What Happened to the US Economy During the 1918 Influenza Pandemic? A View Through High-Frequency Data

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European Macro History Online Seminar
21 Apr 2020

Disclaimers

- The views presented here do not necessarily reflect...

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- This is not my century!

The 1918 Pandemic

- was until now the last deadly pandemic
  - 1st wave (spring 1918), virulent but not very deadly
  - 2d wave (autumn 1918), simultaneous in Europe and U.S.
  - 3d wave (winter 1919) in some places
- economic impact hard to trace, even in the richest countries
  - US: pre-NIPA, BLS and FRB data collection just beginning
  - timing makes reliance on annual data tricky
- small literature (for now...)
  - Barro, Ursúa, and Weng (2020): cross-country, annual data: big effects of pandemic
  - Brainerd and Siegler (2002): higher growth in more affected states after 1918
  - Correia, Luck, and Verner (2020): lower output, employment, bank balance sheets five years after
- my approach: US only, high-frequency data during the pandemic, supplemented with contemporaneous qualitative evidence
  - very old-school, à la Burns and Mitchell

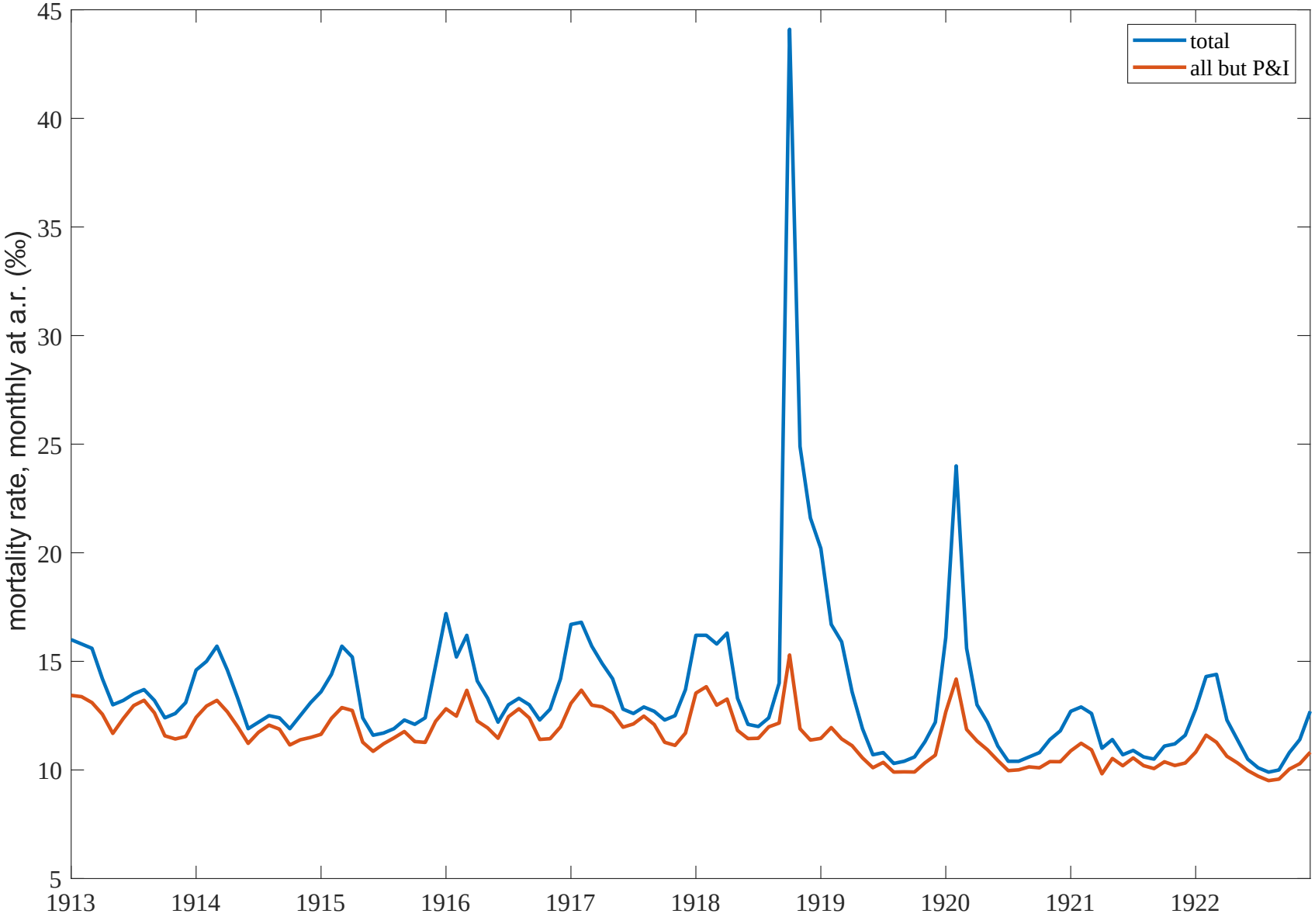
Punchline

the recession of 1918–19 was of "exceptional brevity and moderate amplitude" (Burns and Mitchell, 1946, p. 109)

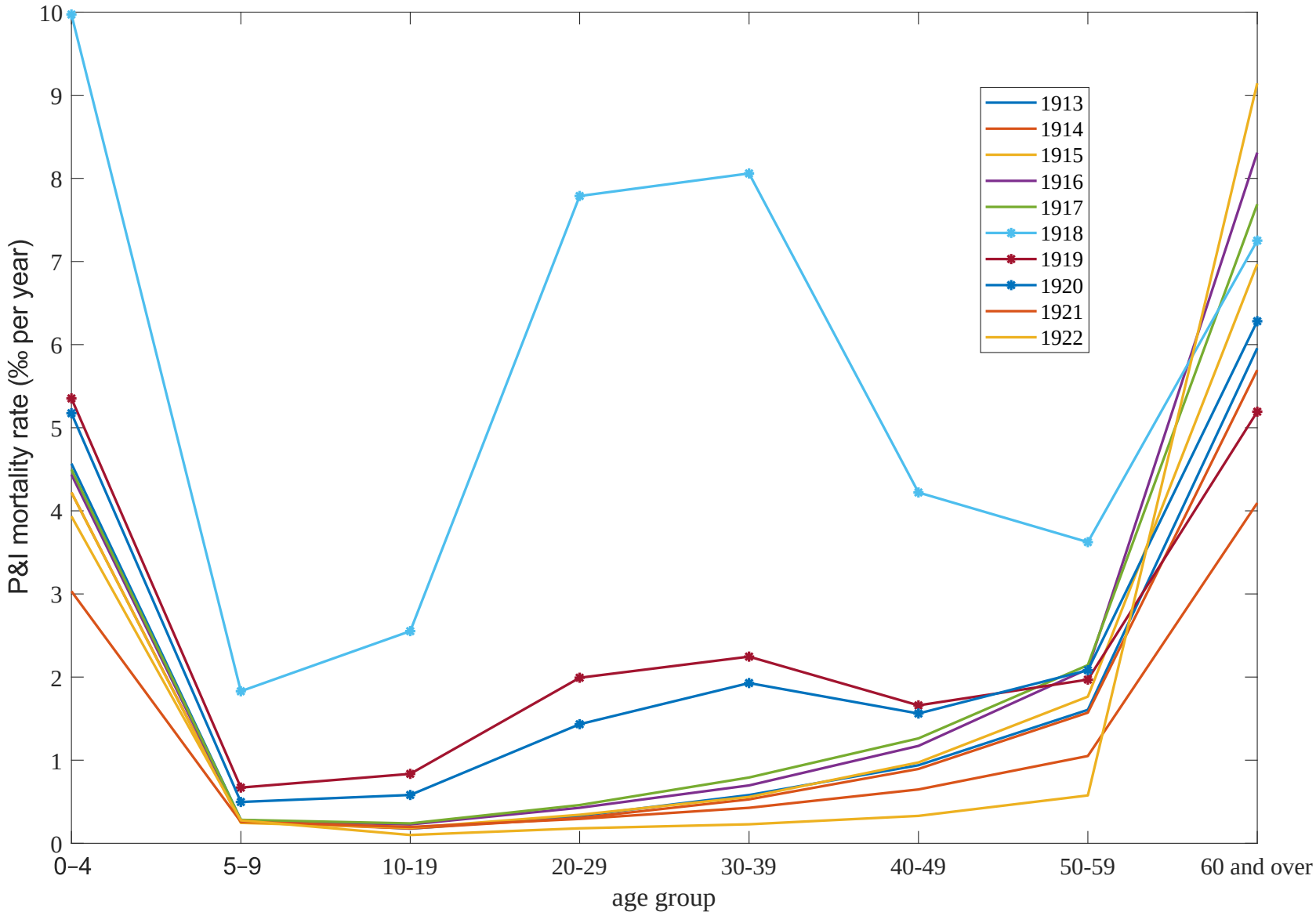
Mortality: Technicalities and Data Sources

- Only thirty states provided vital statistics at the time
- Collins et al. (1930): weekly data on 47 US cities
- no data whatsoever on infections/cases
  - rely on deaths
  - which deaths? pneumonia (all forms) and influenza (P&I)

Mortality: national level



Signature of the 1918 pandemic

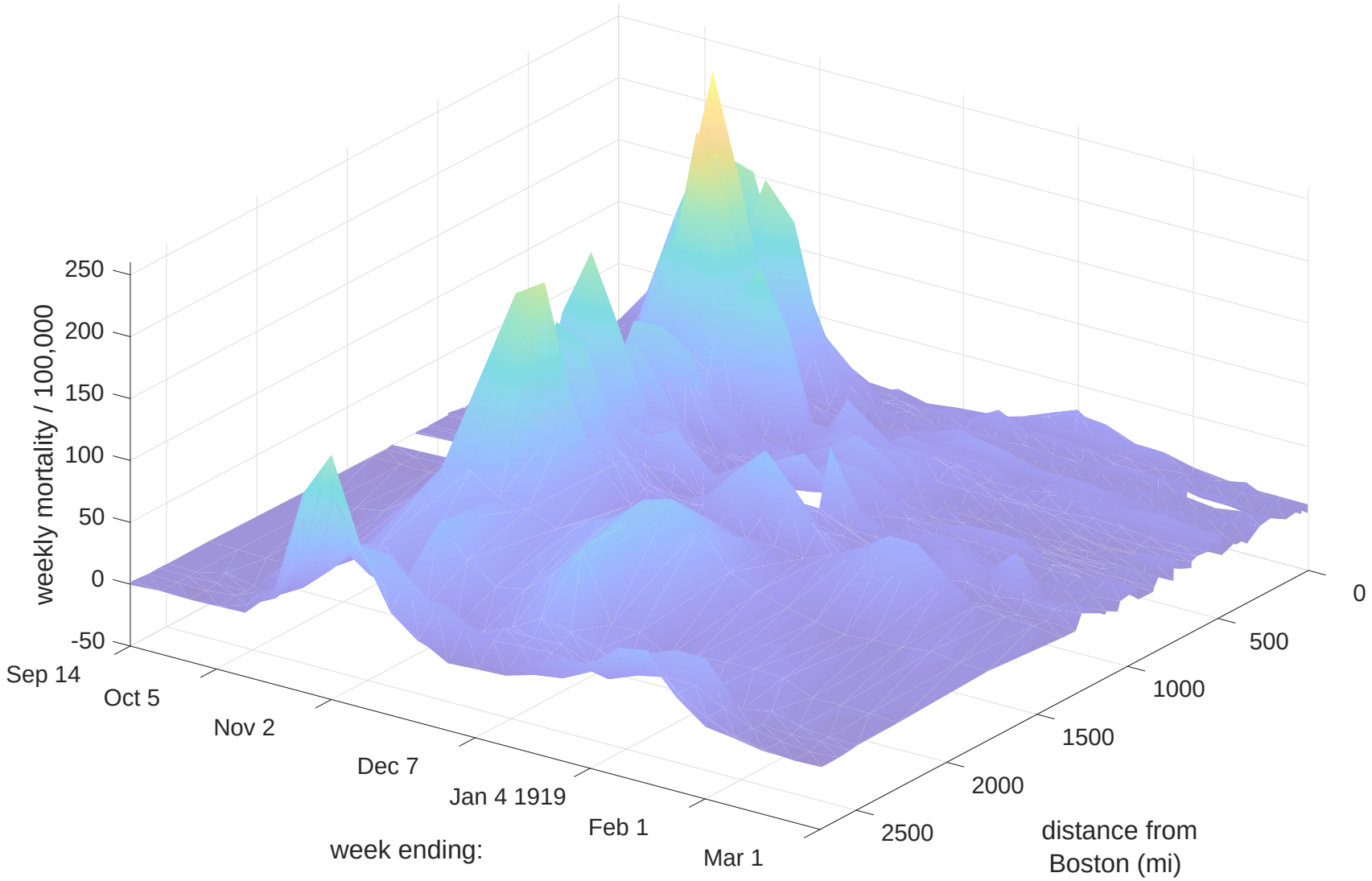


Impact on population, labor force

	excess mortality				
	all ages		ages 20–60		
	Jul 1918-Jun 1919	Jul 1919-Jun 1920	1918	1919	1920
in thousands	516	72	300	65	52
as % of population (103m)	0.50	0.07			
as % of 20-60 age group			0.56	0.12	0.10
as % of labor force (39m)			0.77	0.17	0.13

