Modern Pandemics: Recession and Recovery

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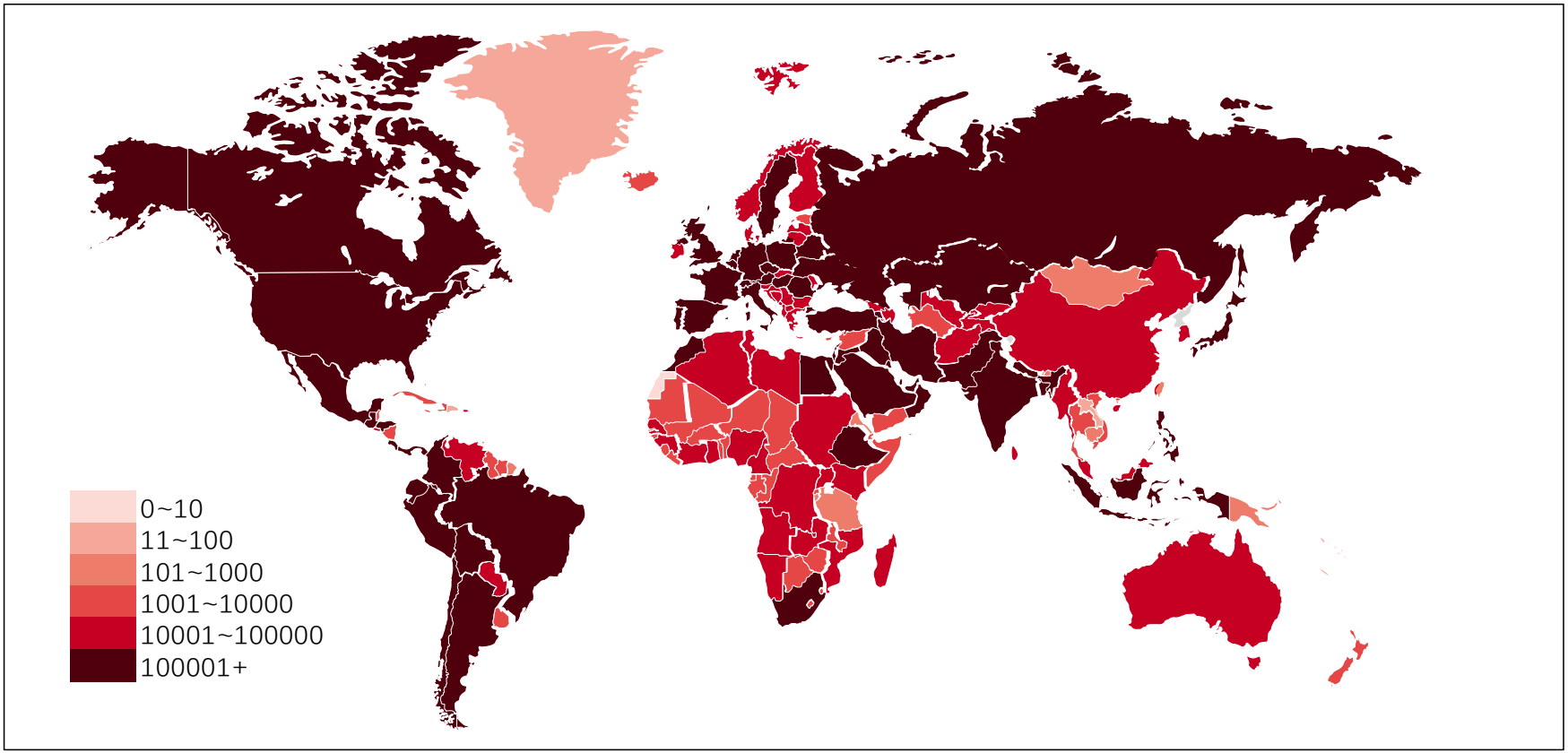
For teaching purpose only

Examine six postwar pandemics/epidemics

- Estimate effects of a "pandemic shock" on GDP, unemployment, and trade
  - impact effects are large
  - bounce-back in growth is rapid, but levels effects are persistent
  - transmission channels from growth accounting
- Document additional effects of past pandemics
  - distributional effects significant
  - international trade networks important
  - expansionary fiscal policy aids recovery
- Conclusion

