

# Métodos causales con R

Magno Coloquio Internacional de Posgrado en  
Economía

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# Lo que veremos En esta plática

## 1. Antes de empezar

- \* Sobre mi
- \* Causalidad
- \* ¿Por qué R?

## 2. La causalidad en los tiempos del cólera

Viajemos a 1858.

## 3. Diferencias en Diferencias

Spoilers

## 4. Otros modelos

Variables Instrumentales

Control sintético

# Causalidad

“Relación que se establece entre causa y efecto”

**Wikipedia**

Dos condiciones necesarias pero no suficientes para que A sea causa de B son:

- Que A preceda a B en el tiempo
- Que A y B estén relativamente próximos en el espacio y tiempo

**Wikipedia**

# Preguntas sobre las preguntas

1. ¿Cuál es la relación causal de interés?
2. ¿Cuál es el experimento que podría usarse de manera ideal para capturar el efecto causal de interés?
3. ¿Cuál es tu estrategia de identificación?
4. ¿Cuál es tu modo de inferencia estadística?

# El problema de selección

$$\text{resultado potencial} = \begin{cases} Y_{1i} & \text{si } D_i = 1 \\ Y_{0i} & \text{si } D_i = 0 \end{cases}$$

$$= Y_{0i} + (Y_{1i} - Y_{0i})D_i$$

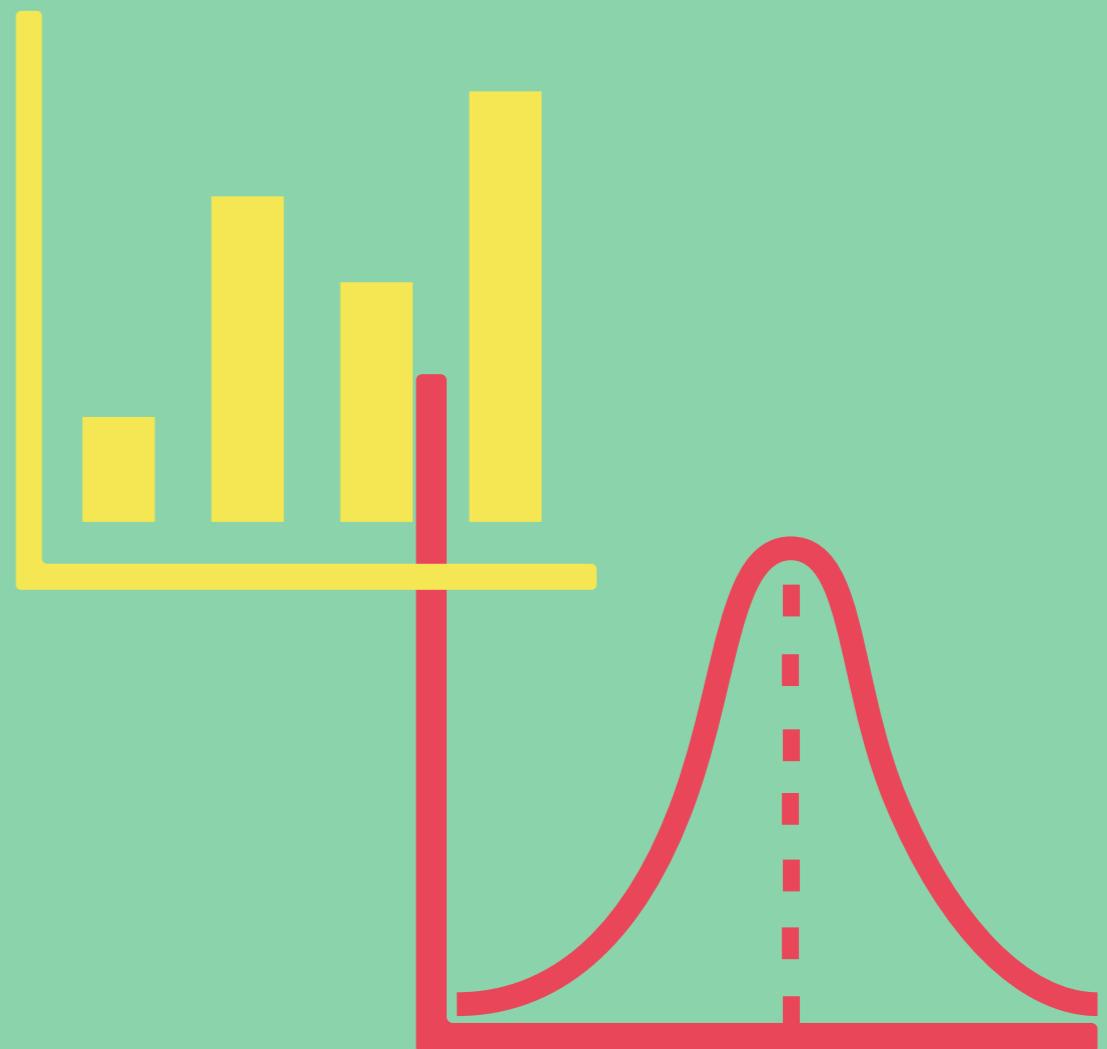
Efecto promedio del tratamiento

$$\begin{aligned} E[Y_i | D_i = 1] - E[Y_i | D_i = 0] &= \\ (E[Y_{1i} | D_i = 1] - E[Y_{0i} | D_i = 1]) + \\ (E[Y_{0i} | D_i = 1] - E[Y_{0i} | D_i = 0]) \end{aligned}$$

Sesgo de selección

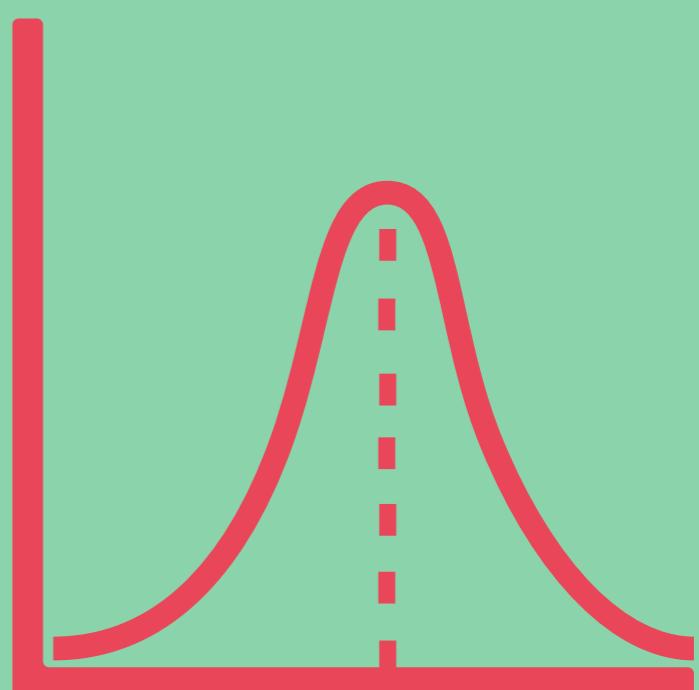
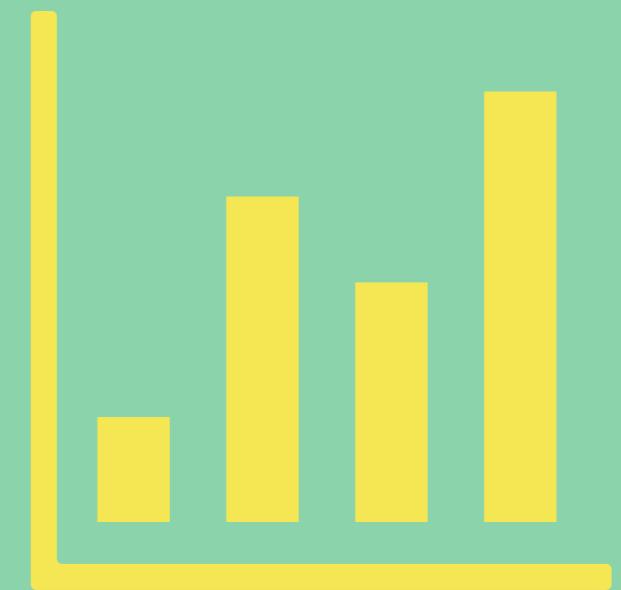
# Por qué R y RStudio

- Es software libre
- Paqueterías en CRAN
- Amplia comunidad de soporte
- Adopción y crecimiento
- Software libre



[https://github.com/  
MariusAgm/metodos-  
causales](https://github.com/MariusAgm/metodos-causales)

- Entra en la página
- Puedes descargar todo el proyecto o sólo el script
- El script se llama diff-in-diff.R