- WWI draft: 4m men, casualties: 116,000

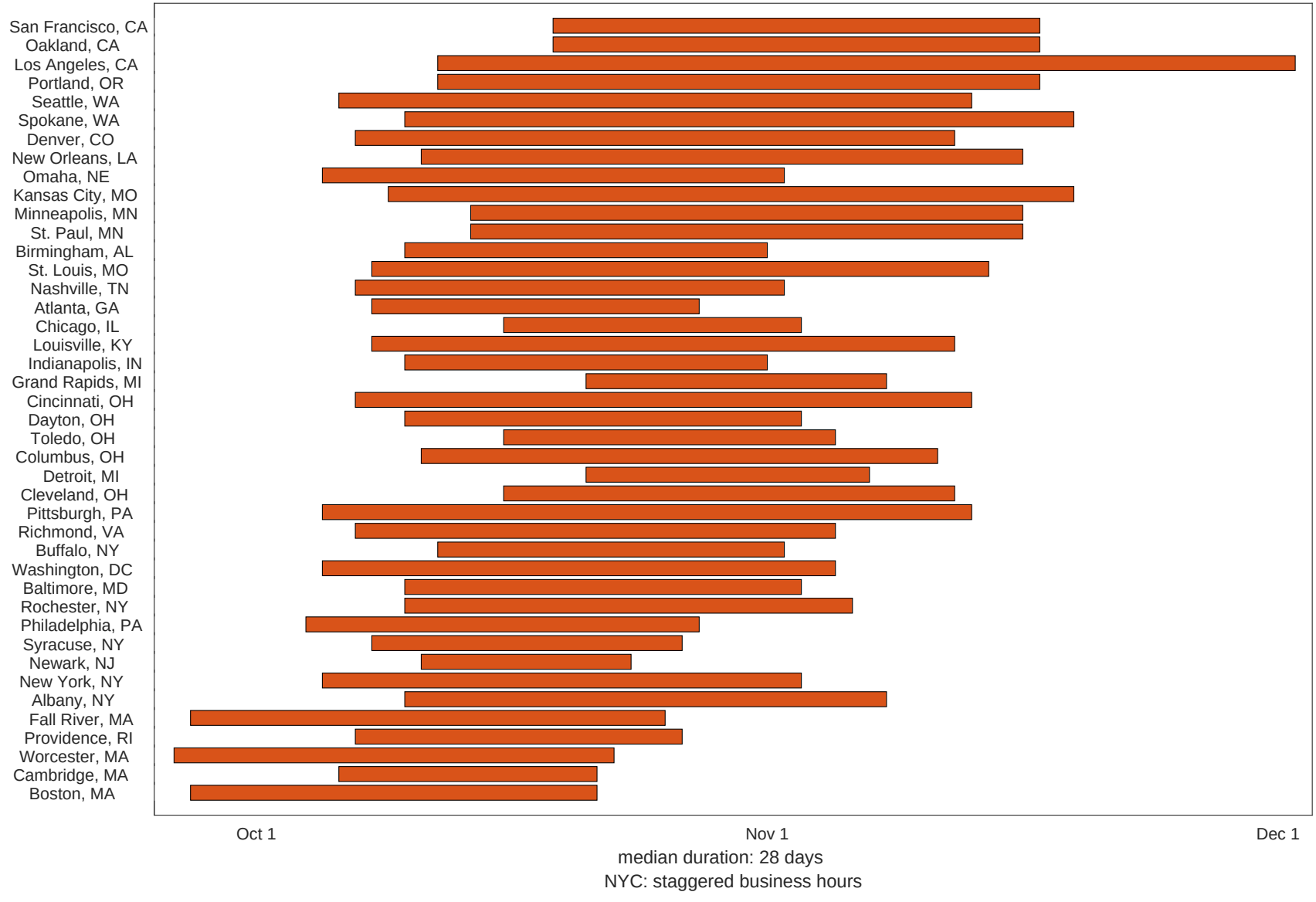
Data from 47 US cities



The second (main) wave

- characteristics
  - started in September 1918 in New England
  - spread quickly, largely over by December 1918
  - large variation in peak mortality
  - in some places, a third wave
- economic impact
  - labor force (unusual "W shape" of mortality + virulence)
  - non-pharmaceutical interventions (NPIs), at the city/state level
  - "social distancing"
    - almost all cities closed schools, churches, entertainment, large gatherings (notable exception: NYC)
    - efforts to reduce congestion: staggered business hours in some places
  - quarantine and isolation of infected individuals: less or no economic impact

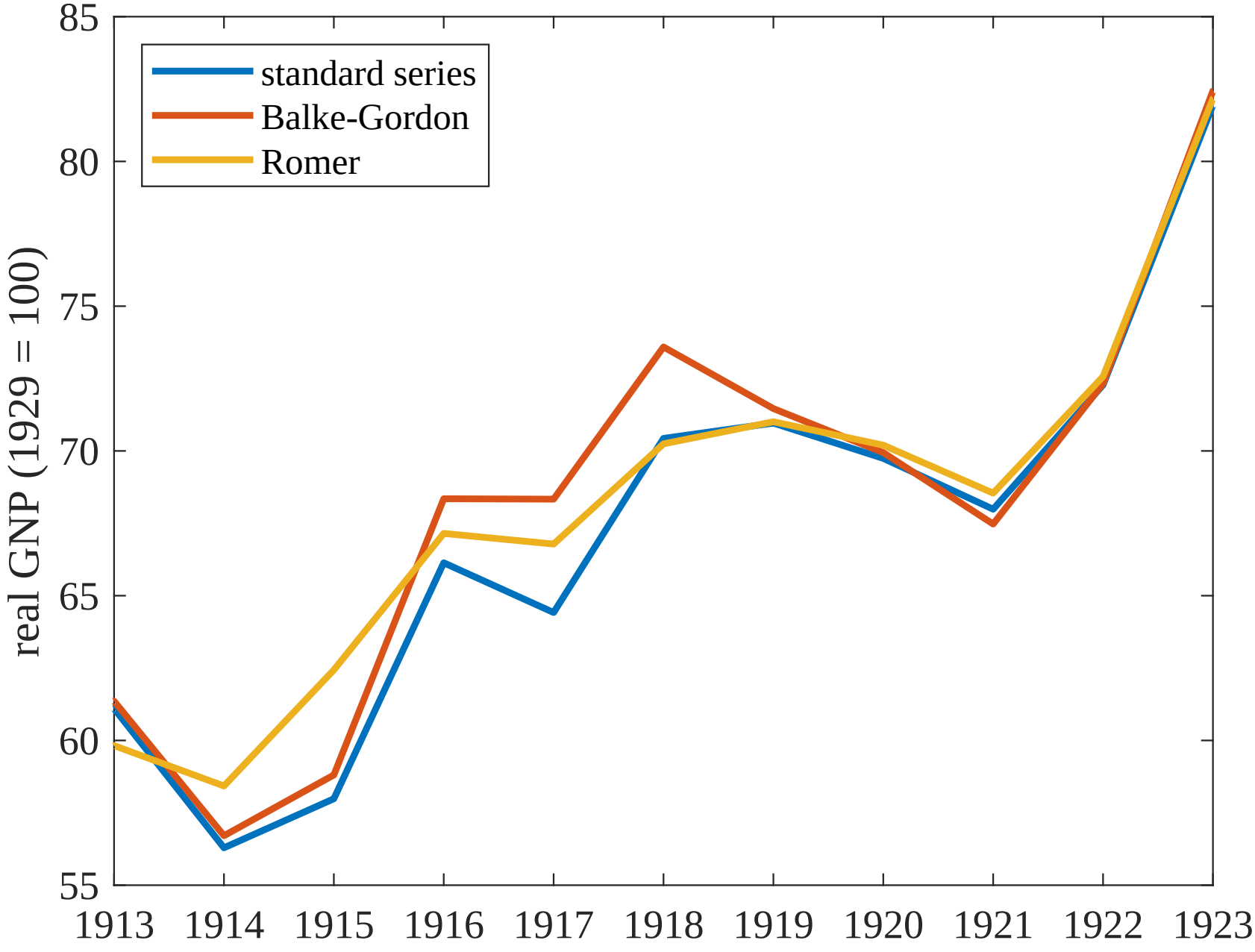
Duration of closings



median duration: 28 days

NYC: staggered business hours

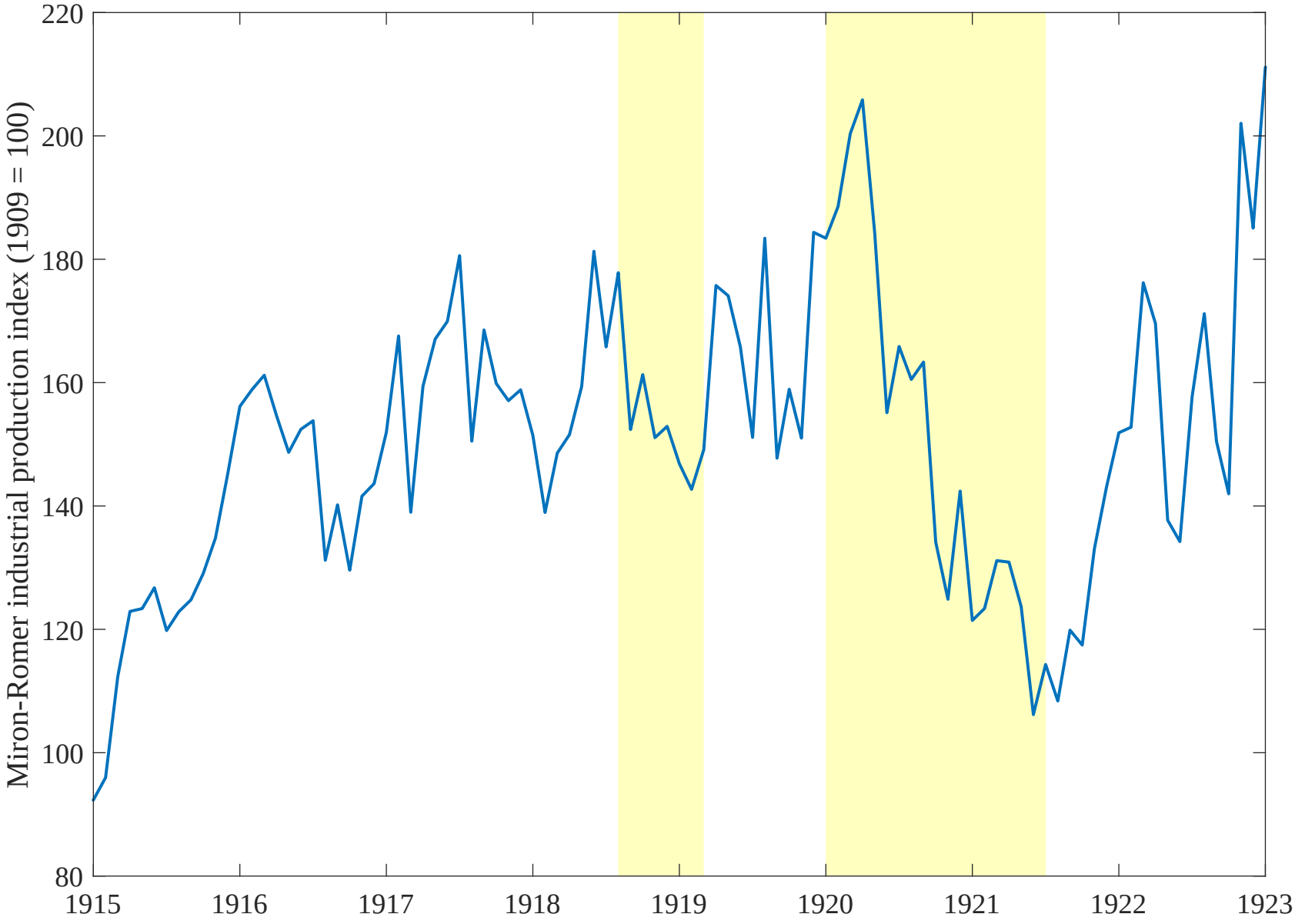
Looking for Impact: Estimates of annual GNP



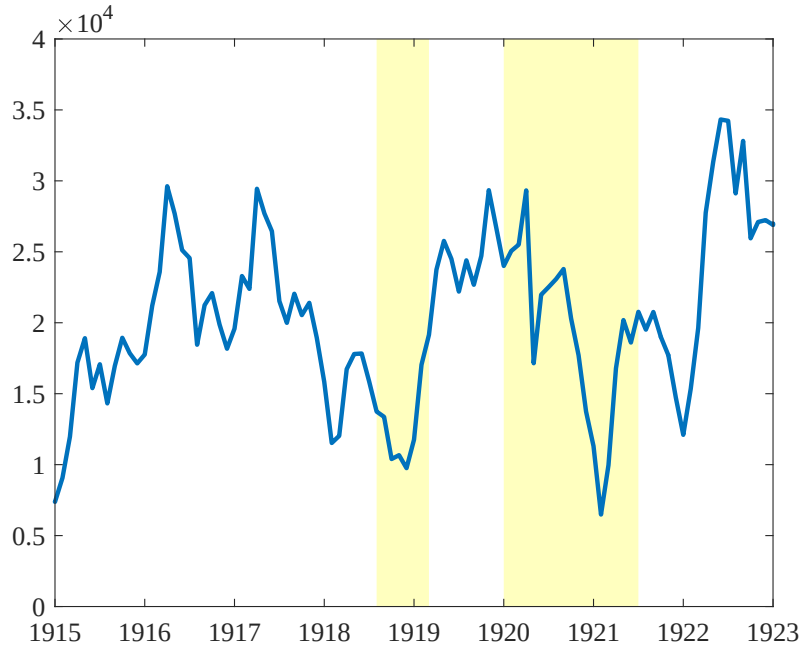
Drilling down

- recession in 1920–21 very clear in aggregate data
- 1918? much less so (all three series show 1918 GNP higher than 1917)
- annual data too coarse given the timing of the epidemic
- there is lots of data
  - business people were obsessed with numbers and nowcasting
  - beginnings of data collection (BLS) and analysis (NBER, R.E.Stat.)
- next few slides: sequence of monthly series, with NBER "yellow stripes"