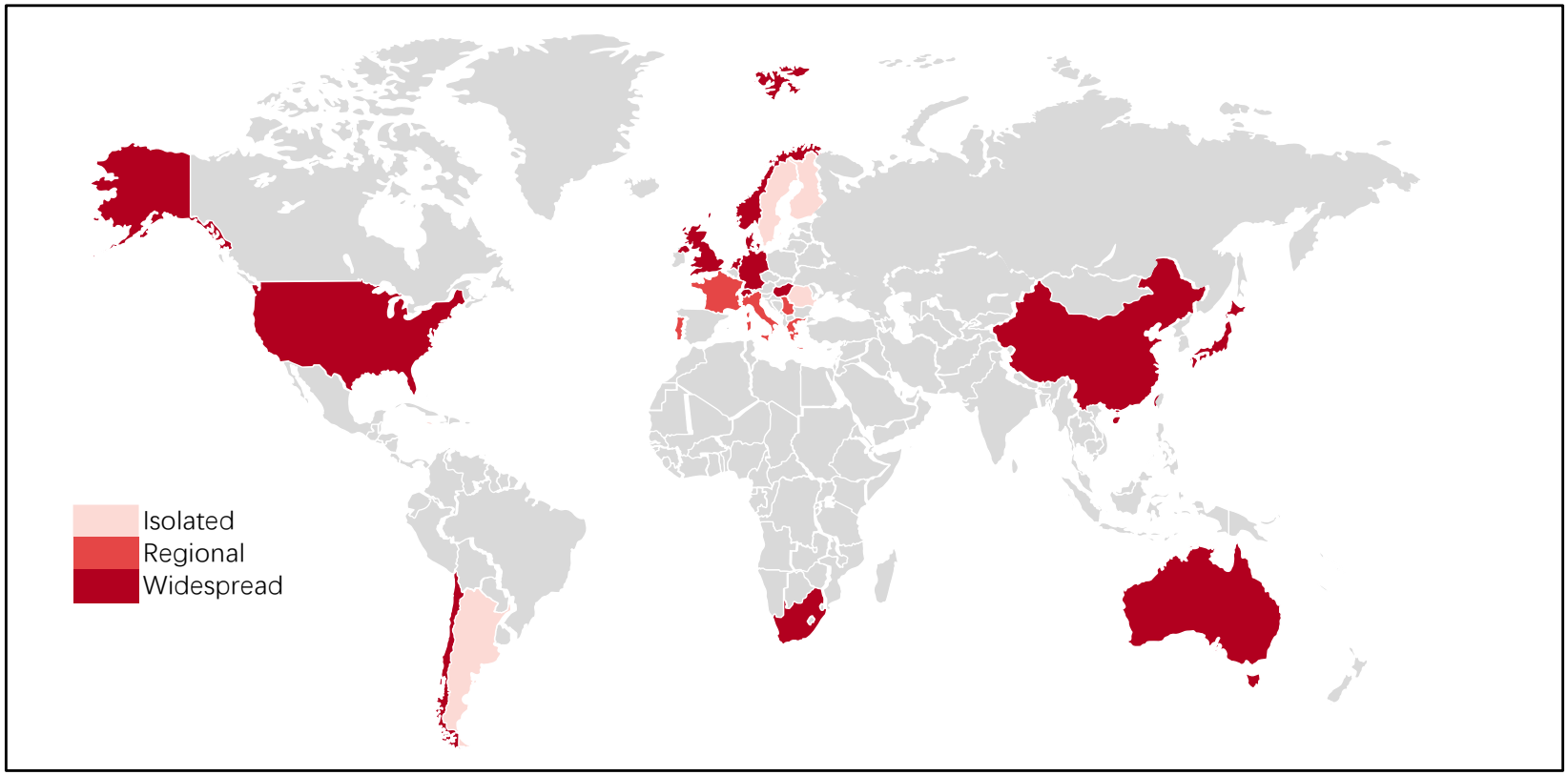
COVID-19

Through Nov 15 2020, Total cases: 54.4 million (now over 214 mill.)



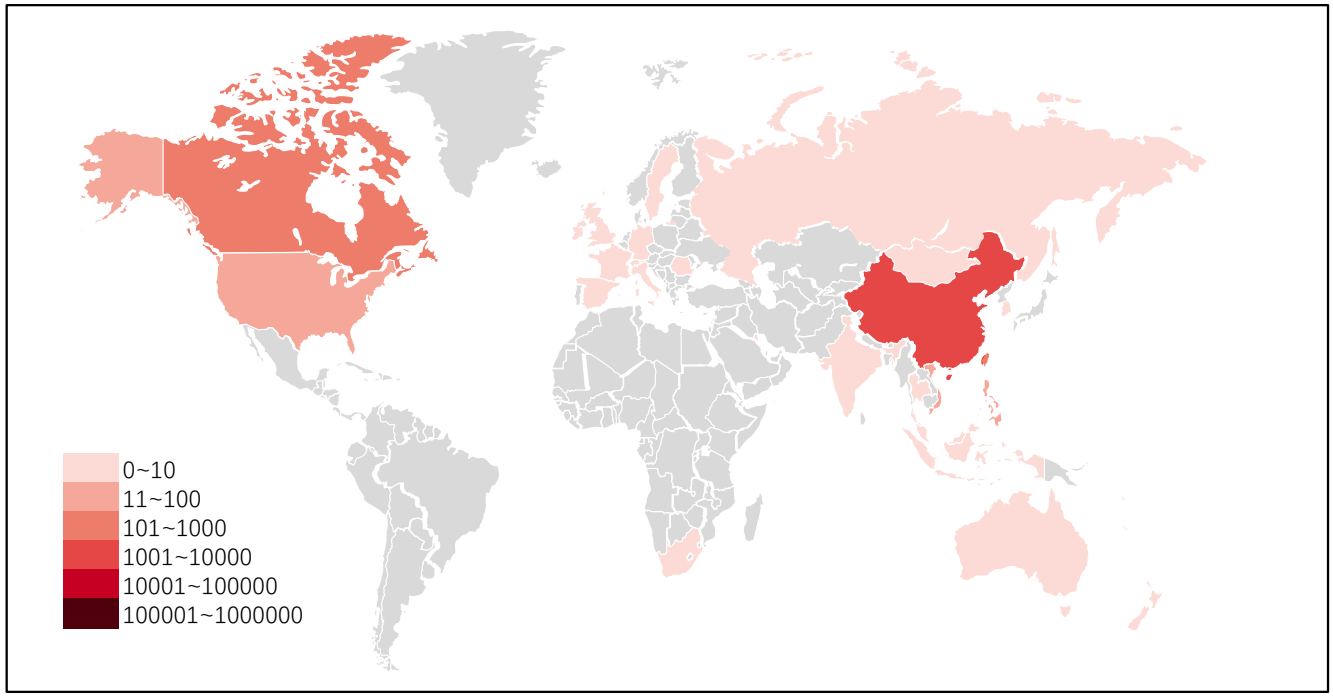
The 1968 Flu (HK)