# Causalidad en los tiempos del Córrea

## Cómo John Snow descubrió las causas de una pandemia

- Han habido 7 pandemias de cólera en los últimos 200 años, cobrando la vida de más de 40 millones de personas
- En 1854 hubo un brote en Londres, Inglaterra que mató a 616 personas
- La hipótesis dominante era la del miasma.
- Aún no se desarrollaba la teoría de los gérmenes





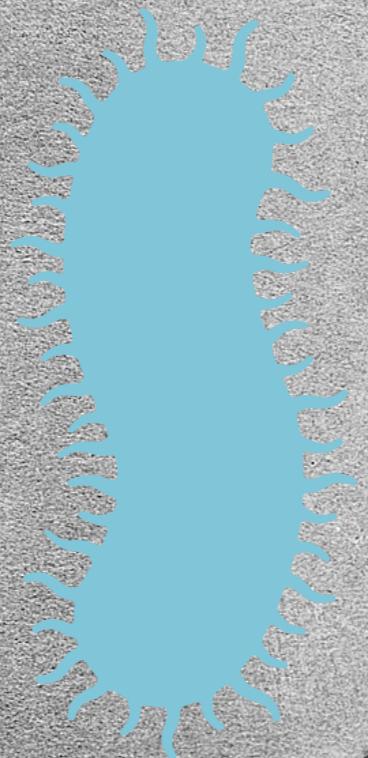
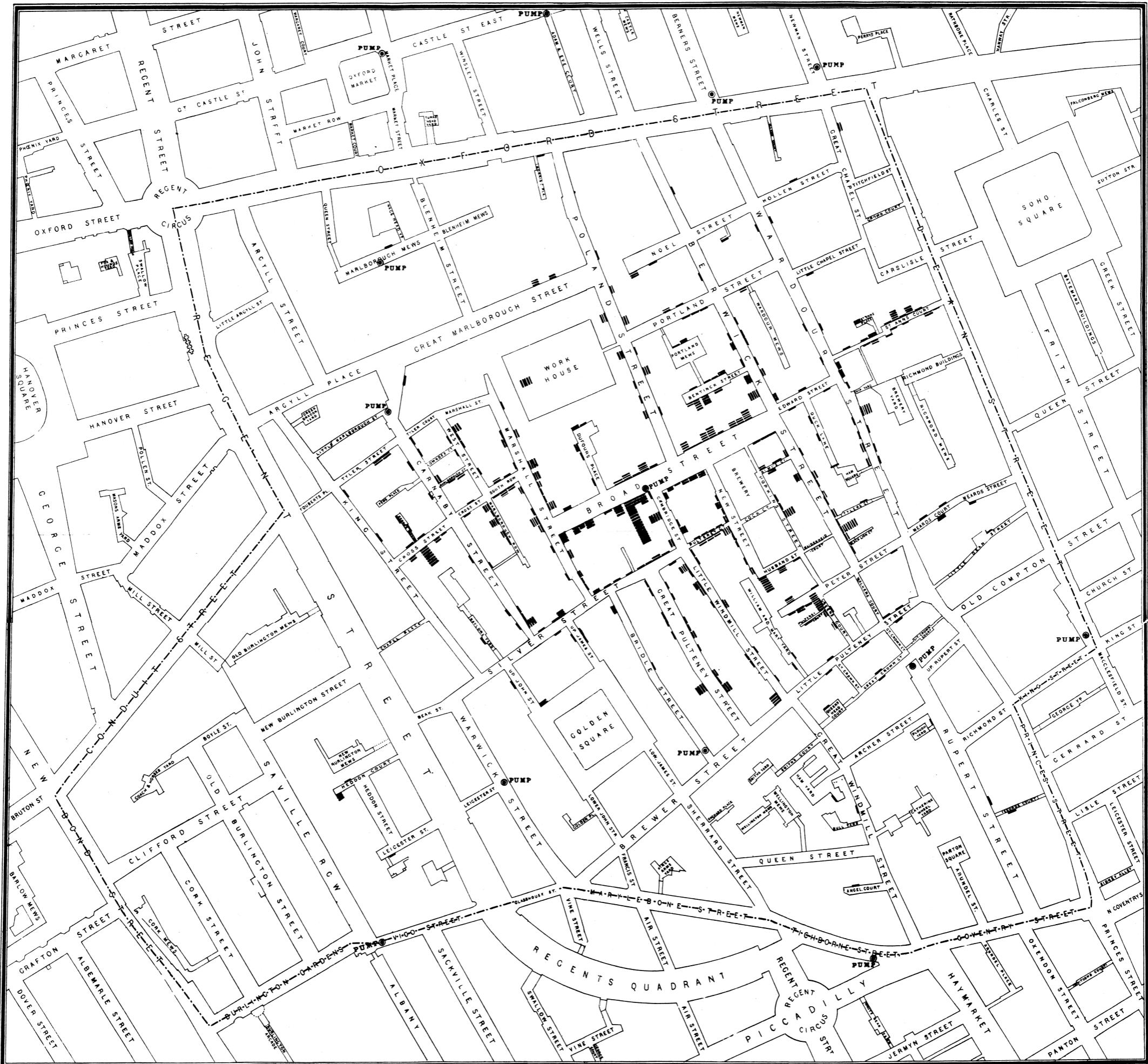