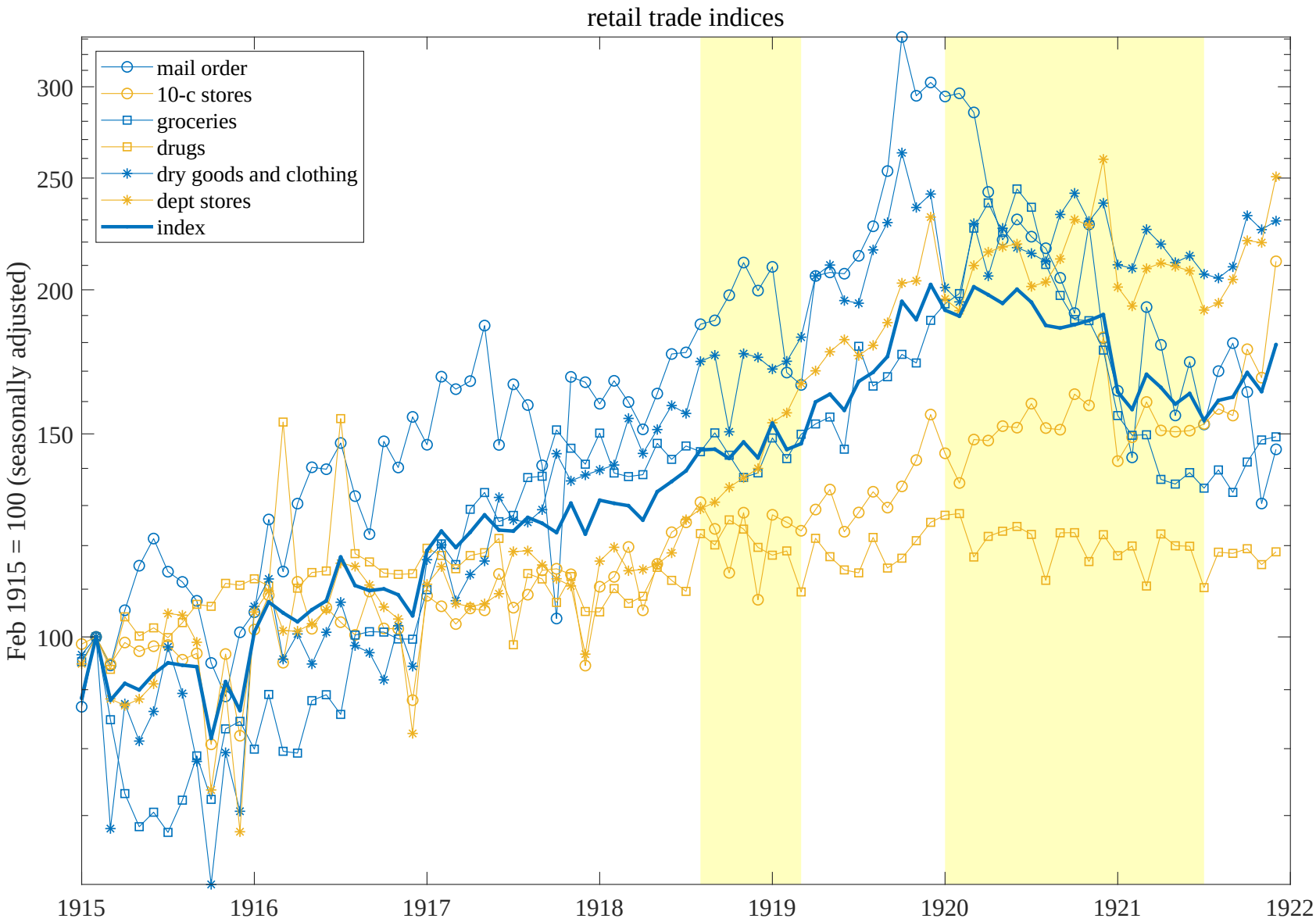
Industrial production



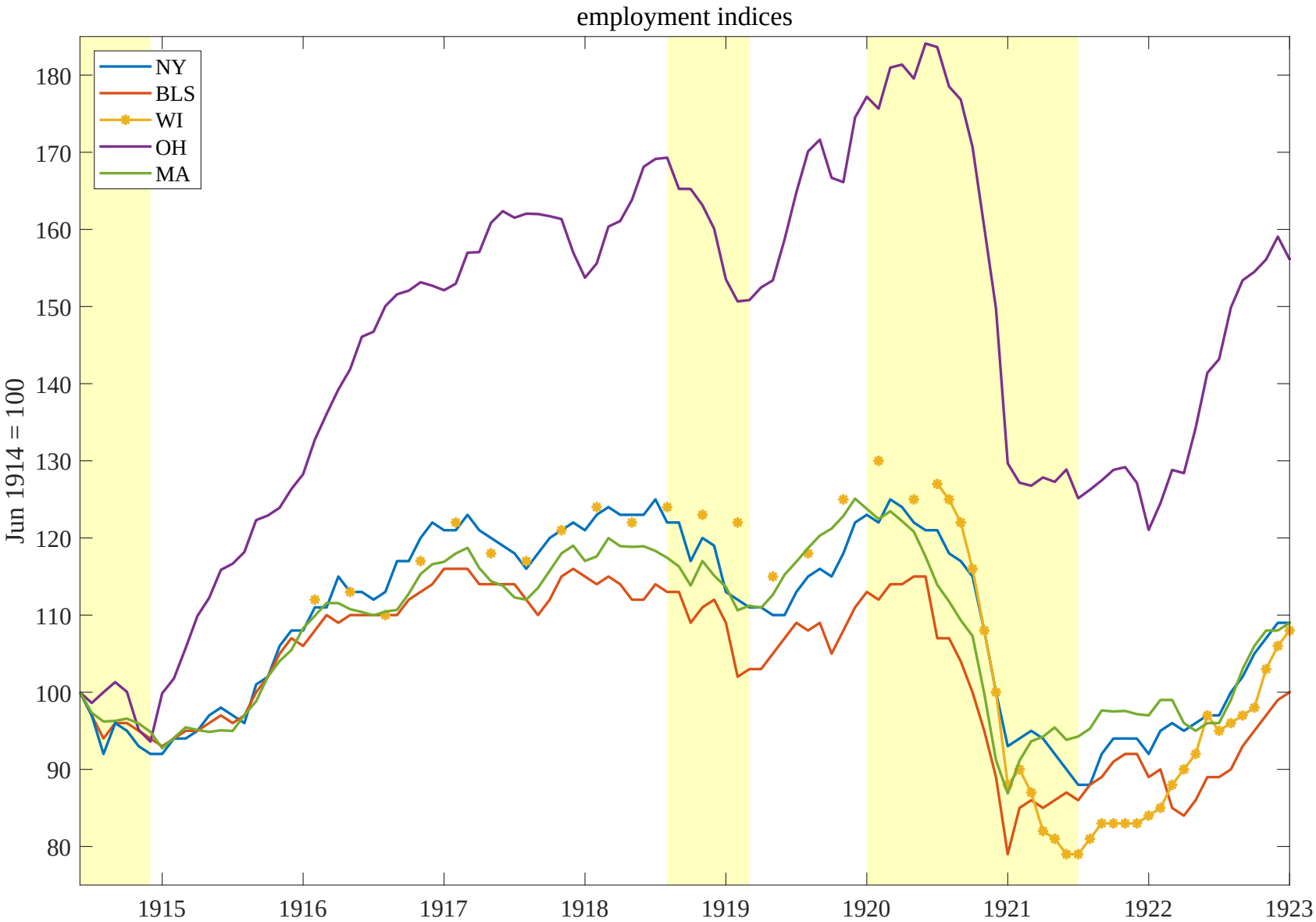
Autos


×10^4
4
3.5
3
2.5
2
1.5
1
0.5
0
1915
1916
1917
1918
1919
1920
1921
1922
1923

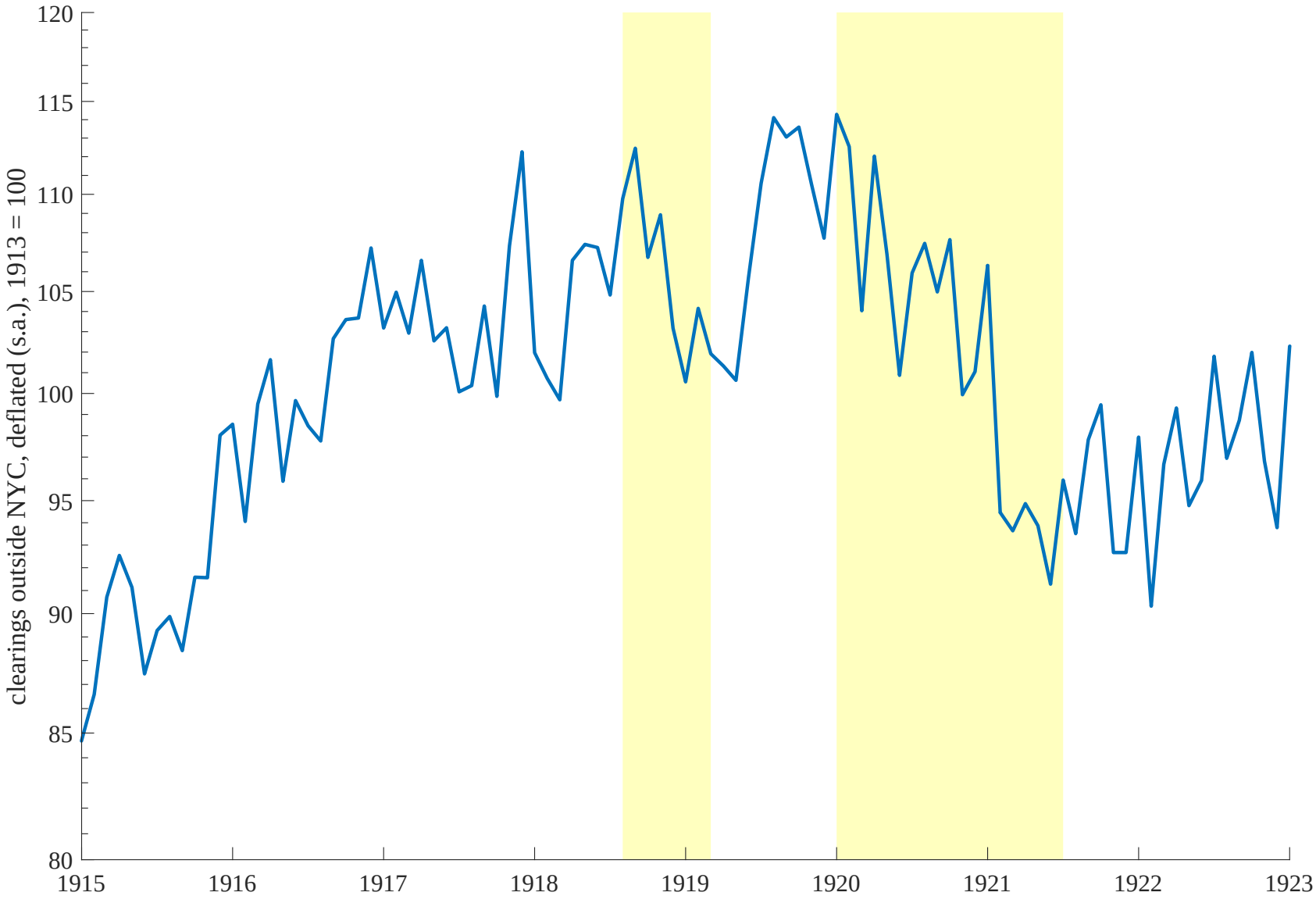
Retail


retail trade indices
mail order
10-c stores
groceries
drugs
dry goods and clothing
dept stores
index
Feb 1915 = 100 (seasonally adjusted)
300
250
200
150
100
1915
1916
1917
1918
1919
1920
1921
1922

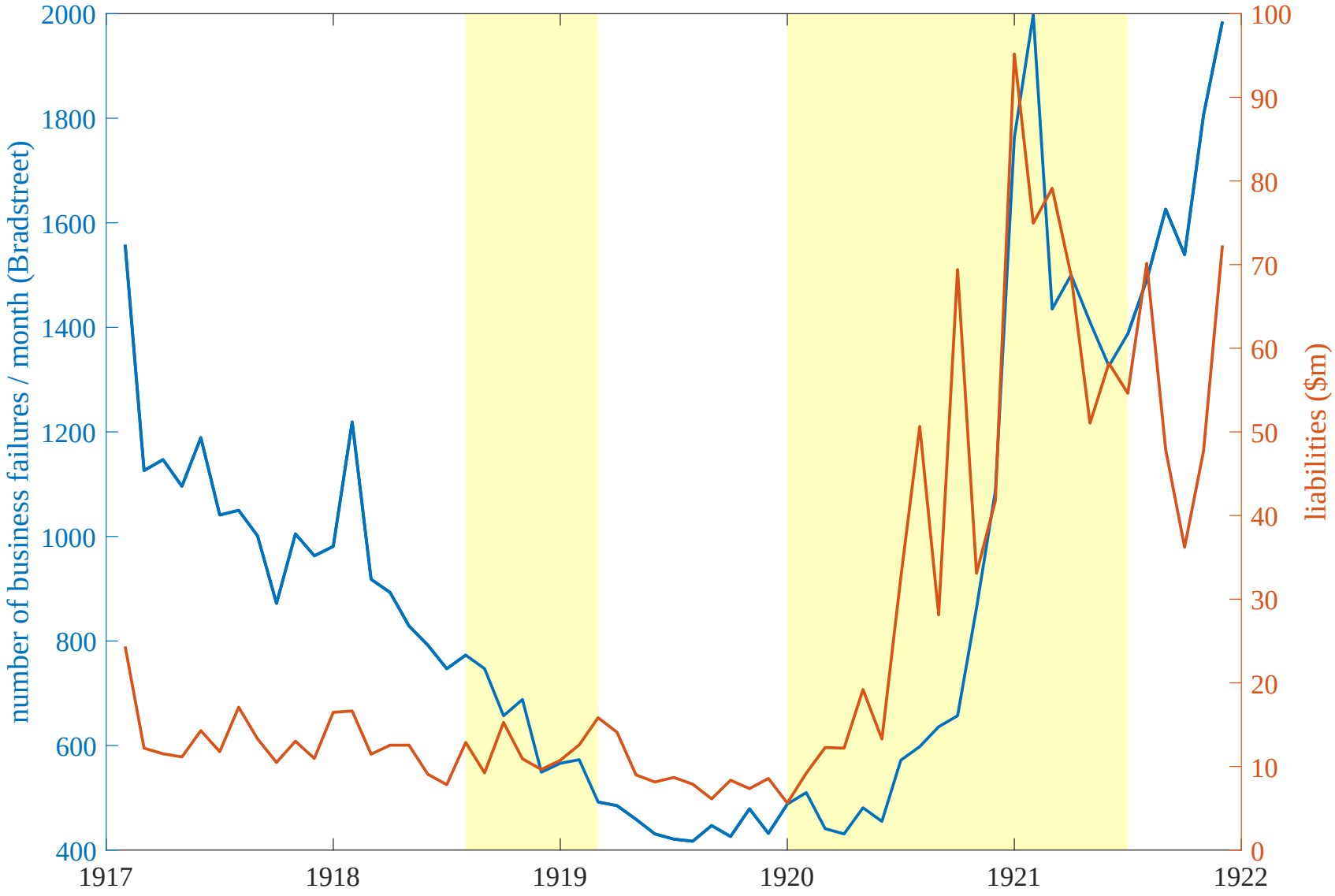
Employment


employment indices
NY
BLS
WI
OH
MA
Jun 1914 = 100
180
170
160
150
140
130
120
110
100
90
80
1915
1916
1917
1918
1919
1920
1921
1922
1923

