# Qualifying Exam

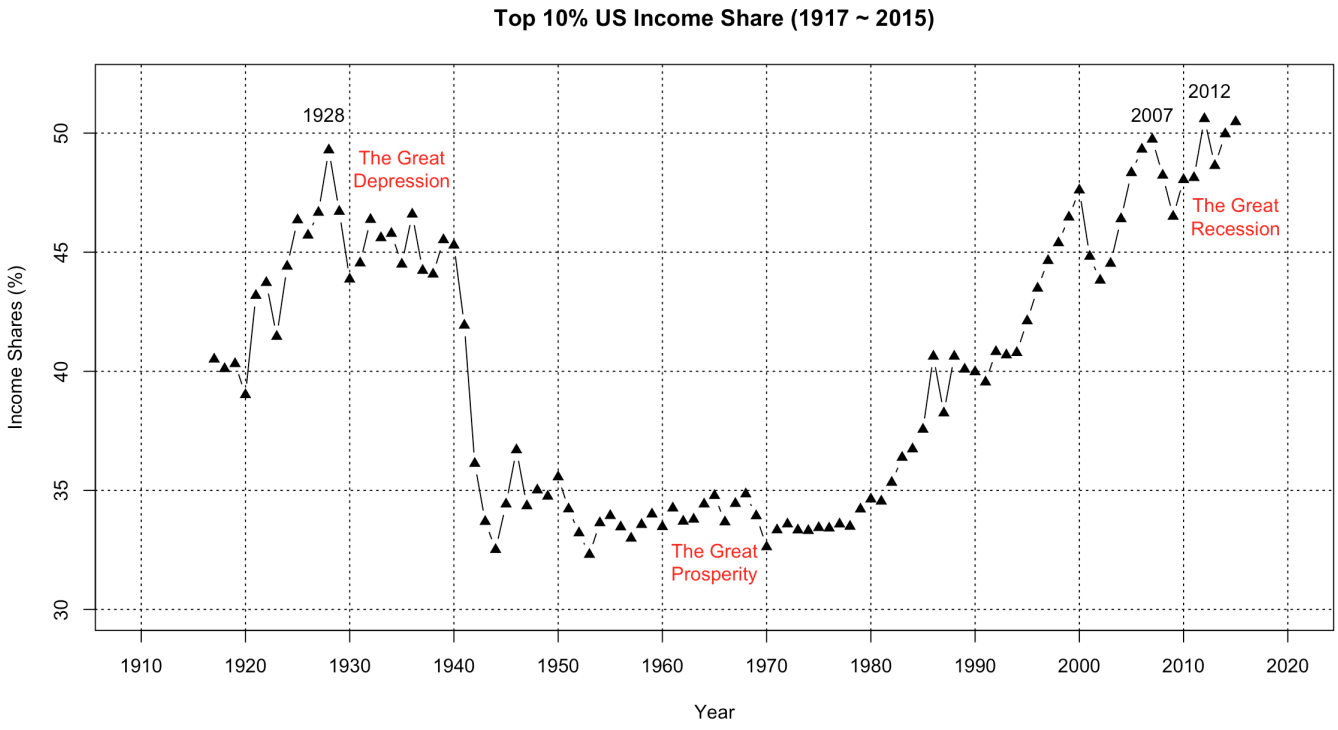
*Applied Statistics*

Explain the relationship between the plots and the codes as detailed as possible. What can you infer from the plots?

