequality vs Index of Health and Social Problems"
x.lab <- "Income Inequality (5th Ratio)"
y.lab <- "Index of Health and Social Problems"
title(main = main.title, xlab = x.lab, ylab = y.lab)
mtext(c("Better", "Worse"), side = 2, at = c(-1.8, 2.8), las = 1)
text(x = 5, y = 1.5, labels = paste("r =", round(cor.1, digits = 2)), col = "blue")
```



```
# dev.copy(png, file = "../pics/inequality_health_social_en_72dpi.png", width = 640,
# height = 480)
# dev.off()
```

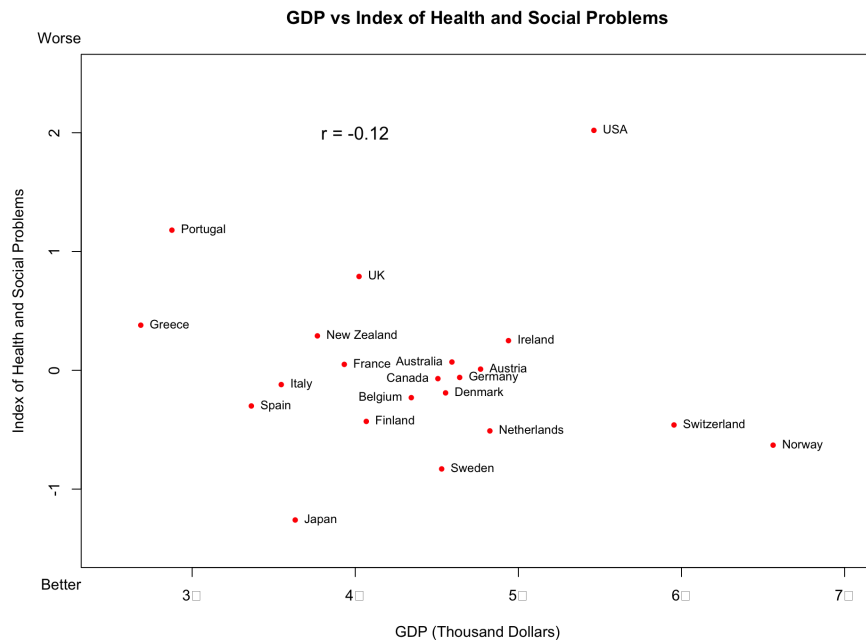
선형회귀선을 추가하여 대체적인 추세를 보려면 `lm()` 을 이용하되, `x`, `y` 의 순서를 제대로 바꿔야 함에 유의.

```
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
     ann = FALSE)
text(Index_inequality.df, labels = Country, pos = pos.text, cex = 0.8)
main.title <- "Income Inequality vs Index of Health and Social Problems"
x.lab <- "Income Inequality (5th Ratio)"
y.lab <- "Index of Health and Social Problems"
title(main = main.title, xlab = x.lab, ylab = y.lab)
mtext(c("Better", "Worse"), side = 2, at = c(-1.8, 2.8), las = 1)
text(x = 5, y = 1.5, labels = paste("r =", round(cor.1, digits = 2)))
lm.ineq <- lm(Index.HS ~ Income.inequality, data = Index_inequality.df)
# lm.ineq <- lm(Index_inequality.df[2:1])
abline(lm.ineq$coef, col = "blue")
```



GDP와 건강 및 사회문제 지수