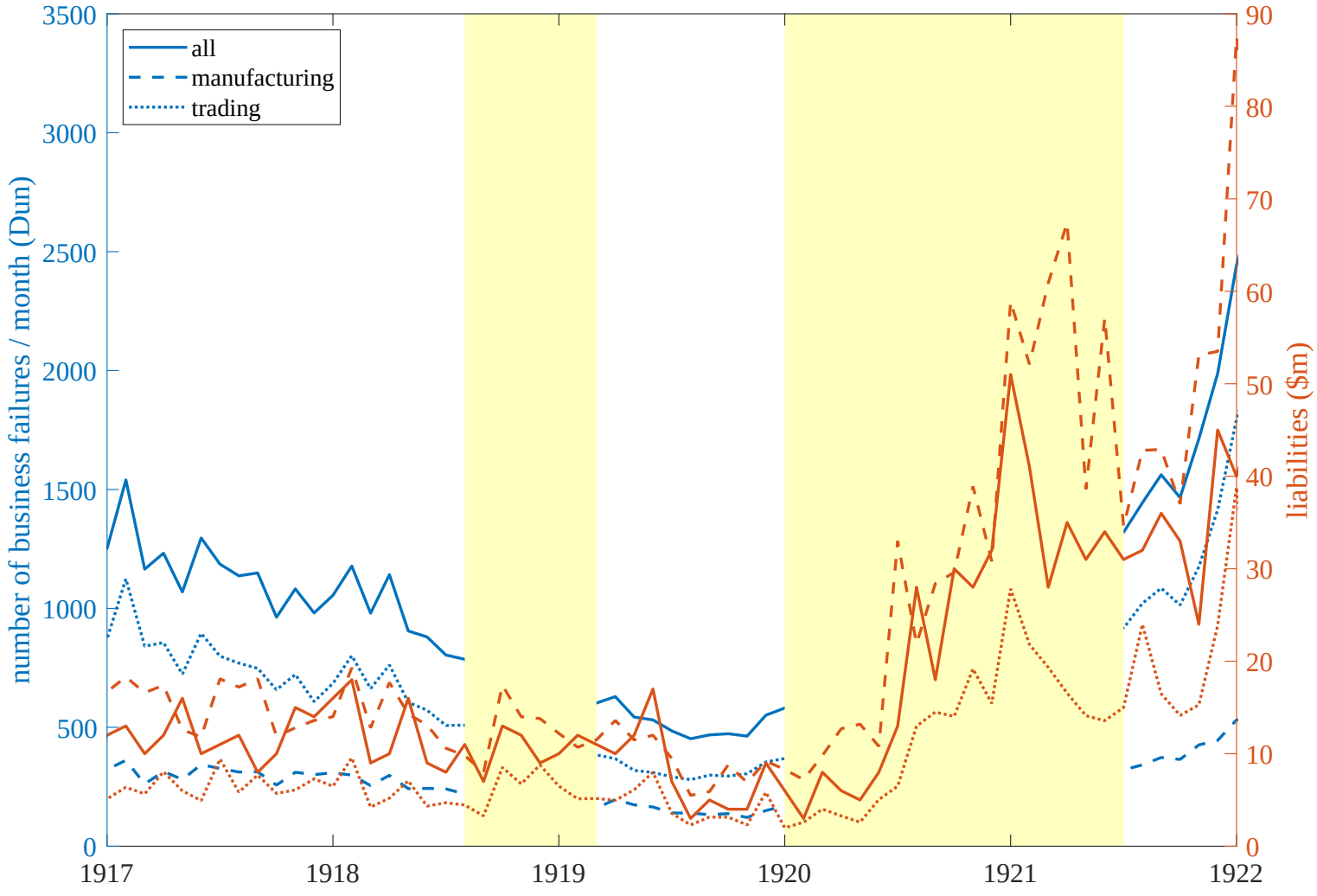
Bank clearings



Business failures



Business failures



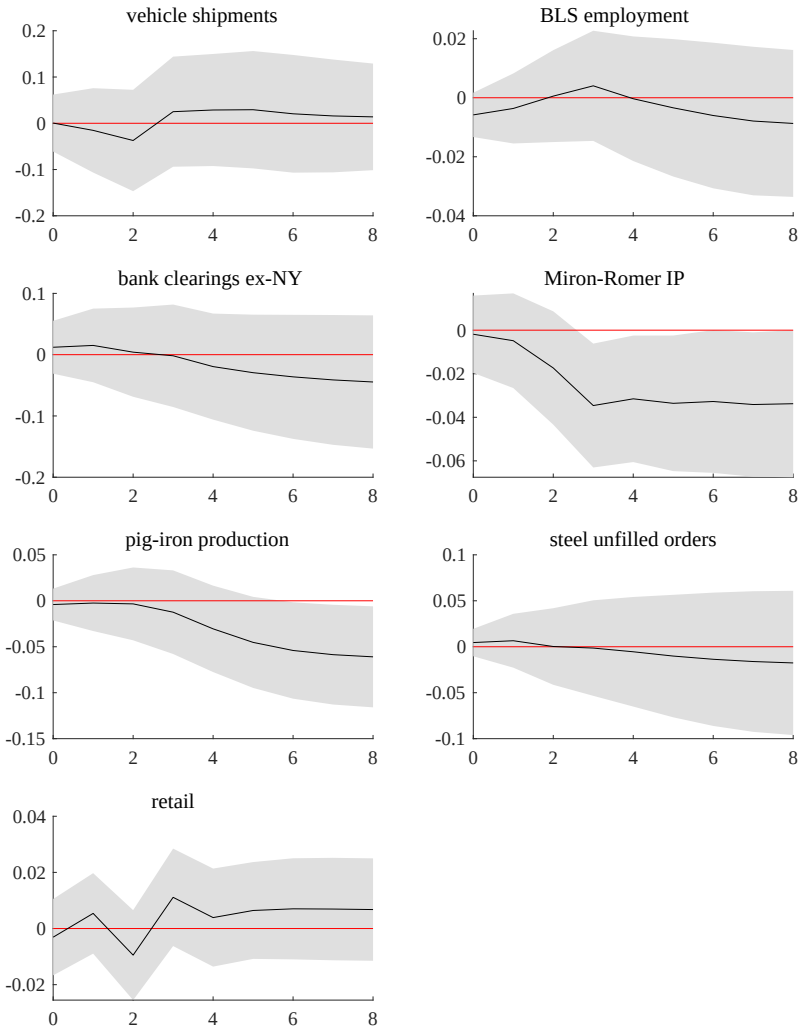
Contemporary testimony

- sharp downturn due to labor shortages and fall in retail
- fast rebound as epidemic waned in November
- Armistice brought uncertainty about transition to peacetime economy, became main preoccupation
  - not clear that the 1918 recession is all due to epidemic

Summing up

- visual inspection: industrial output falls, retail much less, failures unaffected
- sharp contrast with the 1920–21 recession (these series do detect recessions!)

Summing up


vehicle shipments
BLS employment
bank clearings ex-NY
Miron-Romer IP
pig-iron production
steel unfilled orders
retail

Summing up

- visual inspection: industrial output falls, retail much less, failures unaffected
- sharp contrast with the 1920–21 recession (these series do detect recessions!)
- monthly bivariate VARs with national excess mortality: suggestive but not conclusive
- let's move to the cross-section

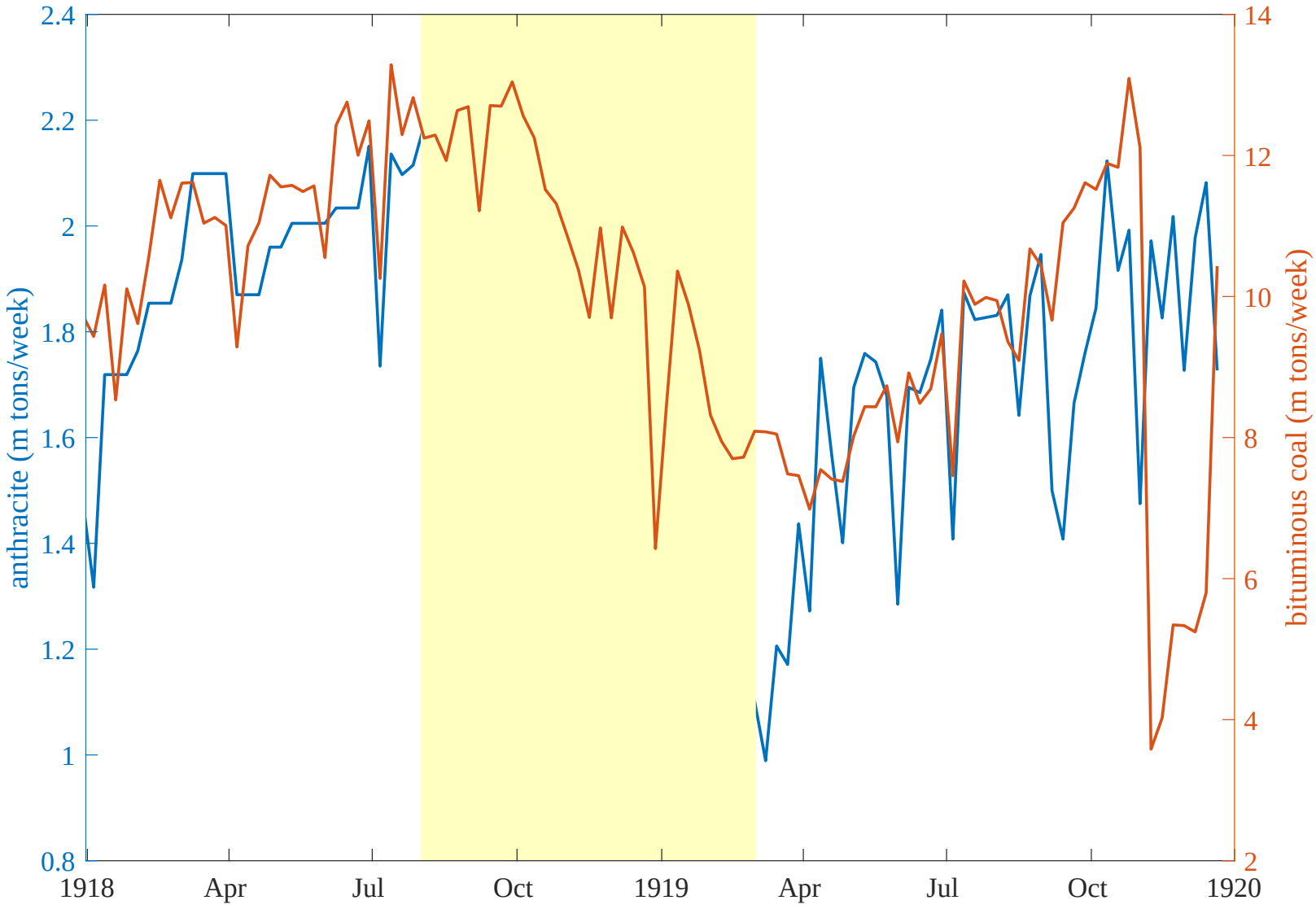
The Cross-Section

- two levels available: states/monthly (those with vital statistics), cities/weekly
  - cities also have NPIs
- task: find high-frequency series that match up
- next up:
  - coal industry (state)
  - data on banks (state and city, monthly)
  - business conditions, bank clearings (city)
  - business failures (weekly, aggregated to regional)

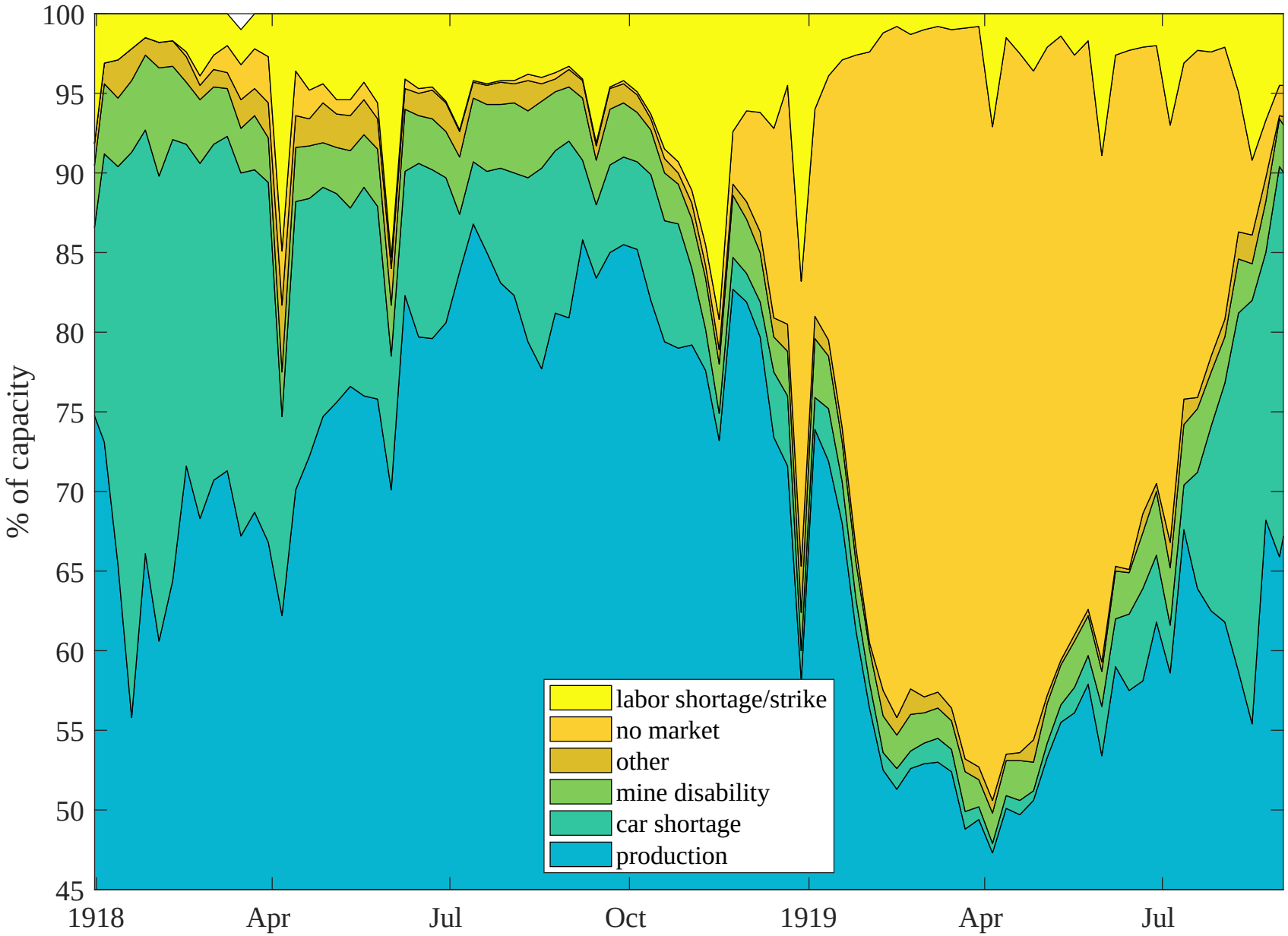
Coal industry

- US Fuel Administration set up when US entered WWI
- coordinate/monitor production
- lots of data collection at mine level, in particular:
  - weekly reports on percentage of capacity unused and why

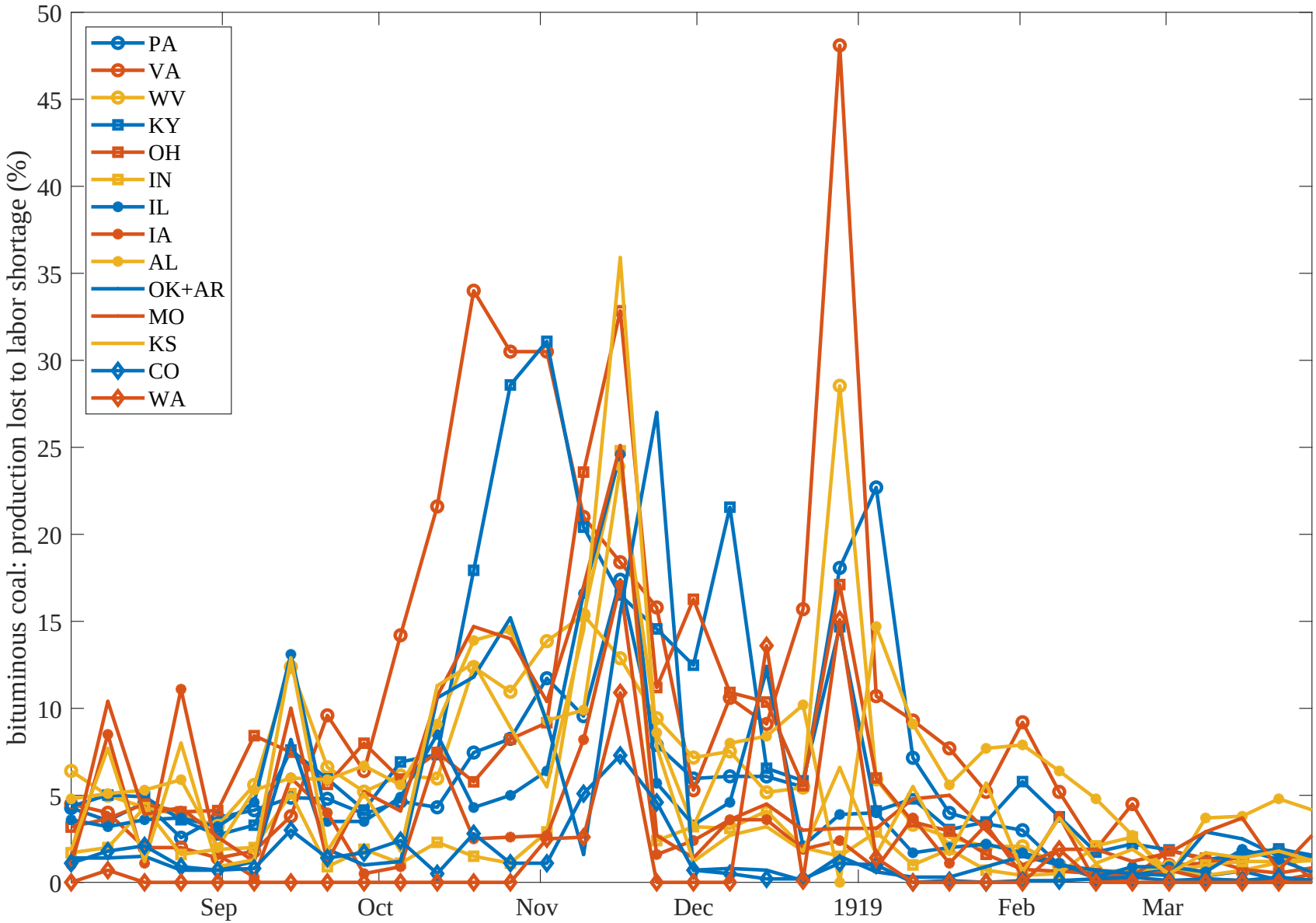
Coal output


anthracite (m tons/week)
bituminous coal (m tons/week)
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
14
12
10
8
6
4
2
1918
Apr
Jul
Oct
1919
Apr
Jul
Oct
1920