Total cases: 1 million



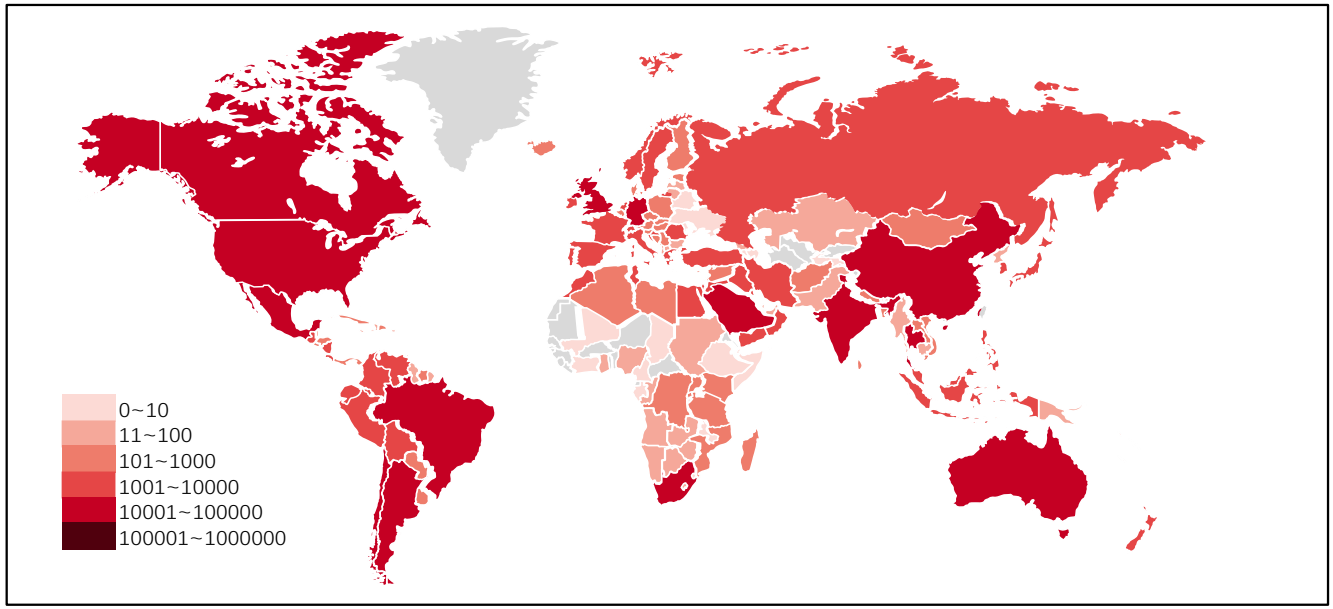
SARS (2003)

Total cases: 8096



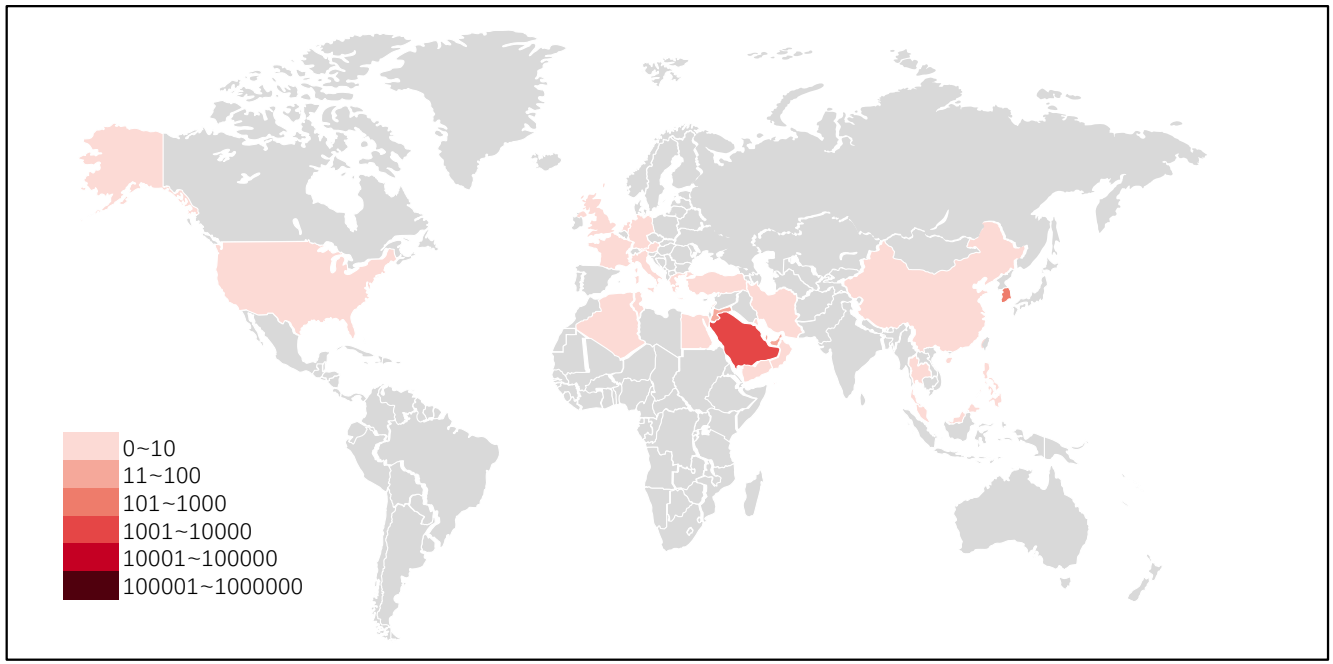
H1N1 (2009)