FIGURE 5.7  
John Snow's DD recipe

TABLE XII.

Sub-Districts.	Deaths from Cholera in 1849.	Deaths from Cholera in 1854.	Water Supply.
St. Saviour, Southwark .	283	371	Southwark & Vauxhall Company only.
St. Olave . . .	157	161	
St. John, Horsleydown .	192	148	
St. James, Bermondsey .	249	362	
St. Mary Magdalen .	259	244	
Leather Market . .	226	237	
Rotherhithe*	352	282	
Wandsworth . . .	97	59	
Battersea . . .	111	171	
Putney . . .	8	9	
Camberwell . . .	235	240	
Peckham . . .	92	174	
Christchurch, Southwark	256	113	Lambeth Company, and Southwark and Vauxhall Compy.
Kent Road . . .	267	174	
Borough Road . . .	312	270	
London Road . . .	257	93	
Trinity, Newington .	318	210	
St. Peter, Walworth .	446	388	
St. Mary, Newington .	143	92	
Waterloo Road (1st)	193	58	
Waterloo Road (2nd)	243	117	
Lambeth Church (1st)	215	49	
Lambeth Church (2nd)	544	193	
Kennington (1st) .	187	303	
Kennington (2nd) .	153	142	
Brixton . . .	81	48	
Clapham . . .	114	165	
St. George, Camberwell	176	132	
Norwood . . .	2	10	Lambeth Company only.
Streatham . . .	154	15	
Dulwich . . .	1	—	
Sydenham . . .	5	12	
First 12 sub-districts .	2261	2458	Southwk. & Vauxhall.
Next 16 sub-districts .	3905	2547	Both Companies.
Last 4 sub-districts .	162	37	Lambeth Company.

\* A small part of Rotherhithe is now supplied by the Kent Water Company.



# Cómo salvar los bancos de una crisis económica (o al menos evitar que quiebren tantos)

- La Reserva Federal en EEUU dividía Mississippi entre el distrito 6 (Atlanta) y el 8 (St. Louis).
- Durante la Gran Depresión, las políticas de estos distritos diferían.
- Atlanta tenía como política la extensión de ayuda a los bancos que se encontraban en problemas.
- St. Louis estaba en contra de extender créditos a los bancos cuando lo requerían.

# **Monetary Intervention Mitigated Banking Panics during the Great Depression: Quasi- Experimental Evidence from a Federal Reserve District Border, 1929–1933**

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The Federal Reserve Act divided Mississippi between the 6th (Atlanta) and 8th (St. Louis) Districts. During the Great Depression, these districts' policies differed. Atlanta championed monetary activism and the extension of aid to ailing banks. St. Louis eschewed expansionary initiatives. During a banking crisis in 1930, Atlanta expedited lending