Coal output


100
95
90
85
80
75
70
65
60
55
50
45
% of capacity
1918
Apr
Jul
Oct
1919
Apr
Jul
labor shortage/strike
no market
other
mine disability
car shortage
production

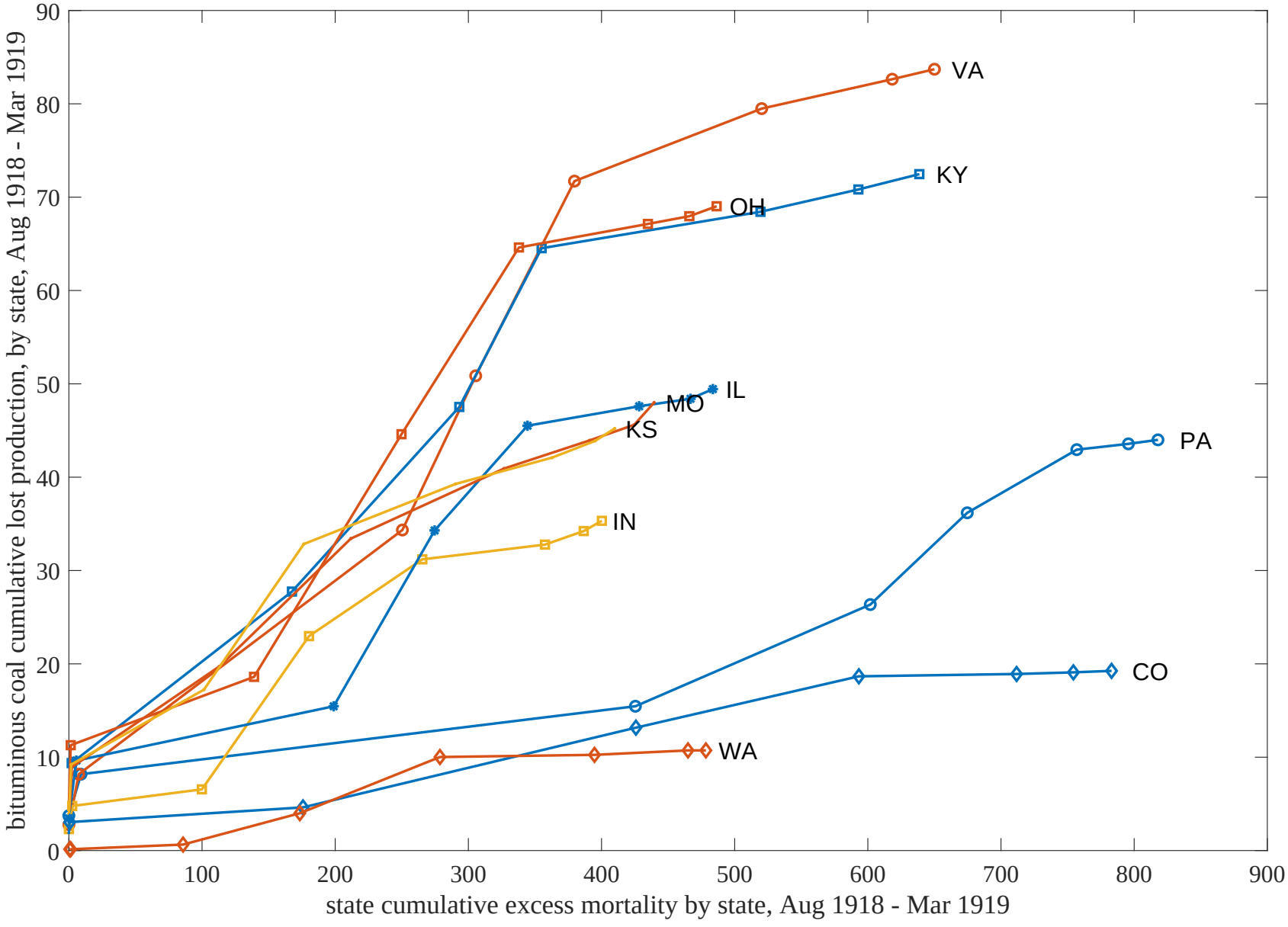
Coal: capacity unused and why



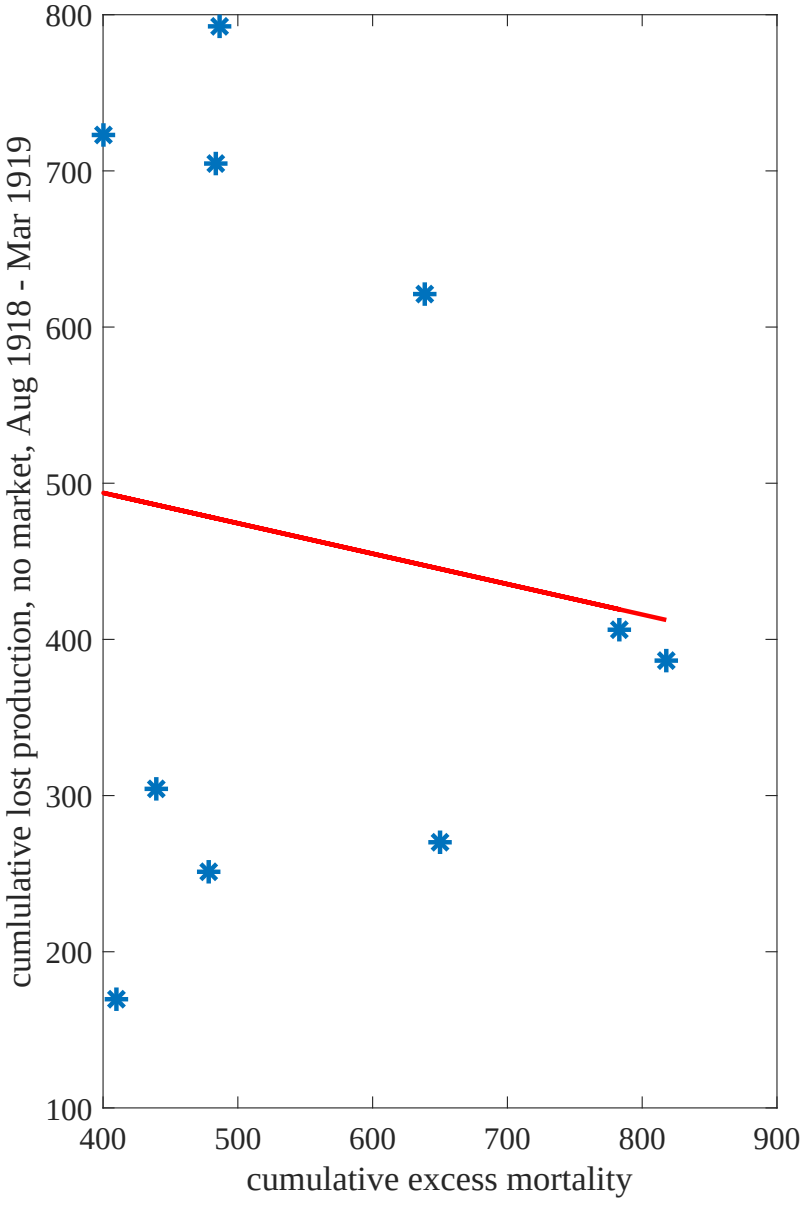
The 1918–19 recession in the coal industry

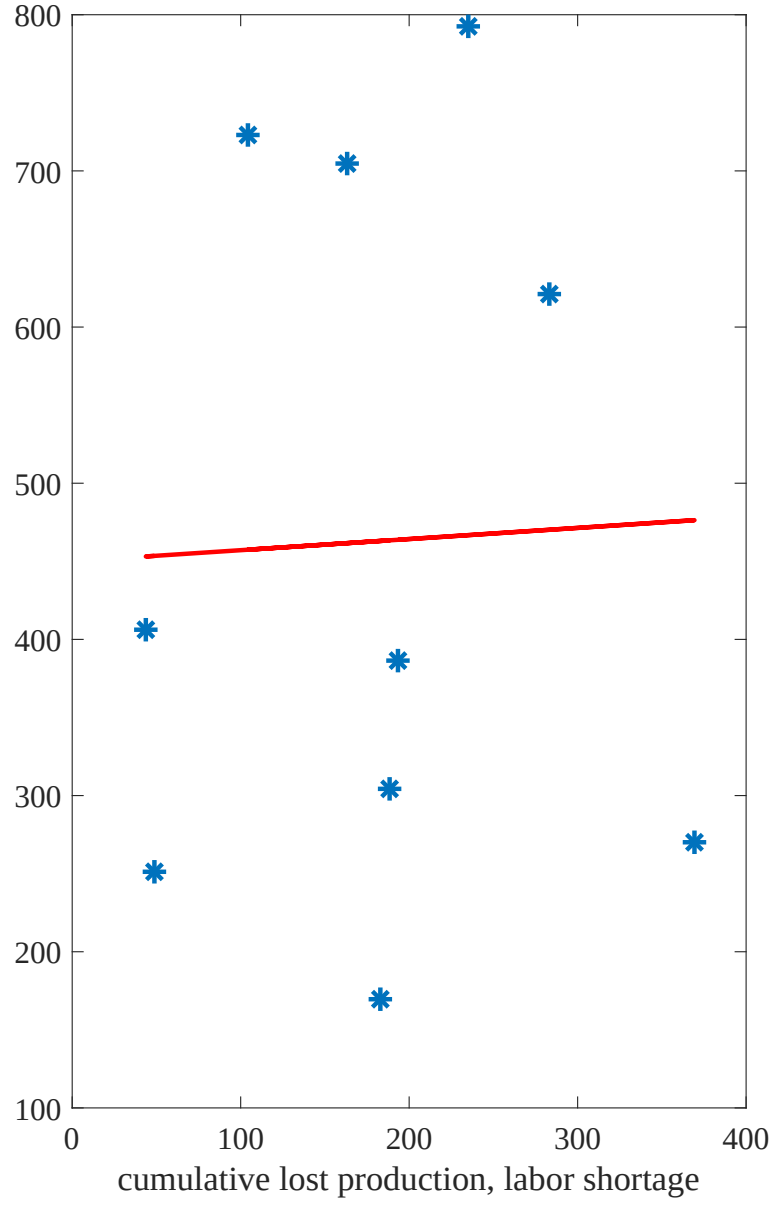
- first shock: labor shortage (epidemic?)
- second shock: "no market" i.e., lack of demand
- labor supply shock $\rightarrowtail$ demand shock?

Labor shortages in coal industry, by state



Epidemic and labor shortages





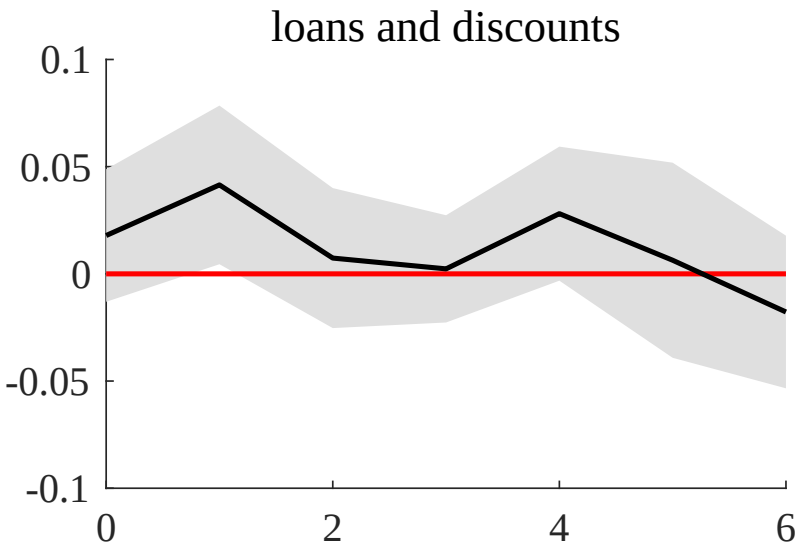
Banking data

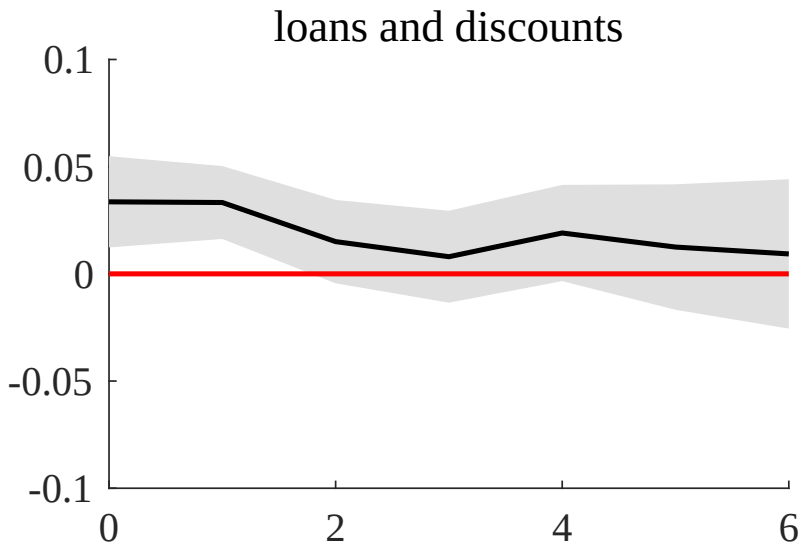
- US has (a) national banks and (b) state-chartered banks (40/60 split)
- Data on (a) is consistent, 6 times/year
- local projection method: for $h = 0, \ldots 6$