Total cases: over half a million



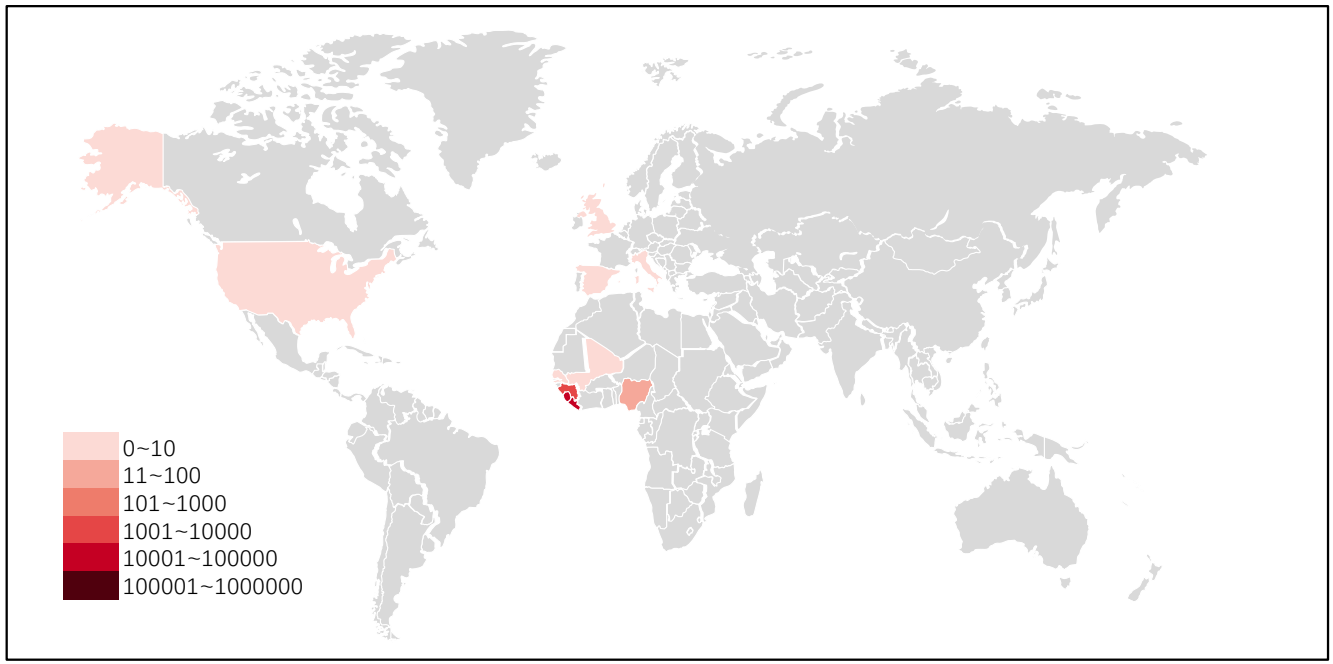
MERS (2012)

Total cases: 1289



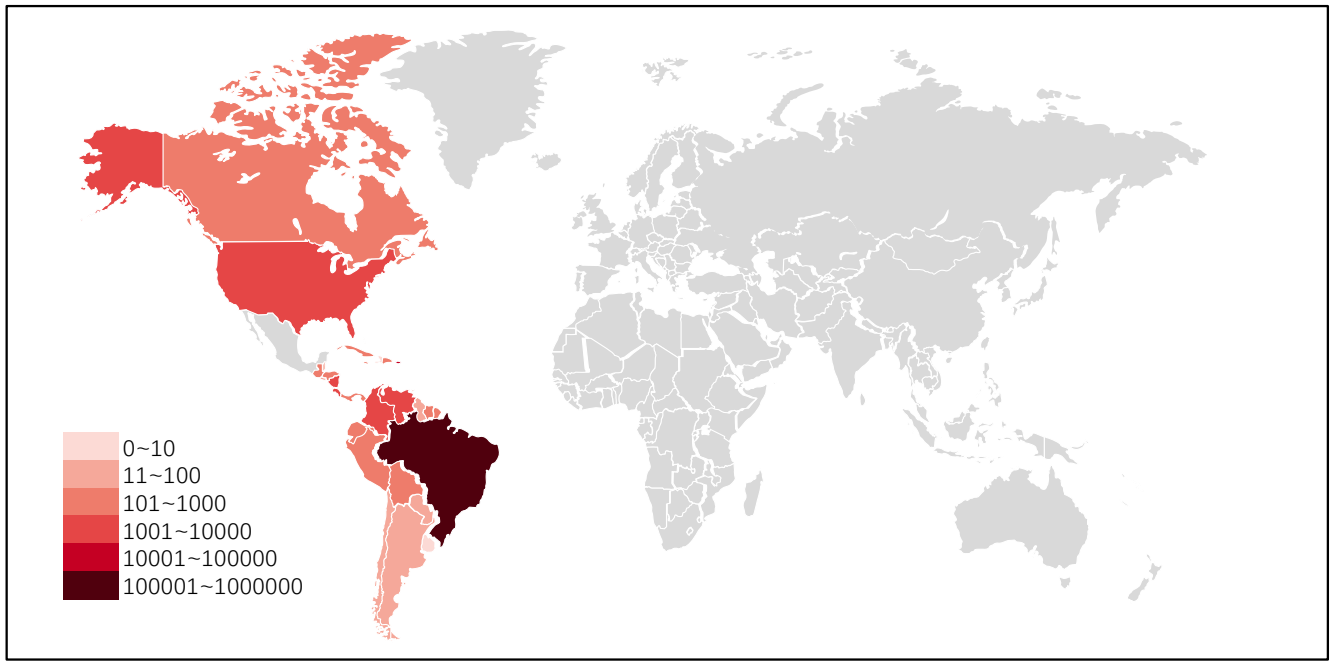
Ebola (2014)

Total cases: 28646



Zika (2016)