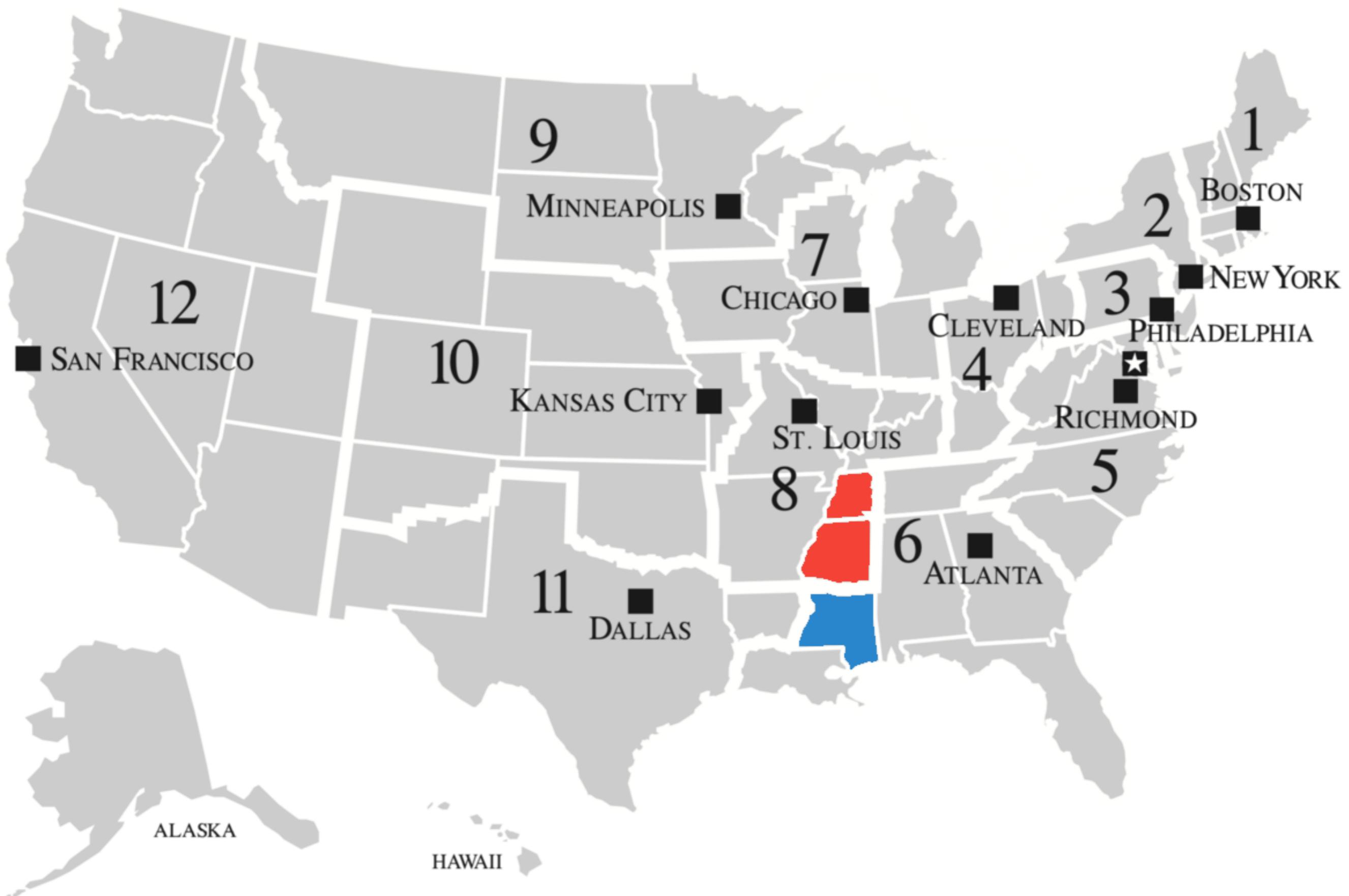


TABLE 5.1  
Wholesale firm failures and sales in 1929 and 1933

	1929	1933	Difference (1933–1929)
Panel A. Number of wholesale firms			
Sixth Federal Reserve District (Atlanta)	783	641	–142
Eighth Federal Reserve District (St. Louis)	930	607	–323
Difference (Sixth–Eighth)	–147	34	181
Panel B. Net wholesale sales (\$ million)			
Sixth District Federal Reserve (Atlanta)	141	60	–81
Eighth District Federal Reserve (St. Louis)	245	83	–162
Difference (Sixth–Eighth)	–104	–23	81