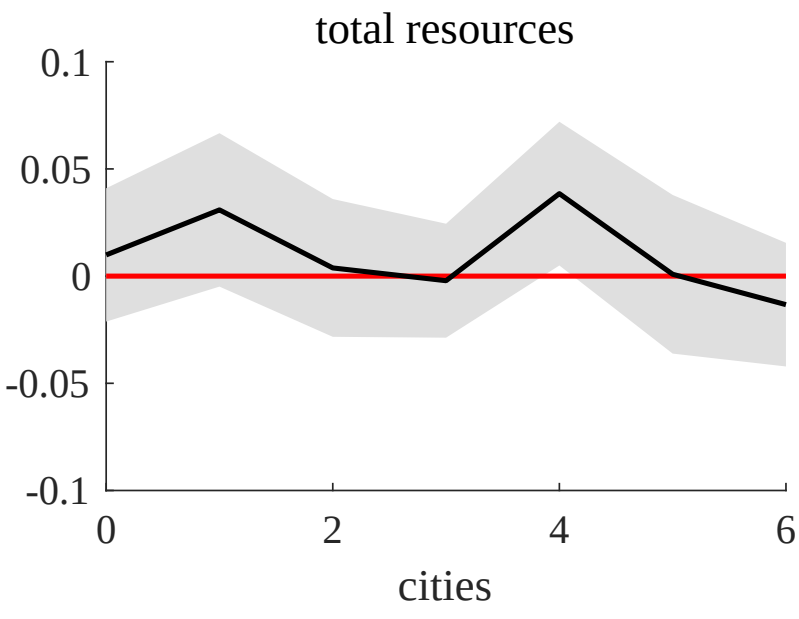
$$\Delta \log(\text{assets}_{i,t+h}) = \beta_h m_{i,t} + \sum_{k=1}^{4} \gamma_k \Delta \log(\text{assets}_{i,t-k}) + a_i + b_t$$

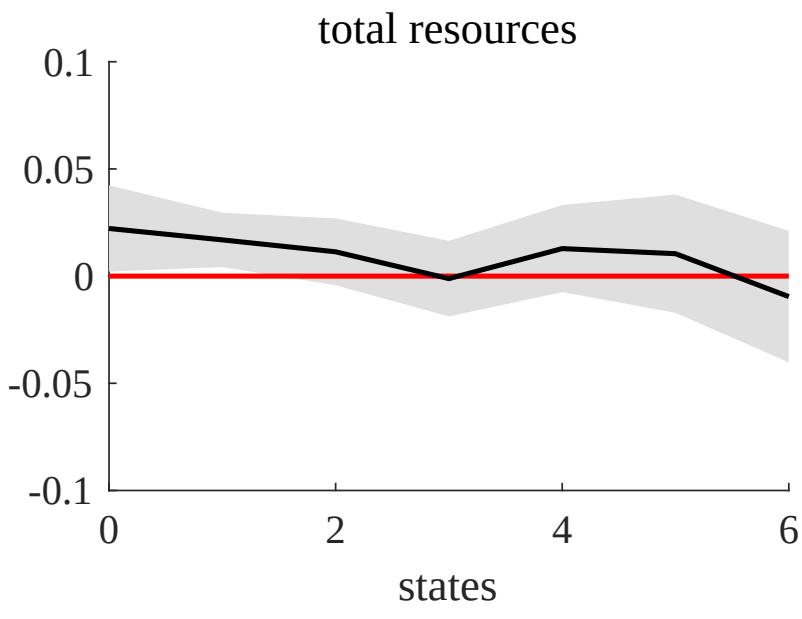
$$\Delta \log(\text{loans}_{i,t+h}) = \beta_h m_{i,t} + \sum_{k=1}^{4} \gamma_k \Delta \log(\text{loans}_{i,t-k}) + a_i + b_t$$

Banks

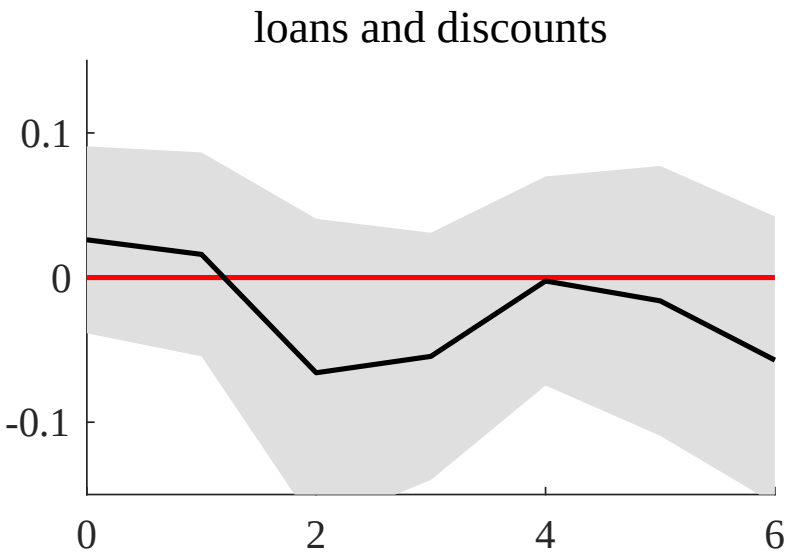

loans and discounts
0.1
0.05
0
-0.05
-0.1
0
2
4
6

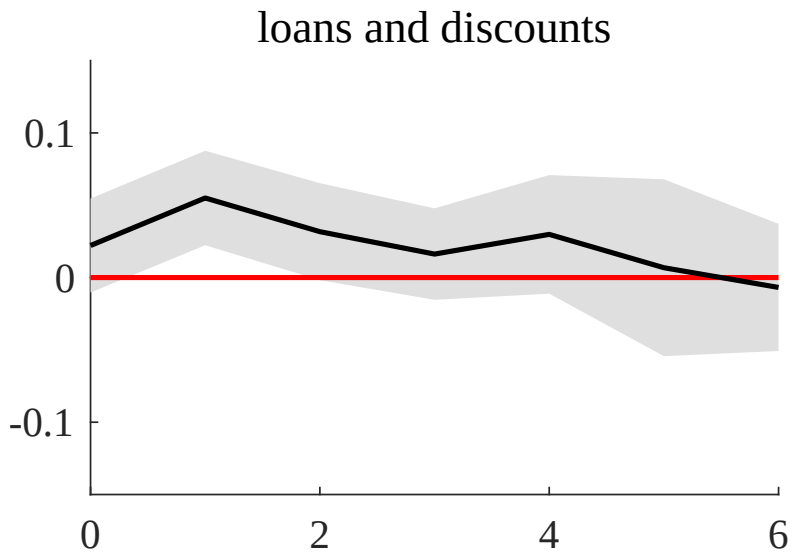

loans and discounts
0.1
0.05
0
-0.05
-0.1
0
2
4
6


total resources
0.1
0.05
0
-0.05
-0.1
0
2
4
6
cities


total resources
0.1
0.05
0
-0.05
-0.1
0
2
4
6
states

Banks


loans and discounts
0.1
0
-0.1
0
2
4
6


loans and discounts
0.1
0
-0.1
0
2
4
6


total resources
0.1
0
-0.1
0
2
4
6
late movers


total resources
0.1
0
-0.1
0
2
4
6
early movers

City-level economic data

- *Bradstreet*, a weekly publication, reported
  - bank clearings (a measure of volume of payments)
  - qualitative description of business conditions

City-level economic data

AY, NOVEMBER 9, 1918 [PRICE, 10 CENTS

BRADSTREET COMPANY.

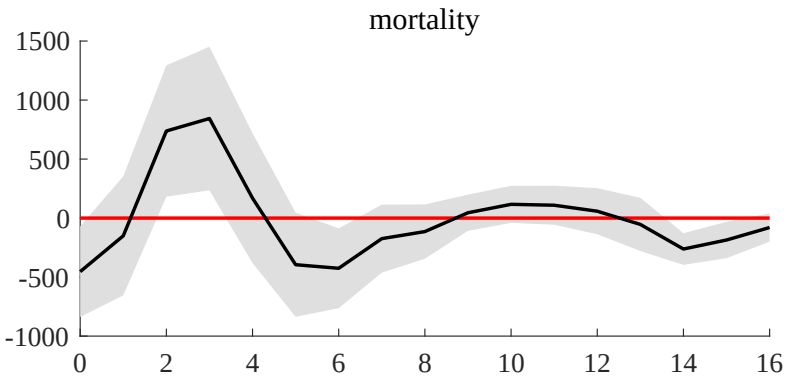
TRADE AT A GLANCE.

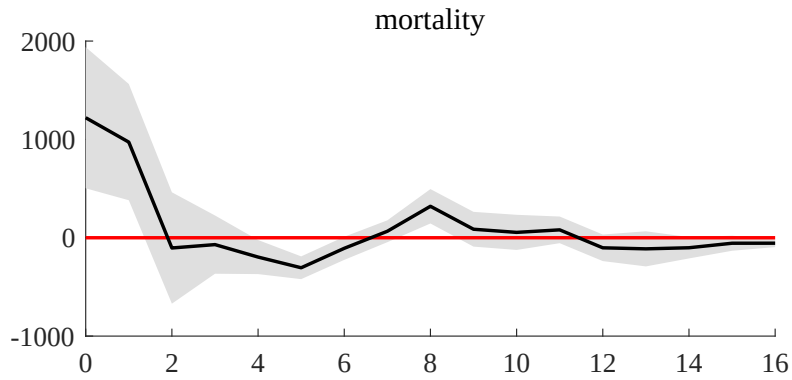
	Whole. and job. trade	*Retail trade*	*Mfg and industry*	*Collections*	*Remarks*
New York	Quiet	Quiet	Active	Fair	Epidemic abates; peace talk represses
Boston	Quiet	Quiet	Active	Fair	Dry goods trade quiet
Burlington, Vt.	Fair	Fair	Active	Good	Labor scarce
Bridgeport	Fair	Fair	Active	Slow	Influenza abating
Philadelphia	Good	Good	Active	Fair	Peace news has varying effects
Jamestown	Fair	Fair	Active	Good	Epidemic hurts trade
Buffalo	Good	Good	Active	Good	Additional government orders
Pittsburgh	Quiet	Fair	Restricted	Fair	Trade still lags, but improves slightly
Wheeling	Quieter	Fair	Active	Good	Peace talk slows trade
Chicago	Good	Fair	Active	Good	Peace reports unsettle business
Cincinnati	Fair	Slow	Active	Fair	Epidemic slackening
Cleveland	Good	Dull	Active	Fair	Retail trade in clothing slack
Hamilton, Ohio	Fair	Fair	Active	Good	Buying conservative
Lexington	Fair	Dull	Fairly active	Good	Influenza affects industry
Louisville	Good	Fair	Active	Good	Dry goods sales expected to slacken
Detroit	Fair	Fair	Active	Good	Optimism notable despite peace talk
Milwaukee	Good	Fair	Active	Fair	Peace talk breeds conservatism
Terre Haute	Good	Slow	Active	Good	Rains help fall-sown crops
Indianapolis	Good	Fair	Active	Good	Immediate business quieter; future trade active
Minneapolis	Good	Good	Active	Good	Retail trade exceeds year ago
St. Paul	Fair	Fair	Active	Fair	Influenza curtails trade
Duluth	Good	Quiet	Active	Fair	.....
Kansas City	Fair	Fair	Active	Fair	Influenza cuts trade; wheat splendid
St. Louis	Good	Fair	Active	Good	Belief in lower prices affects trade
Des Moines	Good	Good	Active	Good	Rains benefit wheat
Dubuque	Good	Fair	Active	Good	.....
Lincoln	Good	Good	Active	Fair	Good rains help wheat
Omaha	Fair	Better	Active	Good	Rains benefit wheat
Baltimore	Good	Fair	Active	Good	Influenza abating; prices stronger
Chattanooga	Good	Fair	Fair	Good	Big wheat acreage; floods damaging
Memphis	Fair	Quiet	Fair	Fair	Peace talk restricts trade
Nashville	Good	Good	Active	Good	October trade exceeded year ago
Mobile	Good	Good	Fair	Good	Naval stores active and rising
Montgomery	Good	Fair	Quiet	Good	Trade has conservative trend
Atlanta	Good	Good	Active	Fair	Feeling better
New Orleans	Good	Fair	Active	Good	Influenza abating; good sugar crop
Dallas	Good	Fair	Active	Good	Rains help crops, but dull retailing
Charleston, S.C.	Good	Fair	Active	Good	Influenza abating; labor scarce; cotton unpicked
San Francisco	Fair	Fair	Active	Good	Prunes only short crop
Portland, Ore	Good	Quiet	Active	Good	Rains benefit wheat
Seattle	Good	Fair	Active	Good	Influenza affects retailing
Spokane	Good	Quiet	Quiet	Good	Restrictions affect retail trade
Tacoma	Quiet	Quiet	Active	Good	Trade suspended Thursday
Toronto	Fair	Improved	Active	Slow	Epidemic abated; retail trade better
Montreal	Quiet	Quiet	Active	Good	Epidemic restricts trade

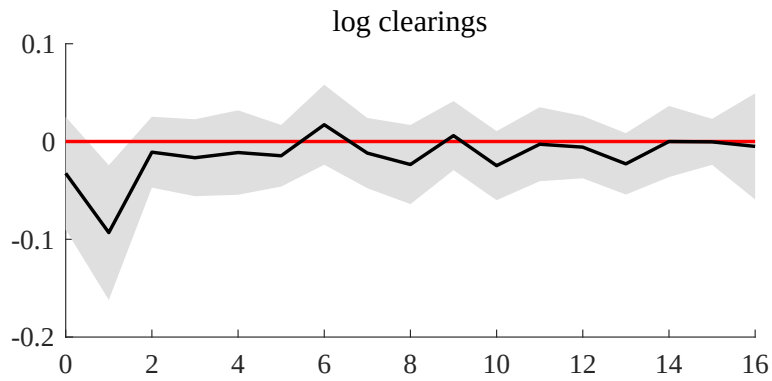
City-level economic data

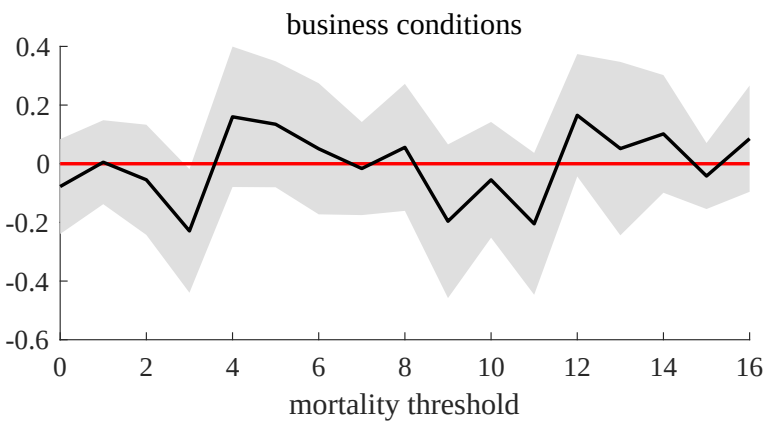
- *Bradstreet*, a weekly publication, reported
  - bank clearings (a measure of volume of payments)
  - qualitative description of business conditions
- convert to 1–5 scaled indicator of business conditions
- local projection method on two "shocks":
  - week in which epidemic threshold is reached (excess mortality twice median)
  - week in which closings are initiated