Total cases: over 200,000



Data Sources

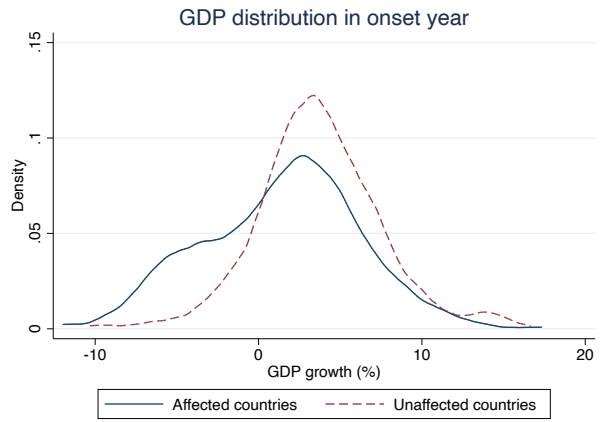
- Crises identified in Jamison et al. (2017) (a World Bank volume)
  - The 1968 Flu ("HK Flu"); SARS (2003); H1N1 (2009); MERS (2012); Ebola (2014); Zika (2016)
- Timing, Infections, and Deaths
  - WHO declares (Public Health Emergency of International Concern, PHEIC)
  - European Centre for Disease Prevention and Control (ECDC)
  - U.S. Centers for Disease Control and Prevention (CDC)
  - Public news articles
- Macro Data
  - World Development Indicators (World Bank), Penn World Tables data
  - GDP, U, consumption, investment, country-level controls
  - 210 countries from 1960-2019; 313 country-year health crises observations
- Consensus Forecasts of GDP growth
- Bilateral trade data: World Integrated Trade Solution (WB)

World GDP growth around past pandemics

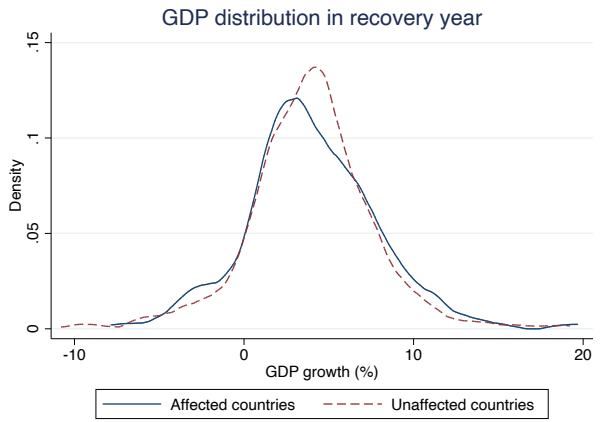
Figure: Real GDP Growth Distributions in Disease and Non-Disease Years