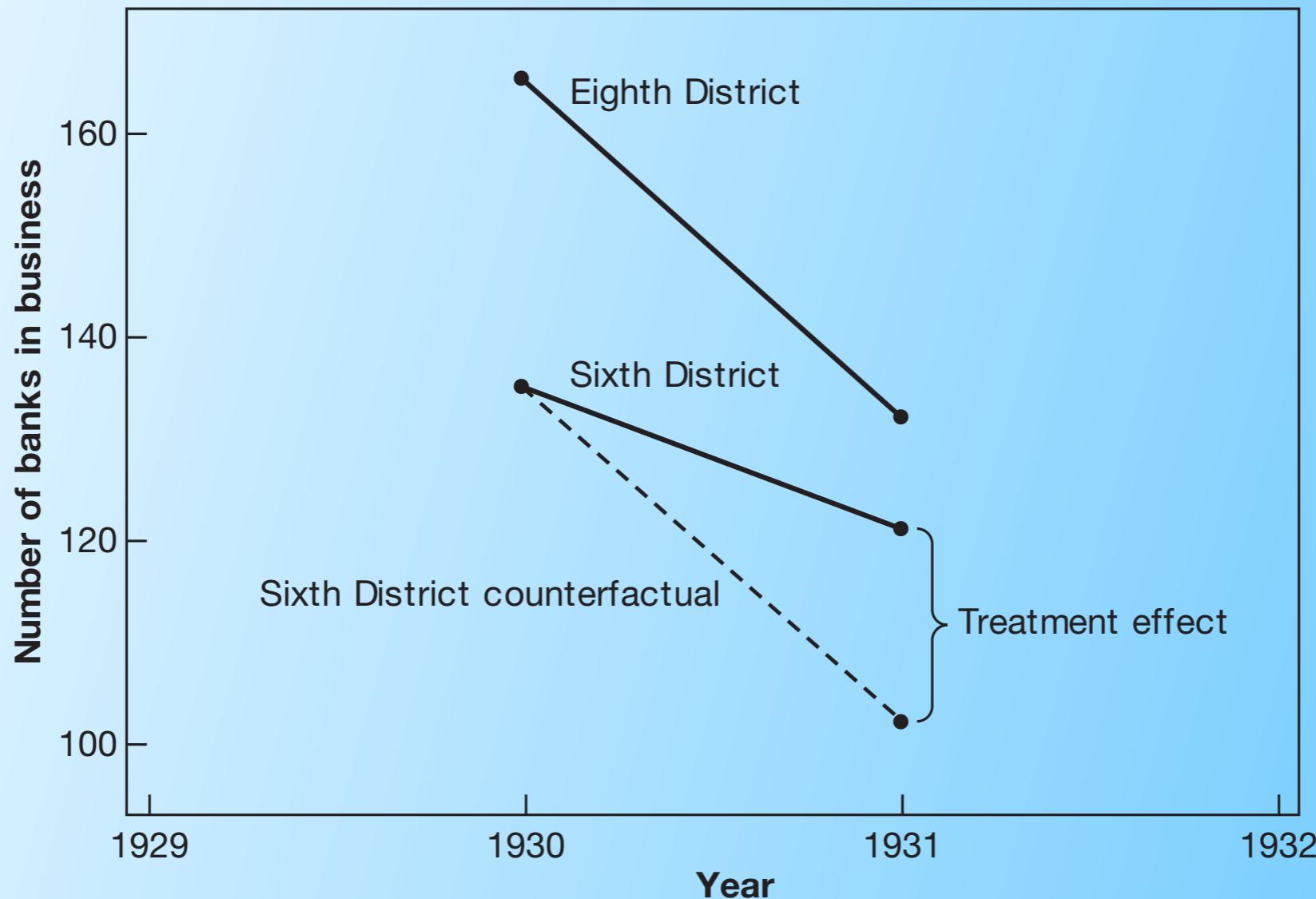
*Notes:* This table presents a DD analysis of Federal Reserve liquidity effects on the number of wholesale firms and the dollar value of their sales, paralleling the DD analysis of liquidity effects on bank activity in Figure 5.1.

# ¿Cómo sabemos que Podemos realizar esta comparación?

- Estamos aprovechando que está dentro del mismo estado
- Las políticas de los distritos preceden a la Gran Depresión
- Las políticas se aplicaron en las jurisdicciones respectivas