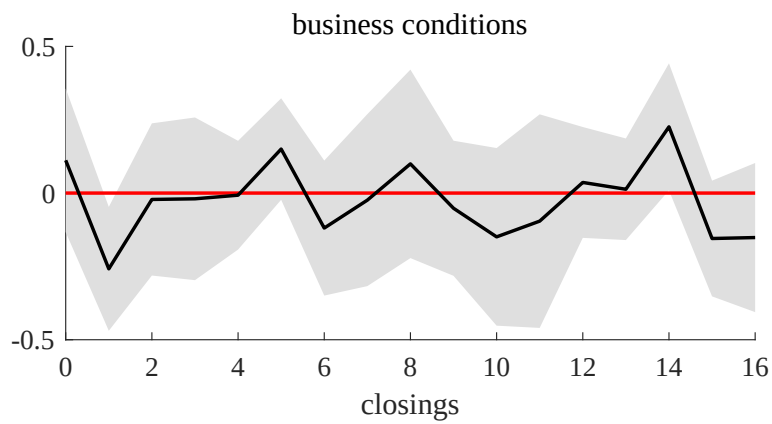
Local projections



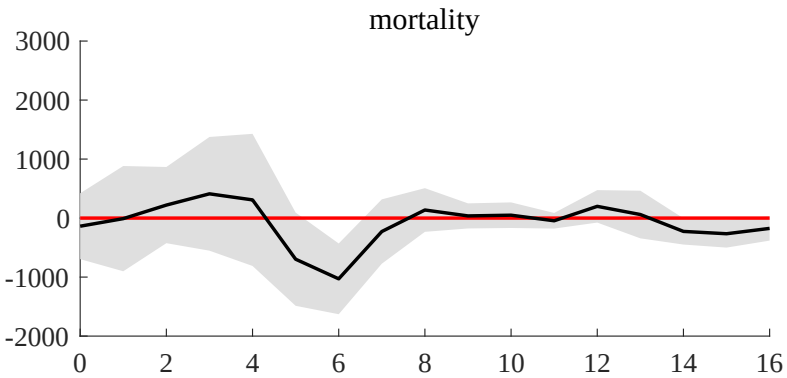


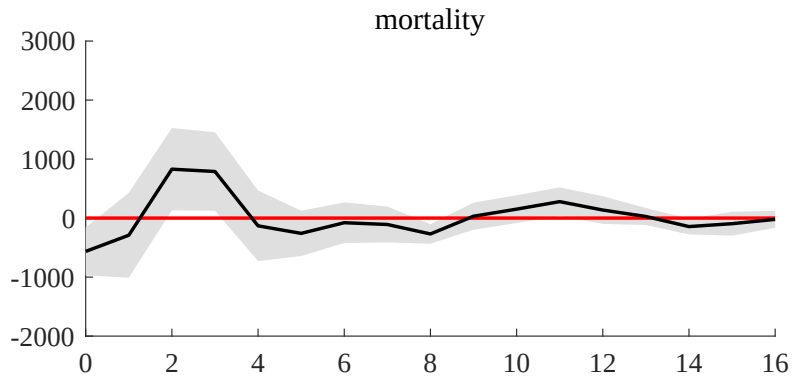


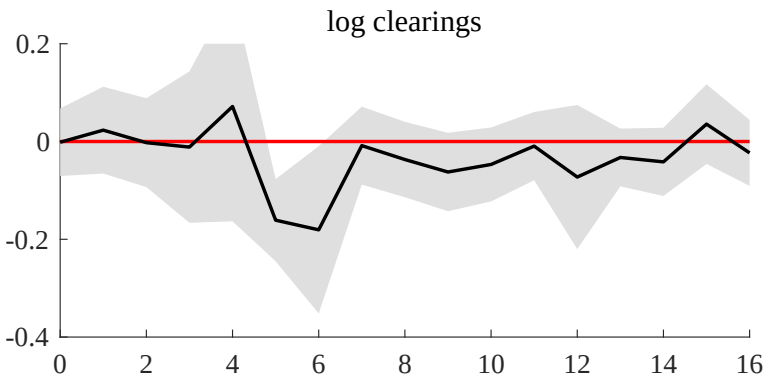


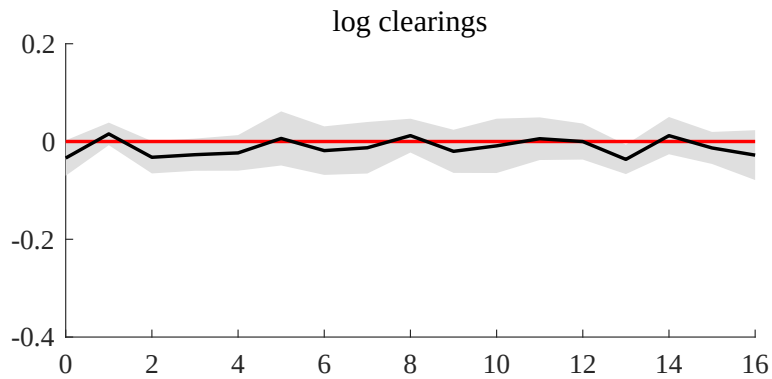


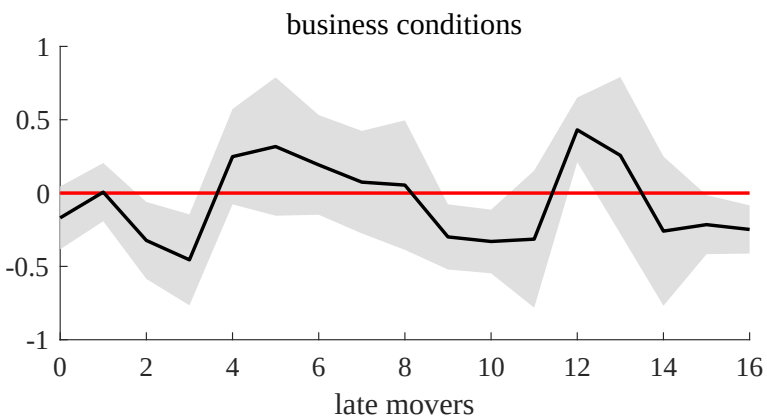
early vs late movers: response to epidemic, closing shock

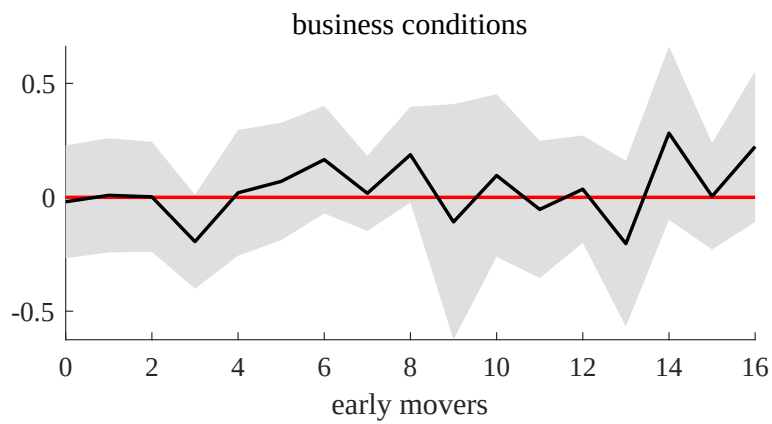




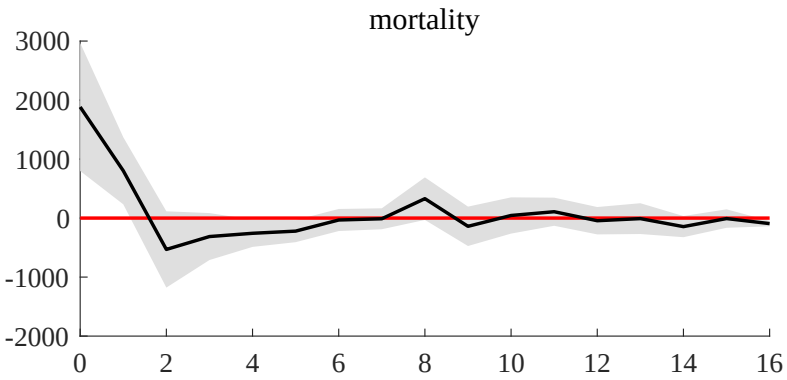


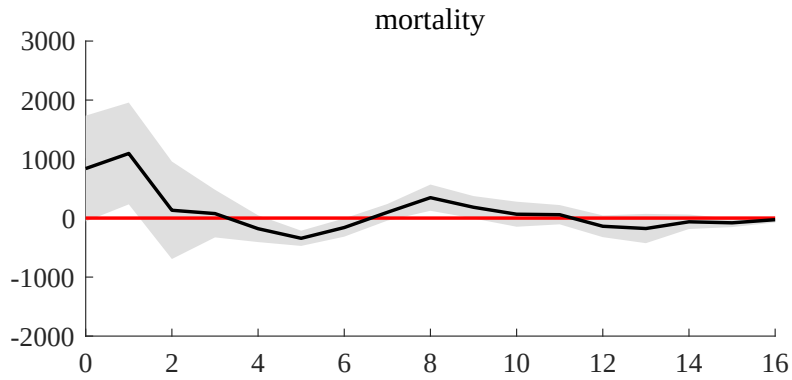


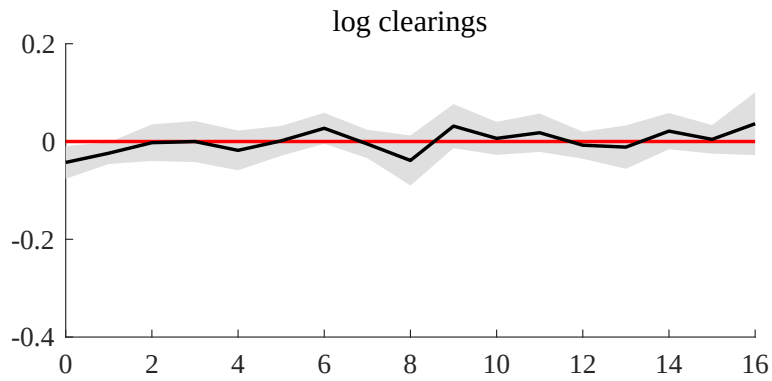


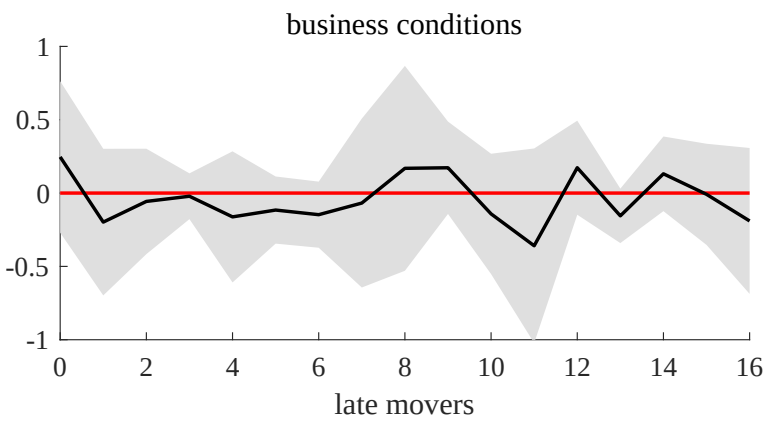


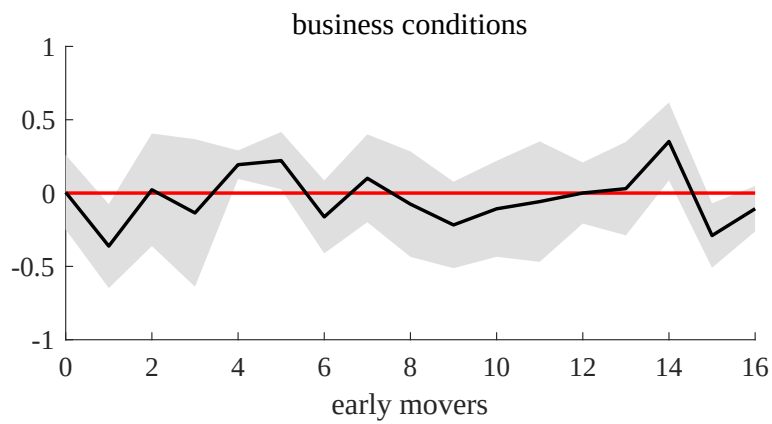
early vs late movers: response to epidemic, closing shock











Estimating impact of mortality and closings on economic activity: a model

- use the basic SIR (susceptible-infected-recovered) model:

$$\begin{aligned} S_{t+1} &= (1 - \beta_t I_t)\, S_t \\ I_{t+1} &= (1 + \beta_t S_t - \gamma)\, I_t \\ R_{t+1} &= R_t + \gamma I_t \\ D_t &= \phi R_t \end{aligned}$$

- β_t can change with NPIs
- add an equation for output (Alvarez, Argente, and Lippi, 2020):

$$Y_t = \theta_t (w S_t + w_i I_t) \tag{1}$$

- only deaths are observable for us, so recast as

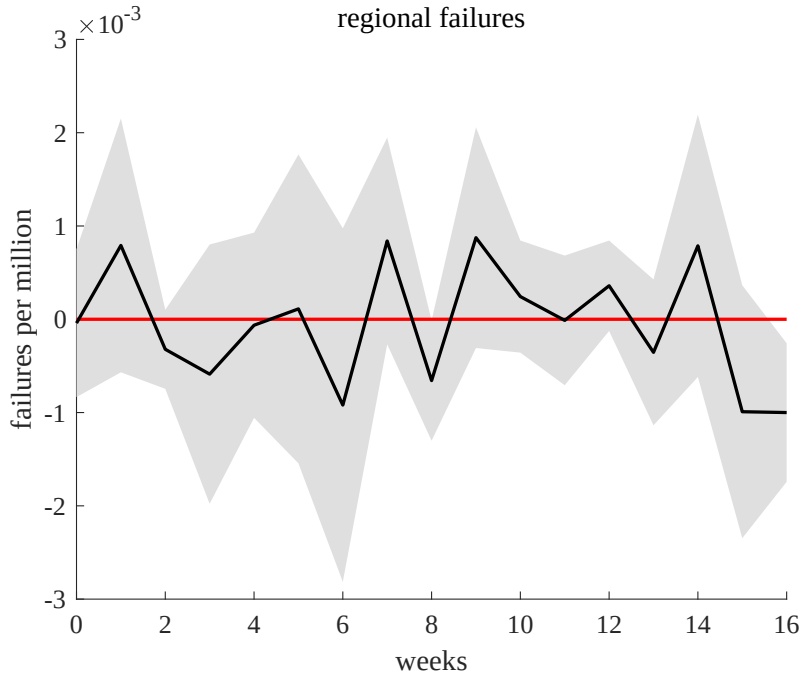
$$\Delta D_t = (1 + \beta_{t-2} - \gamma)\, \Delta D_{t-1} - \frac{\beta_{t-2}}{\phi\gamma} (\Delta D_{t-1})^2 - \frac{\beta_{t-2}}{\phi} D_{t-2} \Delta D_{t-1}$$