Panel A: GDP for Affected and Unaffected Countries

A1: Onset Year

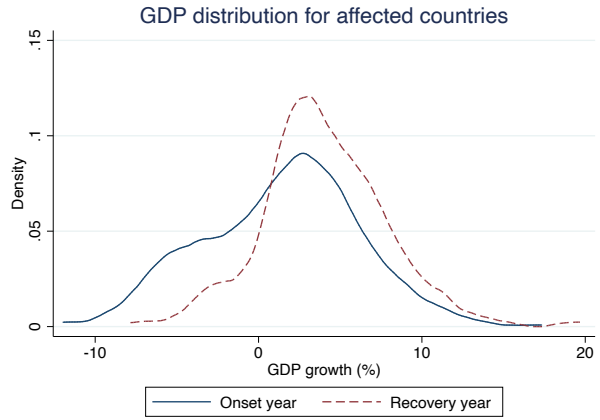


A2: Recovery Year

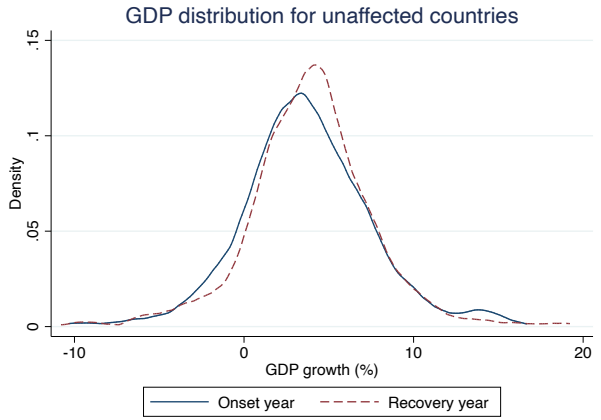


Panel B: GDP in Onset and Recovery Years

B1: Affected Countries



B2: Unaffected Countries



Estimation Methodology

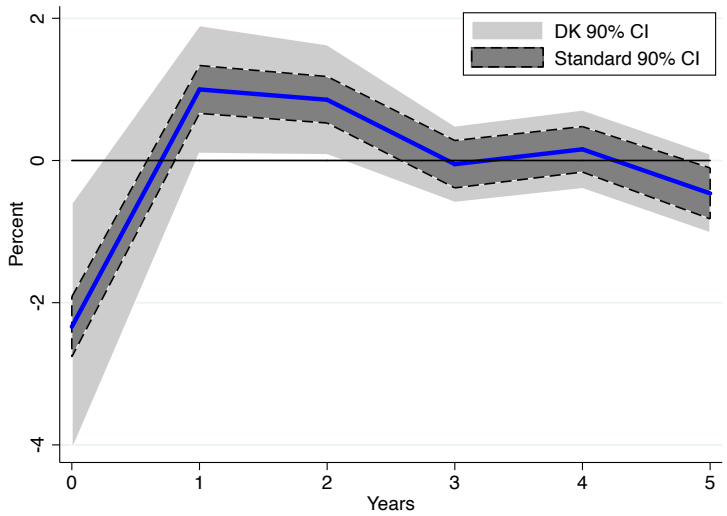
Three approaches

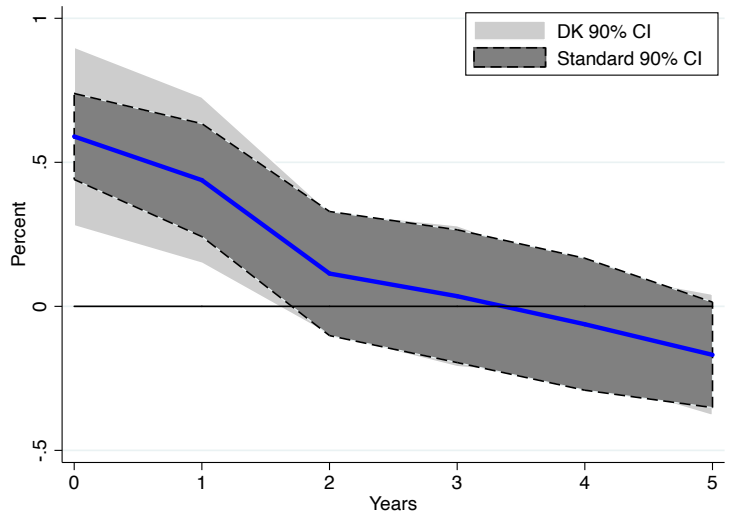
- Local projections impulse responses Jorda (2005)
- Panel OLS regressions
- Efforts to address potential endogeneity
  - Incorporate expectations
  - Seemingly Unrelated Regressions (allows feedback)
  - firm-level regressions

Notes

- Dependent variable (annual frequency) alternatively
  - GDP growth
  - unemployment
  - growth of total trade (imports+exports)
- Baseline: shock a dummy for countries affected by pandemic in that year
- Controls: trade/GDP, domestic credit/GDP, population, GDP per capita, U.S. recession dummy (NBER), decade dummy, country fixed effects, systemic banking crises dummy (Laeven and Valencia)
- IRFs display effect on countries affected by crises ("treated") relative to unaffected countries

GDP and Unemployment (all episodes and cases)





GDP growth

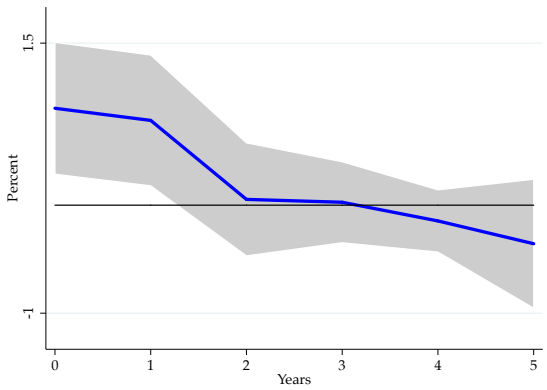
- 2.3% lower in onset years for affected countries relative to unaffected countries, on average for all crises
- bounce-back in growth rapid but persistent decline in level of GDP

Unemployment

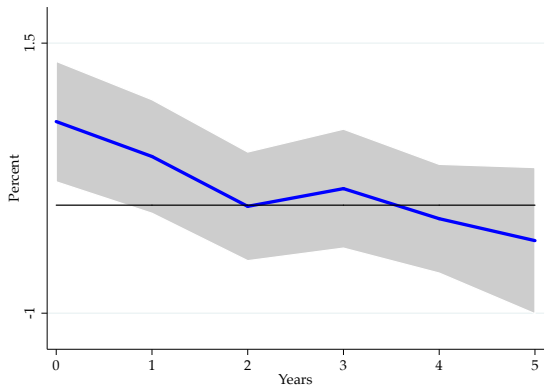
- 0.7% higher in onset years for affected countries relative to unaffected countries, on average for all crises
- greater persistence compared to GDP growth