# 1. US Top Income Shares

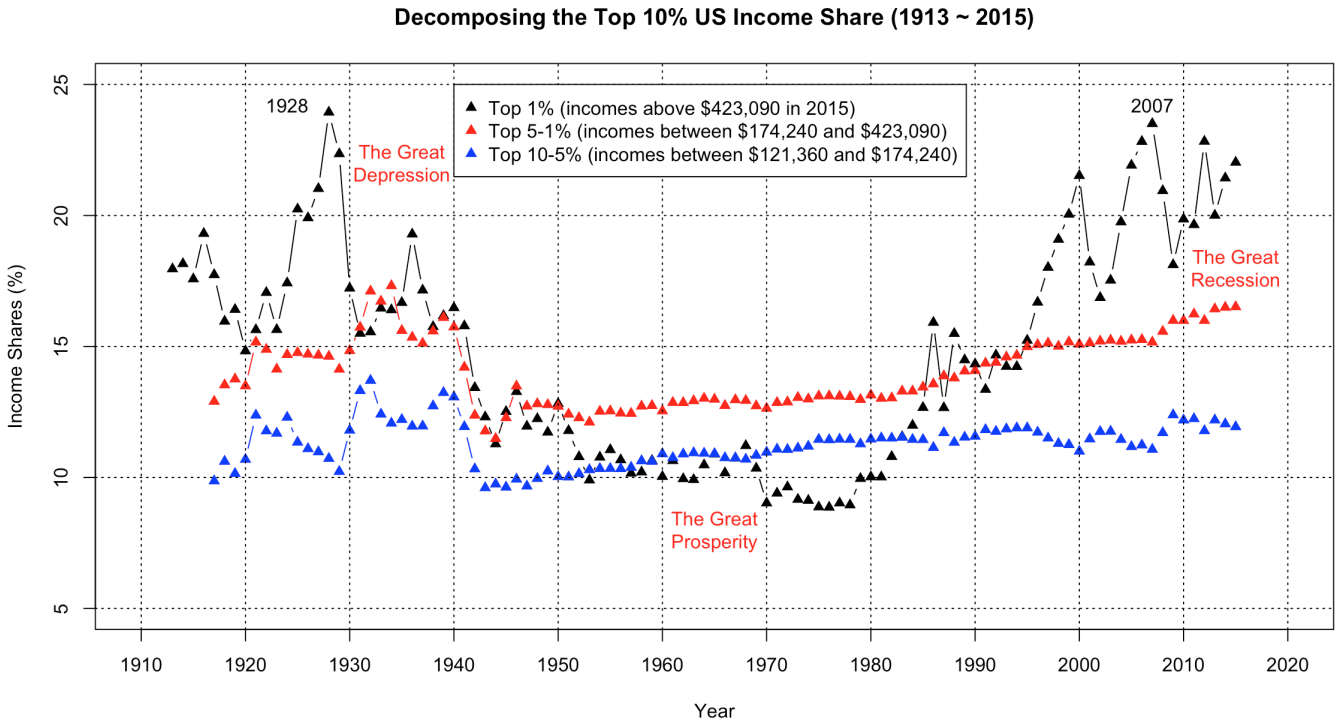
## 1.1 Top 10%

```
x.lab <- "Year"
y.lab <- "Income Shares (%)"
plot(P90_100 ~ Year, data = US.top.income.shares.15, xlab = x.lab, ylab = y.lab, xlim
 = c(1910, 2020), ylim = c(30, 52), xaxt = "n", type = "b", pch = 17)
axis(side = 1, at = seq(1910, 2020, by = 10), labels = seq(1910, 2020, by = 10))
abline(h = seq(30, 50, by = 5), lty = 3)
abline(v = seq(1910, 2020, by = 10), lty = 3)
main.title<- "Top 10% US Income Share (1917 ~ 2015)"
title(main = main.title)
text(x = c(1927.5, 2007, 2012.5), y = c(50, 50, 51), labels = c("1928", "2007", "201
2"), pos = 3)
times.label <- c("The Great\nDepression", "The Great\nProsperity", "The Great\nRecess
ion")
text(x = c(1935, 1965, 2015), y = c(48.5, 32, 46.5), label = times.label, cex = 1.0,
col = "red")
```