$$Y_t = w_t - w_t D_t - \frac{w_t w_t^i}{\phi\gamma} \Delta D_{t+1}$$

dependent variable:	ΔD_t		conditions		clearings	
ΔD_{t-1}	1.810***	1.994***				
	(0.144)	(0.193)				
$(\Delta D_{t-1})^2$	-9.38e-05***	-9.99e-05***				
	(1.85e-05)	(2.04e-05)				
$D_{t-2}\Delta D_{t-1}$	-4.37e-05***	-5.07e-05***				
	(5.48e-06)	(7.54e-06)				
$\mathbf{1}_{t-2}\Delta D_{t-1}$	-0.667***	-0.655***				
	(0.160)	(0.246)				
$\mathbf{1}_{t-2}(\Delta D_{t-1})^2$	7.59e-05***	7.07e-05***				
	(1.87e-05)	(2.19e-05)				
$\mathbf{1}_{t-2}D_{t-2}\Delta D_{t-1}$	1.25e-05	1.69e-05				
	(8.76e-06)	(1.29e-05)				
ΔD_{t+1}			-3.41e-05	-5.75e-05***	-1.13e-05**	-1.02e-05***
			(2.76e-05)	(2.21e-05)	(5.41e-06)	(3.56e-06)
D_t			3.70e-06	1.01e-06	7.60e-07	1.01e-07
			(6.14e-06)	(4.24e-06)	(2.67e-06)	(1.29e-06)
$\mathbf{1}_t\Delta D_{t+1}$			-2.89e-05	-4.91e-06	6.61e-06	1.07e-05
			(5.96e-05)	(6.25e-05)	(9.07e-06)	(7.64e-06)
$\mathbf{1}_t D_t$			-2.19e-05*	-5.55e-06	-2.35e-06	2.68e-06
			(1.32e-05)	(9.40e-06)	(4.61e-06)	(3.13e-06)
$\mathbf{1}_t$			0.0855	-0.0489	-0.0425	-0.136
			(0.278)	(0.244)	(0.108)	(0.0900)
conditions at $t-1$		-42.78		0.328***		
		(67.85)		(0.0656)		
conditions at $t-2$				0.0934		
				(0.0703)		
conditions at $t-3$				-0.0247		
				(0.0410)		
conditions at $t-4$				0.0700		
				(0.0556)		
log real clearings at $t-1$		-108.6				0.394***
		(180.8)				(0.0483)
log real clearings at $t-2$						0.0791
						(0.0614)
log real clearings at $t-3$						-0.00795
						(0.0433)
log real clearings at $t-4$						0.162***
						(0.0330)
constant	-39.45	848.6	4.987***	2.767***	5.584***	2.132***
	(93.73)	(1,036)	(0.127)	(0.341)	(0.0472)	(0.485)
observations	1,153	644	773	563	900	900
number of cities	33	23	27	24	25	25

Table: Panel regressions of mortality ΔD, business conditions index, and log deflated bank clearings on leads and lags of mortality and cumulative mortality (D) and a dummy $\mathbf{1}_{ct} = 1$ if businesses were closed during week t. Time and city fixed effects included; robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

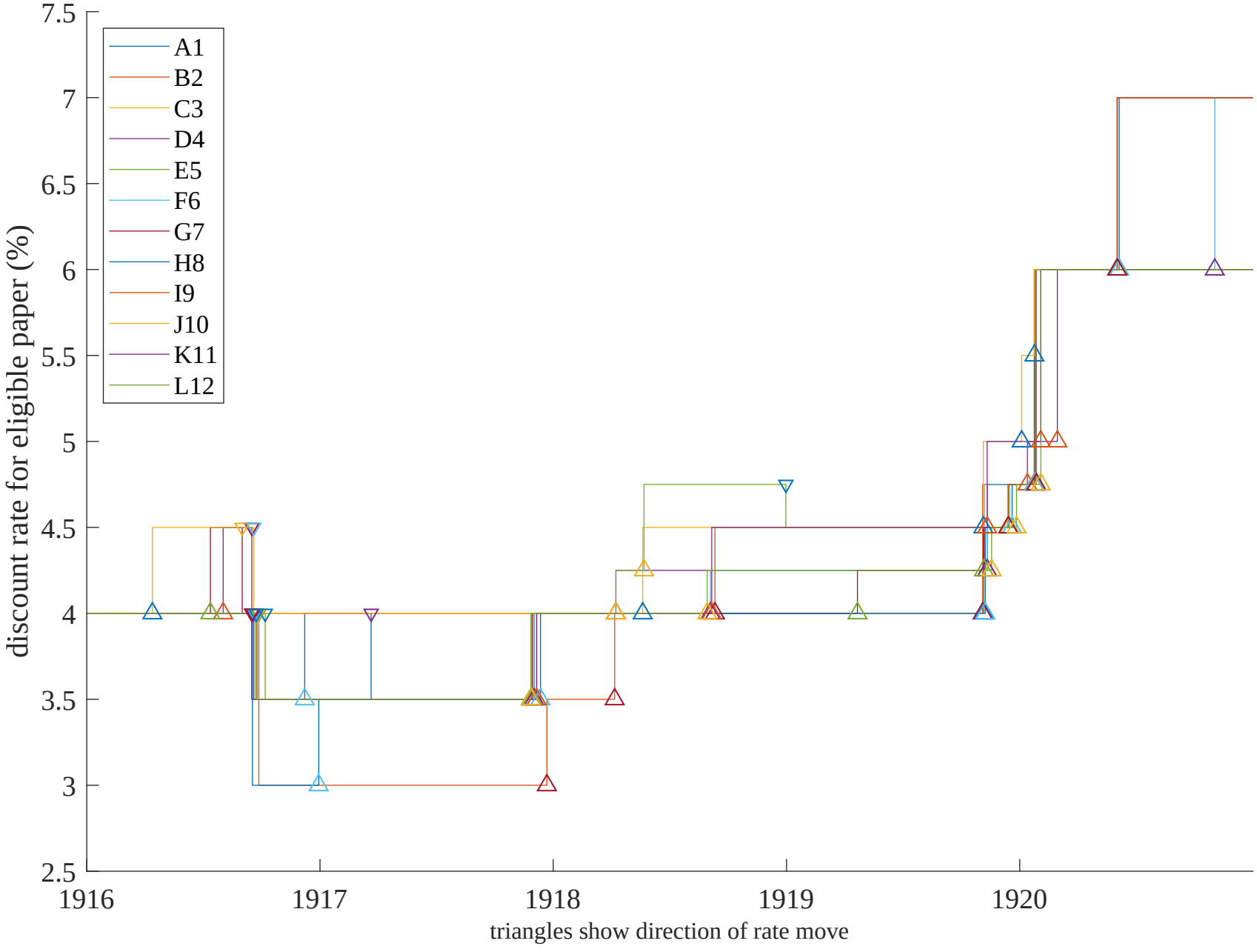
Business failures in the cross-section



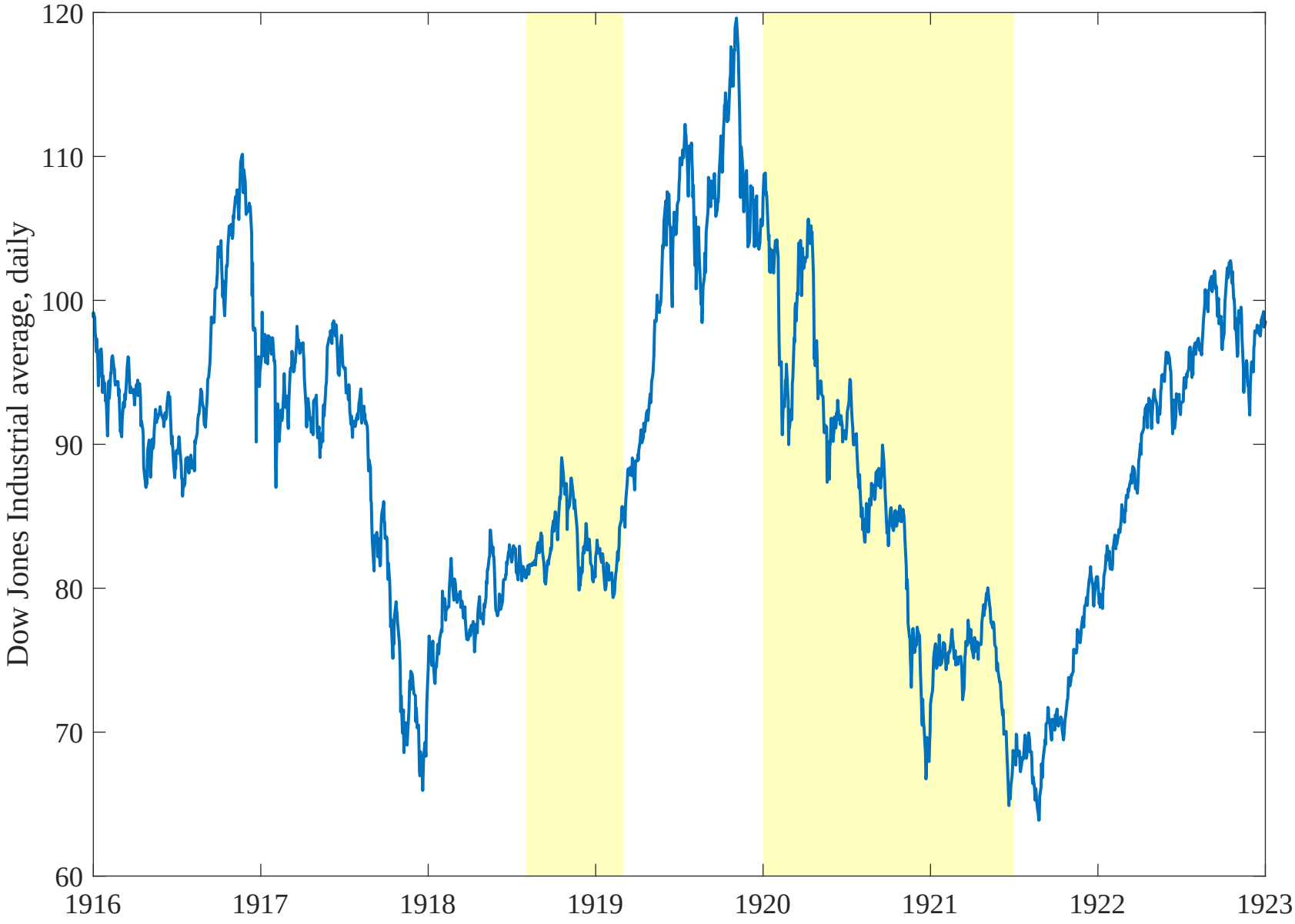
1918 and 2020

- obviously different times
  - urban/rural ratio 1 then, 5 now
  - agriculture, manufacturing share of employment: 33%, 28% then; 2%, 8% now
  - government: 1% GDP in 1914, size exploded with WWI, deficit 20% GDP, debt rose to 36% GDP
  - Fed: essentially lending to household and banks so they can buy Federal debt

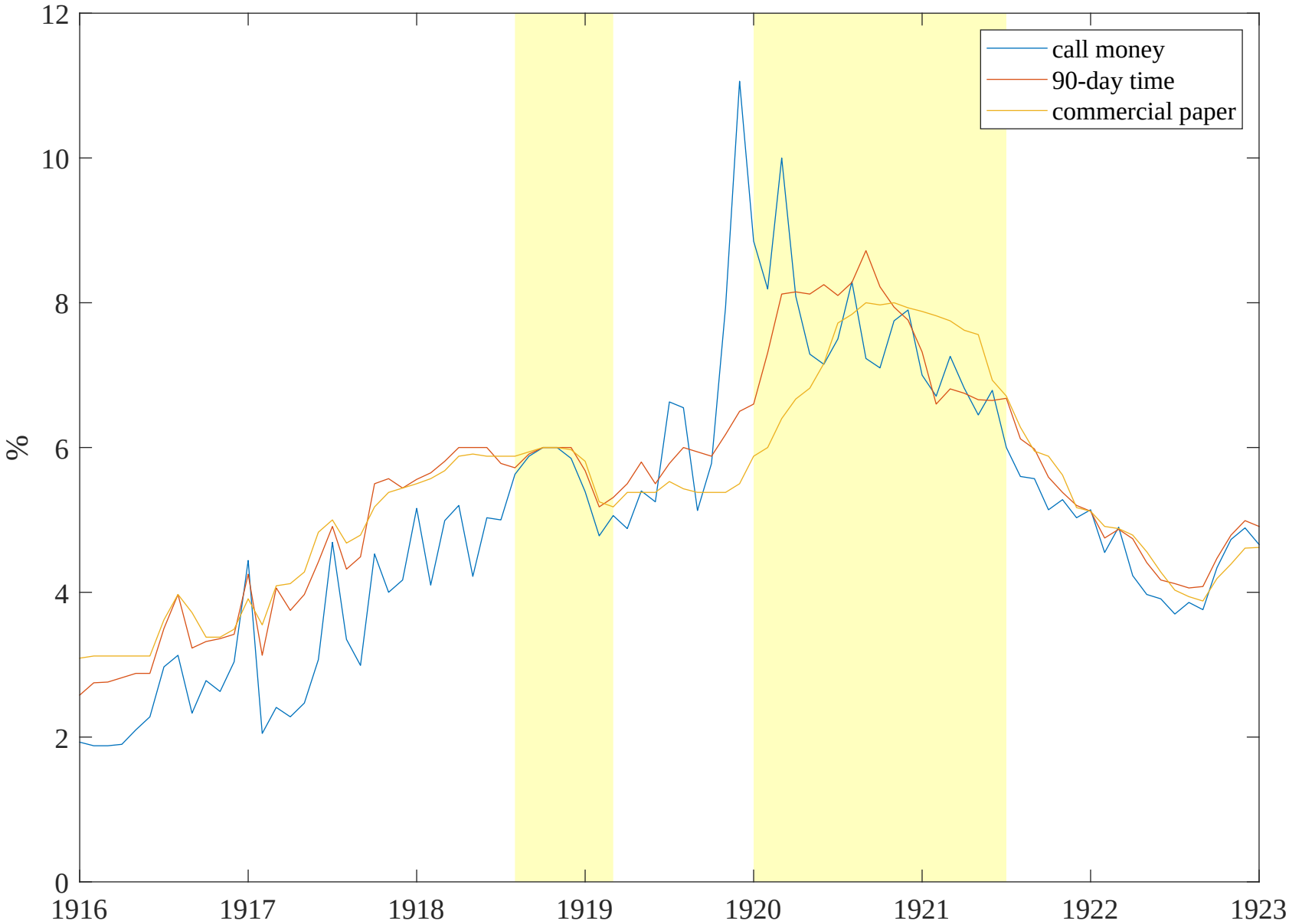
The Fed actually raised rates (slightly)



Financial conditions: stock market



Financial conditions: short-term rates



Conclusion

- perhaps not the expected impact
  - visible, but not as large as 1920-21 recession
  - quick rebound, confirmed by qualitative commentary
  - cross-section confirms, provides some evidence of NPIs effect on economy
- different context
  - Federal government is running a deficit of 20% GDP (and Fed is busy monetizing it)
  - Armistice comes as the closings end, focus on transition to peace
- little room for multiple equilibrium/coordination on bad outcome?
- still a useful case study:
  - a pandemic is not always a disaster
  - bad monetary policy can do a lot worse