```
Index_GDP.df <- data.21[c("GDP_WB", "Index.HS")]
text.left.2 <- which(Country %in% c("Canada", "Belgium", "Australia"))
text.right.2 <- setdiff(1:nrow(data.21), c(text.left.2))
pos.text.2 <- ifelse(1:nrow(data.21) %in% text.left.2, 2, 4)
plot(Index_GDP.df, pch = 20, col = "red", xlim = c(25000, 70000), ylim = c(-1.5, 2.5),
     xaxt = "n", ann = FALSE)
axis(side = 1, at = seq(30000, 70000, by = 10000), labels = paste(3:7, "만", sep = ""))
text(Index_GDP.df, labels = Country, pos = pos.text.2, cex = 0.8)
cor.2 <- cor(Index_GDP.df["GDP_WB"], Index_GDP.df["Index.HS"])
text(x = 40000, y = 2, labels = paste("r =", round(cor.2, digits = 2)), cex = 1.2)
main.title.2 <- "GDP vs Index of Health and Social Problems"
x.lab.2 <- "GDP (Thousand Dollars)"
y.lab.2 <- "Index of Health and Social Problems"
title(main = main.title.2, xlab = x.lab.2, ylab = y.lab.2)
mtext(c("Better", "Worse"), side = 2, at = c(-1.8, 2.8), las = 1)
```



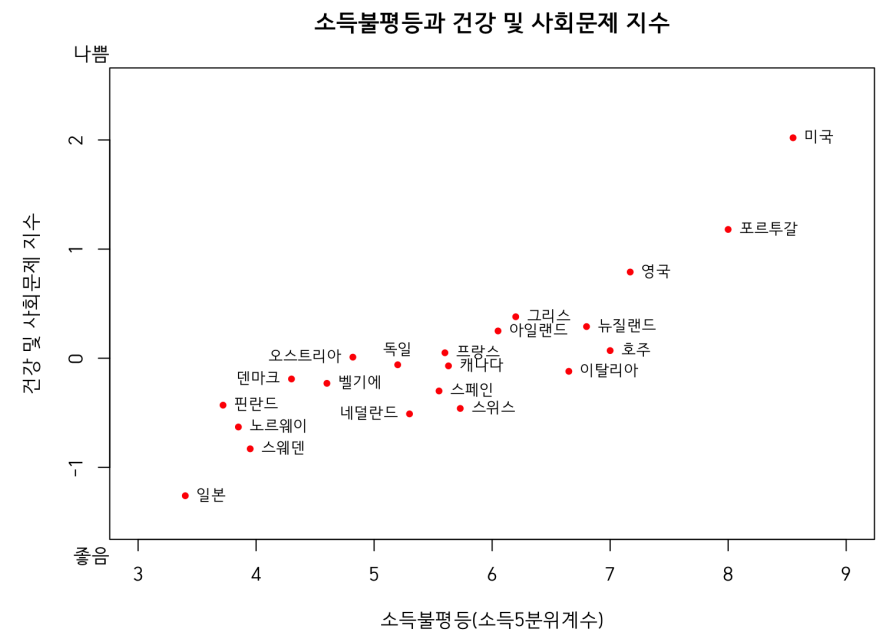
```
# dev.copy(png, file = "../pics/GDP_health_social_en_72dpi.png", width = 640, height
= 480)
# dev.off()
```

## 한글화

국가명을 한글로 만들어 Country.kr 로 저장하자.

```
Country.kr<-c("호주", "오스트리아", "벨기에", "캐나다", "덴마크",
"핀란드", "프랑스", "독일", "그리스", "아일랜드", "이탈리아",
"일본", "네덜란드", "뉴질랜드", "노르웨이", "포르투갈",
"스페인", "스웨덴", "스위스", "영국", "미국")
```

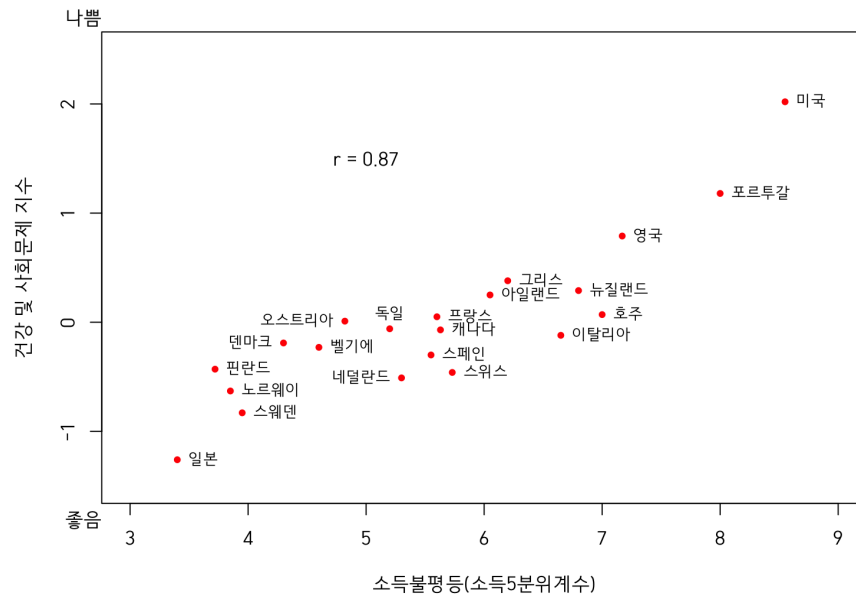
```
# library(extrafont)
par(family = "HCR Dotum LVT")
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
ann = FALSE)
text(Index_inequality.df[text.right, ], labels = Country.kr[text.right], pos = 4, cex
= 0.8)
text(Index_inequality.df[text.left, ], labels = Country.kr[text.left], pos = 2, cex =
0.8)
text(Index_inequality.df[text.up, ], labels = Country.kr[text.up], pos = 3, cex = 0.8
)
main.title.kr <- "소득불평등과 건강 및 사회문제 지수"
x.lab.kr <- "소득불평등(소득5분위계수)"
y.lab.kr <- "건강 및 사회문제 지수"
title(main = main.title.kr, xlab = x.lab.kr, ylab = y.lab.kr)
mtext(c("좋은", "나쁨"), side = 2, at = c(-1.8, 2.8), las = 1)
```



상관계수  $r = 0.87$  를 도표 안에 표시하고 별도의 파일로 출력하려면,