# 1.2 Top 10% Decomposition

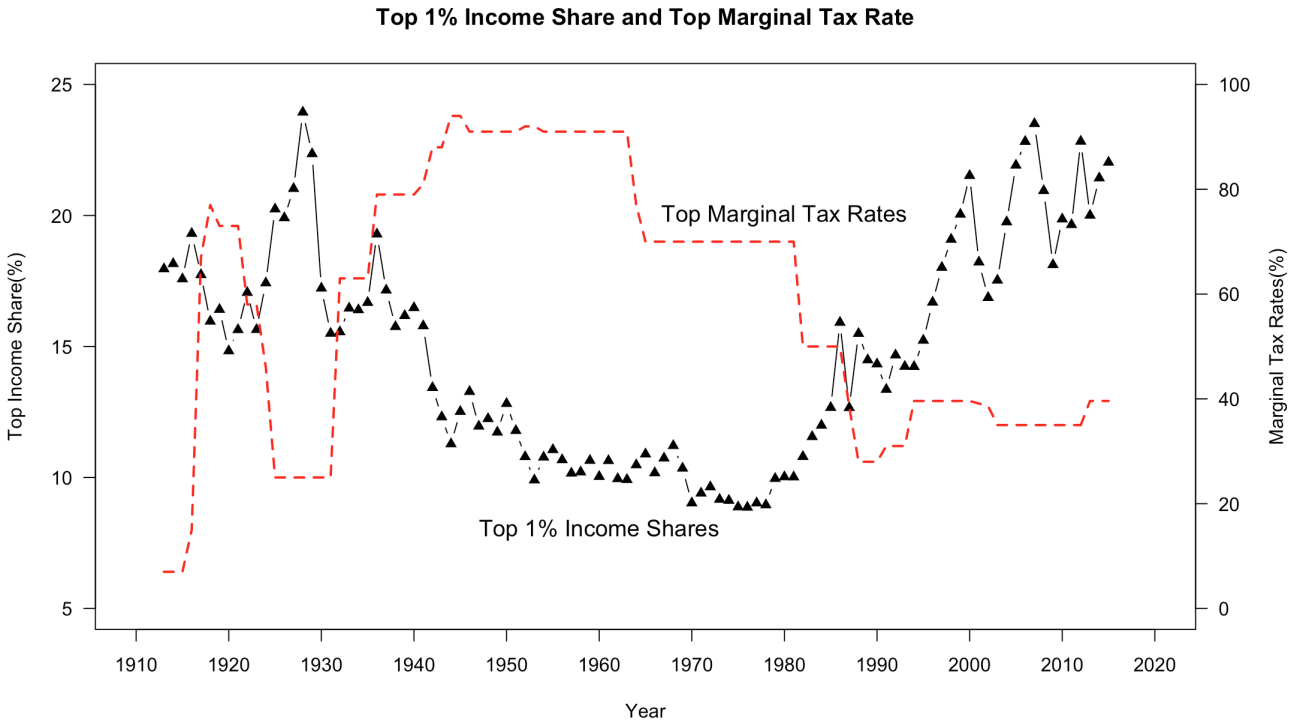
```
x.lab <- "Year"
y.lab <- "Income Shares (%)"
plot(P99_100 ~ Year, data = US.top.income.shares.15, xlab = x.lab, ylab = y.lab, xlim
 = c(1910, 2020), ylim = c(5, 25), xaxt = "n", type = "b", pch = 17)
axis(side = 1, at = seq(1910, 2020, by = 10), labels = seq(1910, 2020, by = 10))
lines(P95_99 ~ Year, data = US.top.income.shares.15, type = "b", pch = 17, col = "re
d")
lines(P90_95 ~ Year, data = US.top.income.shares.15, type = "b", pch = 17, col = "blu
e")
abline(h = seq(5, 25, by = 5), lty = 3)
abline(v = seq(1910, 2020, by = 10), lty = 3)
legend.text.1 <- c("Top 1% (incomes above $423,090 in 2015)", "Top 5-1% (incomes betw
een $174,240 and $423,090)", "Top 10-5% (incomes between $121,360 and $174,240)")
legend(x = 1940, y = 25, legend = legend.text.1, pch = 17, col = c("black", "red", "b
lue"))
main.title.1 <- "Decomposing the Top 10% US Income Share (1913 ~ 2015)"
title(main = main.title.1)
text(x = c(1924, 2007), y = c(23.5, 23.5), labels = c("1928", "2007"), pos = 3)
times.label <- c("The Great\nDepression", "The Great\nProsperity", "The Great\nRecess
ion")
text(x = c(1935, 1965, 2015), y = c(22, 8, 18), label = times.label, cex = 1.0, col =
 "red")
```