Unemployment IRFs by Education

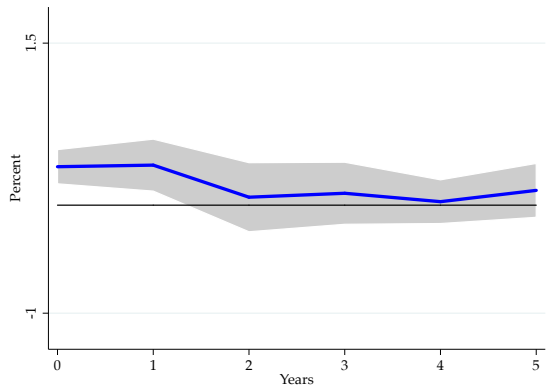
Basic



Intermediate

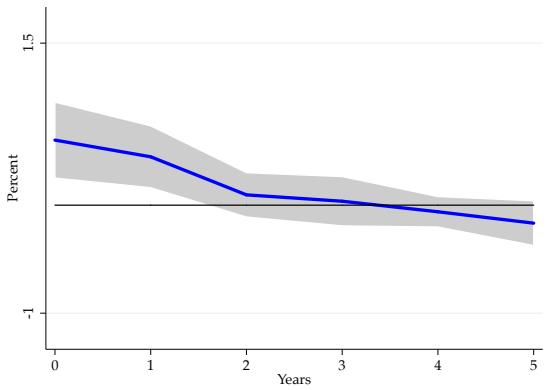


Advanced Education

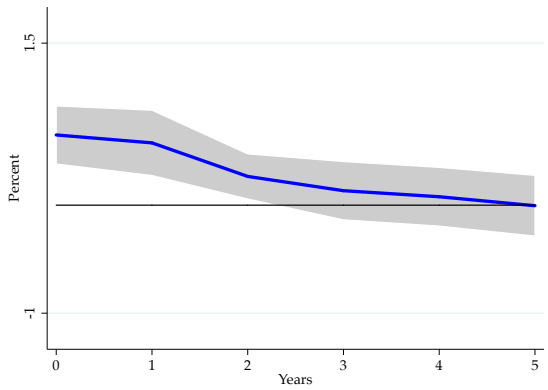


Unemployment IRFs by Gender

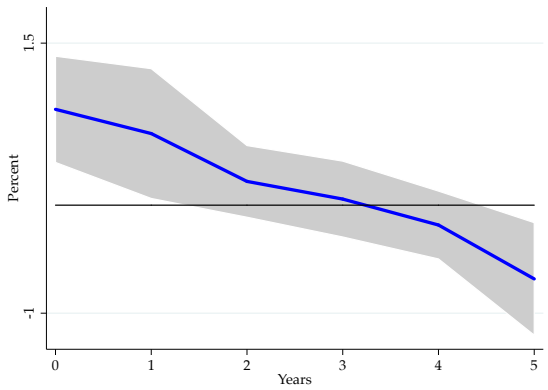
Male



Female



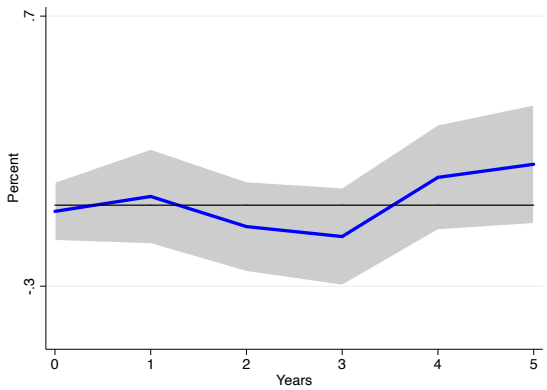
Female, Basic Education



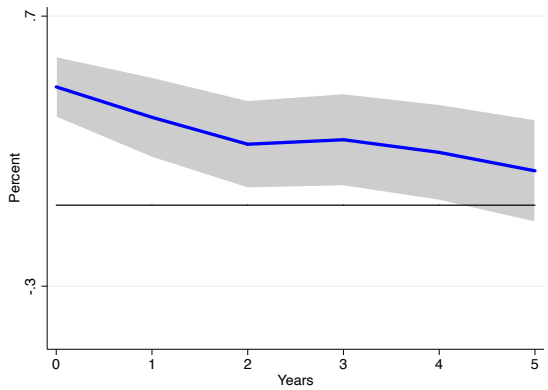
- greater persistence for female and less educated

Unemployment IRFs by Sector

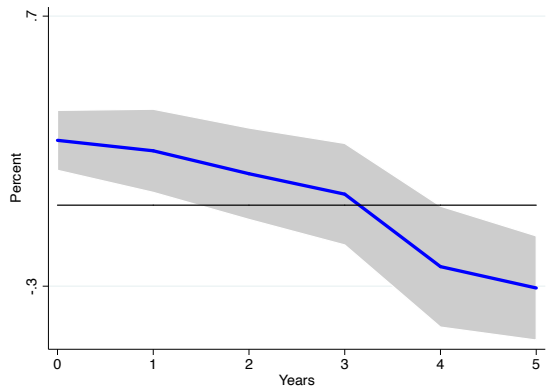
Agricultural



Industry

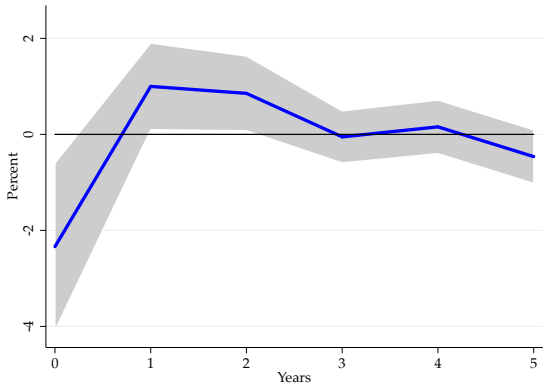


Service

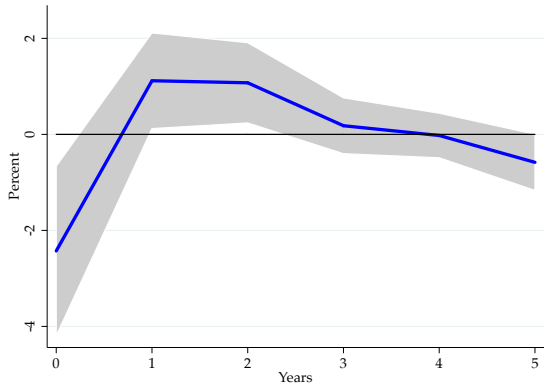


Channels

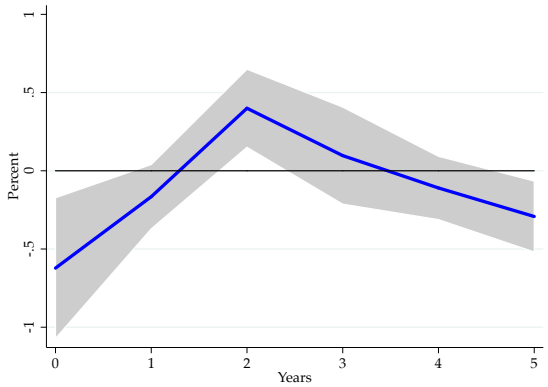
GDP (WDI)



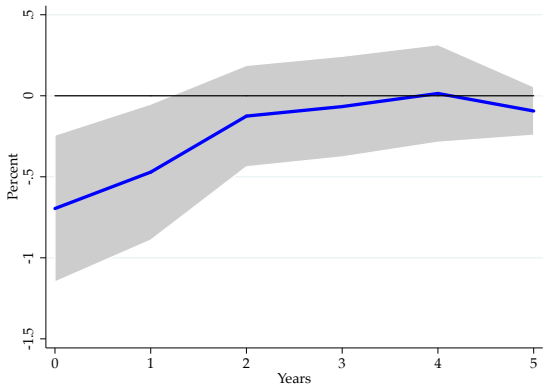
GDP (PWT)