```
par(family = "HCR Dotum LVT")
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
     ann = FALSE)
text(Index_inequality.df, labels = Country.kr, pos = pos.text, cex = 0.8)
main.title.kr <- "소득불평등과 건강 및 사회문제 지수"
x.lab.kr <- "소득불평등(소득5분위계수)"
y.lab.kr <- "건강 및 사회문제 지수"
title(main = main.title.kr, xlab = x.lab.kr, ylab = y.lab.kr)
mtext(c("좋은", "나쁨"), side = 2, at = c(-1.8, 2.8), las = 1)
text(x = 5, y = 1.5, labels = paste("r =", round(cor(Index_inequality.df[1], Index_in
equality.df[2]), digits = 2)))
```

소득불평등과 건강 및 사회문제 지수

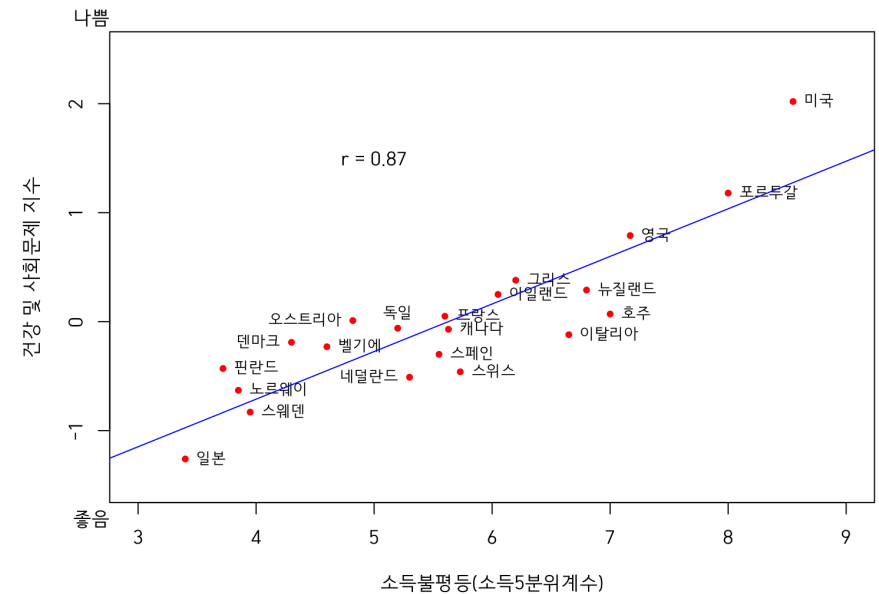


```
# dev.copy(png, file = "../pics/inequality_health_social_72dpi.png", width = 640, hei
ght = 480)
# dev.off()
```

선형회귀선을 이번에는 `lsfit` 을 이용하여 삽입

