Difference-in-Difference Design: Effect of Federal Reserve Monetary Policy on Banking System

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This coding exercise was from the Statistics for Public Policy course taught by Dr. Matthew Levendusky at the University of Pennsylvania. Data was provided by the instructor and taken from Gary Richardson and William Troost's 2009 Journal of Political Economy article.

Background

After 1929 Stock Market Crash, Caldwell banks in Mississippi were located within two different Federal Reserve Districts, 6th and 8th. 6th district lent money to keep banks afloat, but 8th did not offer any aid.

Calculate difference-indifference estimate

Lending policy in 6th district saved 19 additional banks

```r
# Load data and packages
library(readstata13)
failure <- read.dta13(file = "bank_diff_in_diff.dta")
attach(failure)

# View data
failure

# Difference-in-difference estimator (use 1929 and 1930)
(121-135) - (132-165)
```

```
##   year bib6 bib8
## 1 1929  141  169
## 2 1930  135  165
## 3 1931  121  132
## 4 1932  113  120
## 5 1933  102  111
## 6 1934  102  109
## [1] 19
```
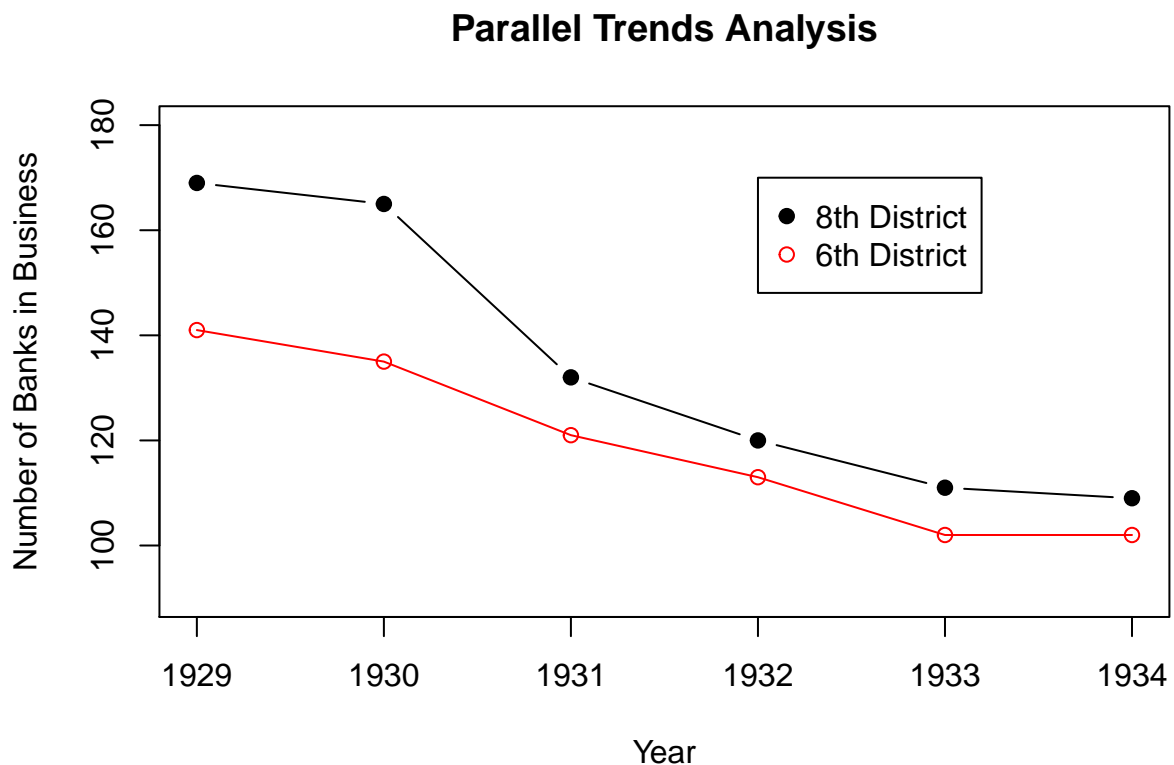
Parallel Trends Analysis

```r
plot(x = year,
     y = bib8,
     type = "b",
     pch = 19,
     col = "black",
     xlab = "Year",
     ylab = "Number of Banks in Business",
     ylim = c(90,180),
     main = "Parallel Trends Analysis")

points(x = year, y = bib6, col = "red", pch = 21)

lines(x = year, y = bib6, col = "red")

legend(x = 1932,
       y = 170,
       legend = c("8th District","6th District"),
       pch = c(19,21),
       col = c("black","red"))
```