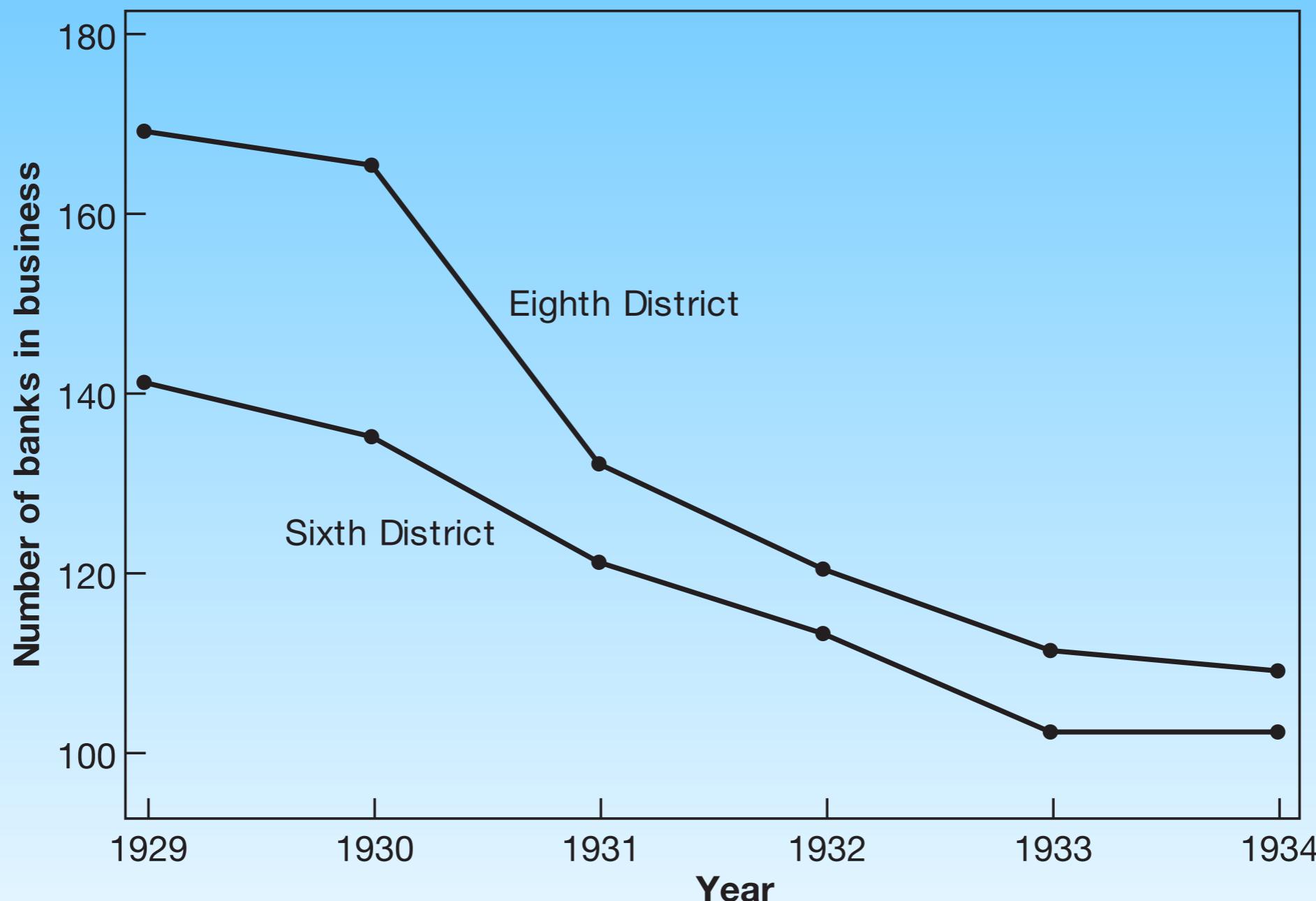
$$\delta_{DD} = (Y_{6,1931}-Y_{6,1930})-(Y_{8,1931}-Y_{8,1930})$$