```
par(family = "HCR Dotum LVT")
plot(Index_inequality.df, pch = 20, col = "red", xlim = c(3, 9), ylim = c(-1.5, 2.5),
     ann = FALSE)
text(Index_inequality.df, labels = Country.kr, pos = pos.text, cex = 0.8)
main.title.kr <- "소득불평등과 건강 및 사회문제 지수"
x.lab.kr <- "소득불평등(소득5분위계수)"
y.lab.kr <- "건강 및 사회문제 지수"
title(main = main.title.kr, xlab = x.lab.kr, ylab = y.lab.kr)
mtext(c("좋은", "나쁨"), side = 2, at = c(-1.8, 2.8), las = 1)
text(x = 5, y = 1.5, labels = paste("r =", round(cor(Index_inequality.df[1], Index_in
equality.df[2]), digits = 2)))
lsfit.ineq <- lsfit(x = Index_inequality.df[, 1], y = Index_inequality.df[, 2])
abline(lsfit.ineq$coefficients, col = "blue")
```

소득불평등과 건강 및 사회문제 지수

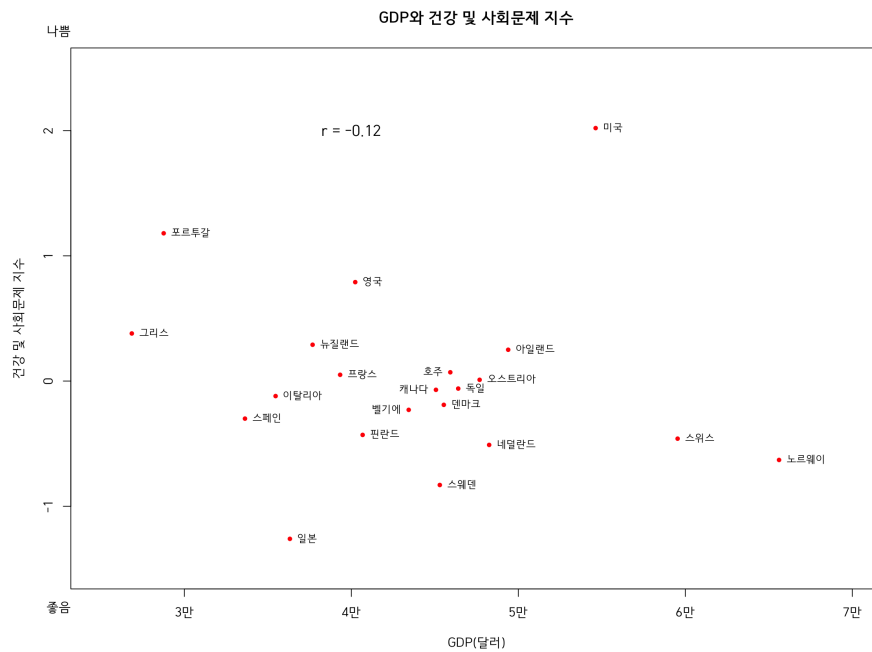


GDP와의 관계

```

par(family = "HCR Dotum LVT")
Index_GDP.df <- data.21[c("GDP_WB", "Index.HS")]
text.left.2 <- which(Country %in% c("Canada", "Belgium", "Australia"))
text.right.2 <- setdiff(1:nrow(data.21), c(text.left.2))
pos.text.2 <- ifelse(1:nrow(data.21) %in% text.left.2, 2, 4)
plot(Index_GDP.df, pch = 20, col = "red", xlim = c(25000, 70000), ylim = c(-1.5, 2.5),
      xaxt = "n", ann = FALSE)
axis(side = 1, at = seq(30000, 70000, by = 10000), labels = paste(3:7, "만", sep = ""))
text(Index_GDP.df, labels = Country.kr, pos = pos.text.2, cex = 0.8)
text(x = 40000, y = 2, labels = paste("r =", round(cor(Index_GDP.df[,1], Index_GDP.df[,2]), digits = 2)), cex = 1.2)
main.title.2.kr <- "GDP와 건강 및 사회문제 지수"
x.lab.2.kr <- "GDP(달러)"
y.lab.2.kr <- "건강 및 사회문제 지수"
title(main = main.title.2.kr, xlab = x.lab.2.kr, ylab = y.lab.2.kr)
mtext(c("좋은", "나쁨"), side = 2, at = c(-1.8, 2.8), las = 1)

```



```

# dev.copy(png, file = "../pics/GDP_health_social_72dpi.png", width = 640, height = 480)
# dev.off()

```