Add counter-factual 6th district on the graph

If there was no Federal Reserve intervention

```r
# Calculate counte-factual
diff <- bib8 - bib6
counter.fact <- ifelse(year == 1929, bib6, bib8 - diff[year == 1930])


plot(x = failure$year,
     y = failure$bib8,
     type = "b",
     pch = 19,
     col = "black",
     xlab = "Year",
     ylab = "Number of Banks in Business",
     ylim = c(75,180),
     main = "Counter-Factual Trends Analysis")

points(x = year, y = bib6, col = "red", pch = 21)
lines(x = year, y = bib6, col = "red")

points(x = year, y = counter.fact, col = "blue", pch = 23)
lines(x = year, y = counter.fact, col = "blue", lty = 2)

legend(x = 1932,
       y = 170,
       legend = c("8th District","6th District", "Counter-Factual 6th District"),
       pch = c(19,21, 23),
       col = c("black","red", "blue"))
```
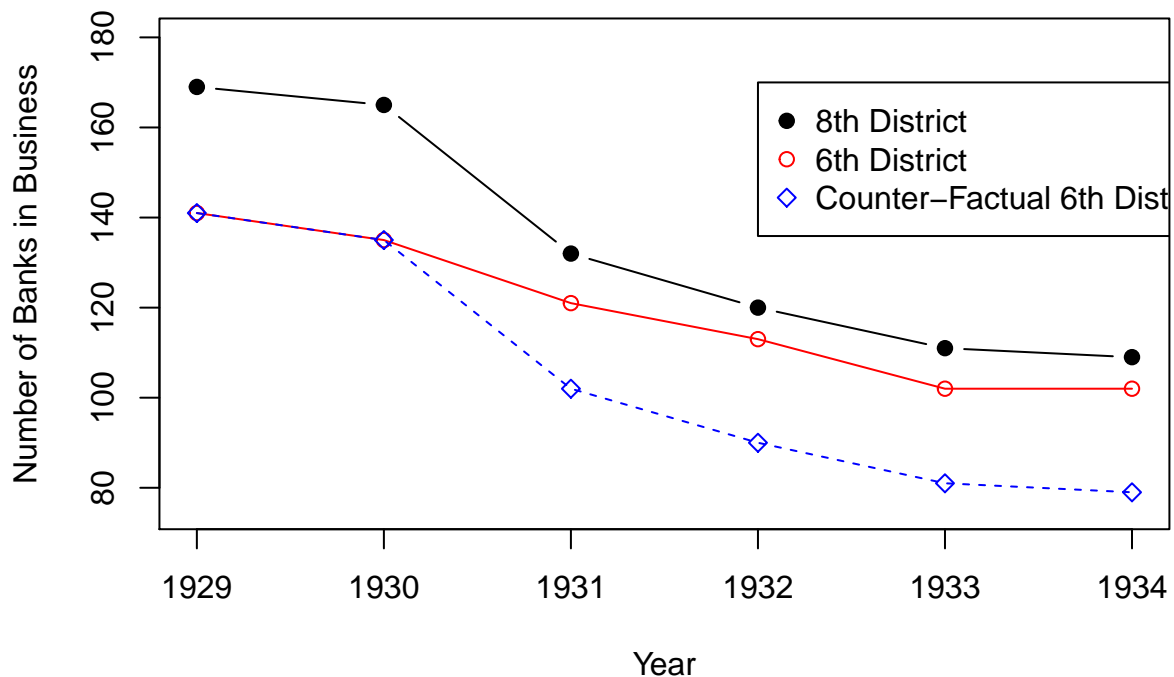

Counter−Factual Trends Analysis

Run regression with interactions terms

```
bank.fit <- read.dta13(file = "did_bank_reg.dta")

summary(lm(banks ~ treat * post, bank.fit))
```

```
##
## Call:
## lm(formula = banks ~ treat * post, data = bank.fit)
##
## Residuals:
##     Min     1Q Median     3Q    Max
## -9.000 -7.125  0.000  3.125 14.000
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   167.000      6.190  26.980 3.83e-09 ***
## treat         -29.000      8.754  -3.313 0.010652 *
## post          -49.000      7.581  -6.464 0.000195 ***
## treat:post     20.500     10.721   1.912 0.092224 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.754 on 8 degrees of freedom
## Multiple R-squared:  0.8906, Adjusted R-squared:  0.8496
## F-statistic: 21.71 on 3 and 8 DF,  p-value: 0.0003369
```

Interpret coefficients and interaction terms

```
# Number of banks in district 8, pre-1931
  167

# Number of banks in district 6, pre-1931:
  167 - 29

# Number of banks in district 8, post-1931:
  167 - 49

# Number of banks in district 6, post-1931:
  167 - 29 - 49 + 20.5
```

```
## [1] 167
## [1] 138
## [1] 118
## [1] 109.5
```