FIGURE 5.1  
Bank failures in the Sixth and Eighth Federal Reserve Districts



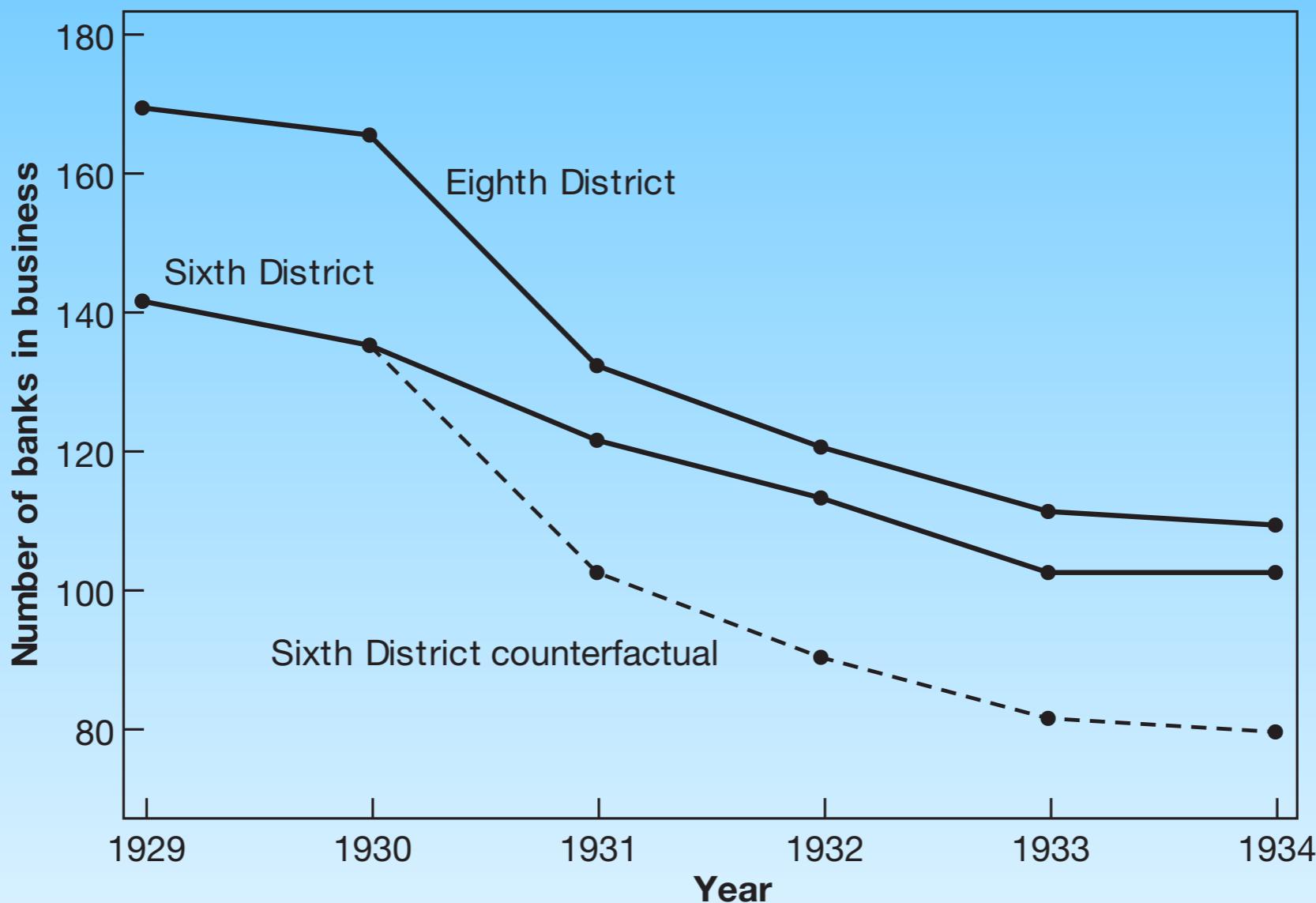
**Notes:** This figure shows the number of banks in operation in Mississippi in the Sixth and Eighth Federal Reserve Districts in 1930 and 1931. The dashed line depicts the counterfactual evolution of the number of banks in the Sixth District if the same number of banks had failed in that district in this period as did in the Eighth.

FIGURE 5.2  
Trends in bank failures in the Sixth and Eighth Federal Reserve Districts



Note: This figure shows the number of banks in operation in Mississippi in the Sixth and Eighth Federal Reserve Districts between 1929 and 1934.

FIGURE 5.3  
Trends in bank failures in the Sixth and Eighth Federal Reserve Districts, and the Sixth District's DD counterfactual



*Notes:* This figure adds DD counterfactual outcomes to the banking data plotted in Figure 5.2. The dashed line depicts the counterfactual evolution of the number of banks in the Sixth District if the same number of banks had failed in that district after 1930 as did in the Eighth.

$$\delta_{DD} = (Y_{6,1931}-Y_{8,1931})-(Y_{6,1930}-Y_{8,1930})$$

$$Y_{dt} = \alpha + \beta \text{TRAT}_d + \gamma \text{POST}_t + \delta_{rDD} (\text{TRAT}_d \times \text{POST}_t) + e_{dt}$$

# Gracias



@marionomics