# 2. US Marginal Tax Rates

## 2.1 Top 1% Income Shares vs Marginal Tax Rates

```
par(mar = c(5, 6, 4, 6) + 0.1)
plot(P99_100 ~ Year, data = top.income_tax, type = "b", pch = 17, axes = FALSE, ann =
 FALSE, xlim = c(1910, 2020), ylim = c(5, 25))
box()
axis(side = 1, at = seq(1910, 2020, by = 10), labels = seq(1910, 2020, by = 10))
axis(side = 2, at = seq(5, 25, by = 5), labels = seq(5, 25, by = 5), las = 1, ylab =
"Top Income Share")
mtext("Top Income Share(%)", side = 2, line = 3)
par(new = TRUE)
plot(Marginal ~ Year, data = top.income_tax, type ="l", lty = 2, lwd = 2, col =
"red", axes = FALSE, ann = FALSE, xlim = c(1910, 2020), ylim = c(0, 100))
axis(side = 4, at = seq(0, 100, by = 20), labels = seq(0, 100, by = 20), las = 1)
mtext("Marginal Tax Rates(%)", side = 4, line = 3)
title(main = "Top 1% Income Share and Top Marginal Tax Rate", xlab = "Year")
text(x = 1980, y = 75, labels = "Top Marginal Tax Rates", cex = 1.2)
text(x = 1960, y = 15, labels = "Top 1% Income Shares", cex = 1.2)
```



# 2.2 Rates of Income Increases vs Marginal Tax Rates

```
par(mar = c(5, 6, 4, 6) + 0.1)
plot(Rate_99 ~ Year, data = top.income_tax, type = "b", pch = 24, col = "black", bg =
 "black", axes = FALSE, ann = FALSE, xlim = c(1910, 2020), ylim = c(0, 400))
lines(Rate_1 ~ Year, data = top.income_tax, type = "b", pch = 24, col = "black", bg =
 "white")
box()
axis(side = 1, at = seq(1910, 2020, by = 10), labels = seq(1910, 2020, by = 10))
axis(side = 2, at = seq(0, 400, by = 100), labels = seq(0, 400, by = 100), las = 1)
ylab.2 <- "Average Income (1913 = 100)"
mtext(ylab.2, side = 2, line = 3)
par(new = TRUE)
plot(Marginal ~ Year, data = top.income_tax, type ="l", lty = 2, col = "red", lwd =
2, axes = FALSE, ann = FALSE, xlim = c(1910, 2020), ylim = c(0, 100))
axis(side = 4, at = seq(0, 100, by = 20), labels = seq(0, 100, by = 20), las = 1)
ylab.4 <- "Marginal Tax Rates(%)"
mtext(ylab.4, side = 4, line = 3)
title(main = "Top 1% and Bottom 99% Income Growth\n(Excluding Capital Gains)", xlab =
 "Year")
legend("bottom", legend = c("Bottom 99%", "Top 1%"), pch = 24, col = "black", pt.bg =
 c("black", "white"), inset = 0.05)
text(x = 1925, y = 82, labels = "Top Marginal Tax Rates", cex = 1.2)
```