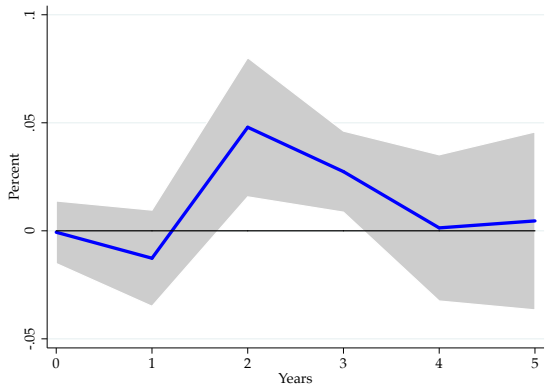
Employment (PWT)



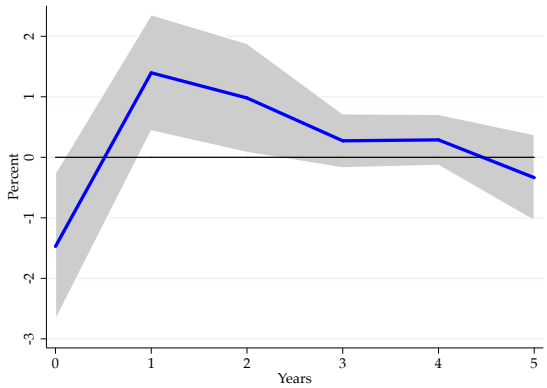
Physical capital (PWT)



Human capital (PWT)

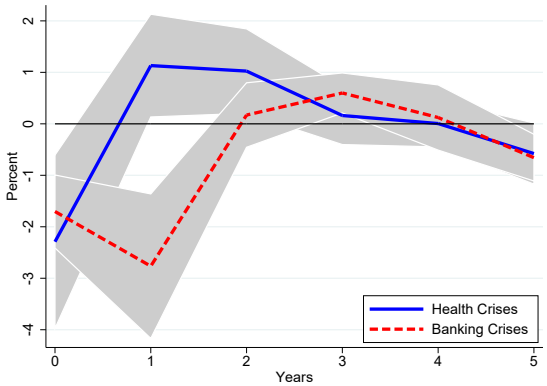


TFP (PWT)

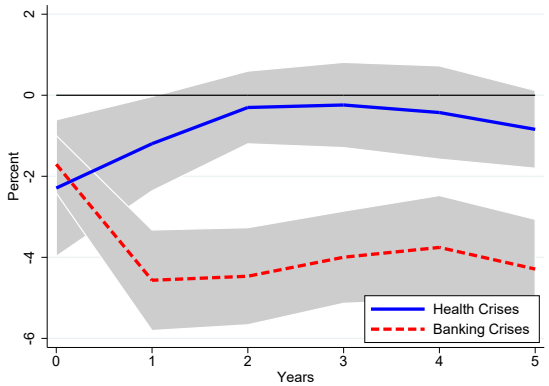


Comparing Pandemics with Financial Crises

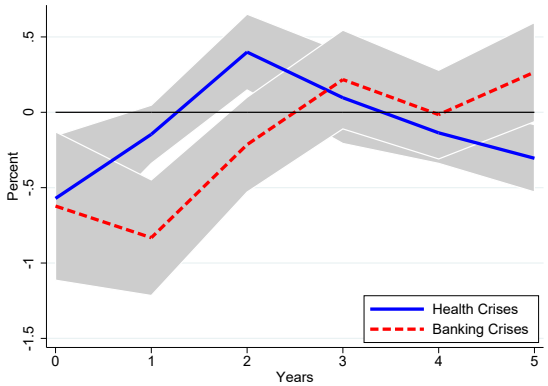
GDP (PWT)



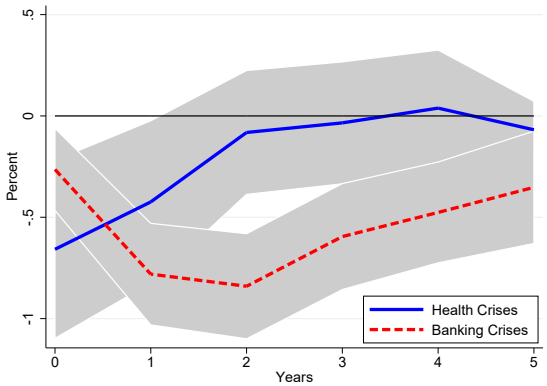
Cumulative GDP growth



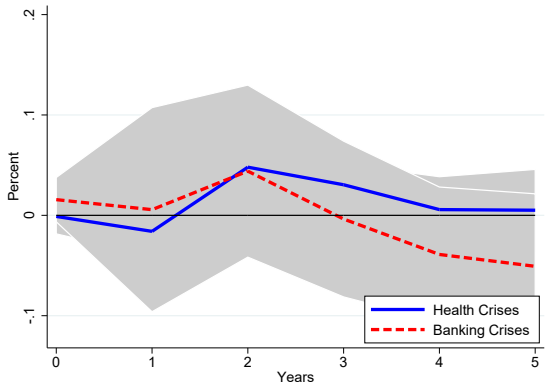
Employment (PWT)



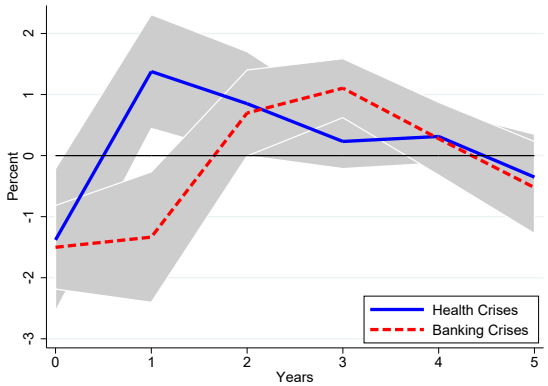
Physical capital (PWT)



Human capital (PWT)

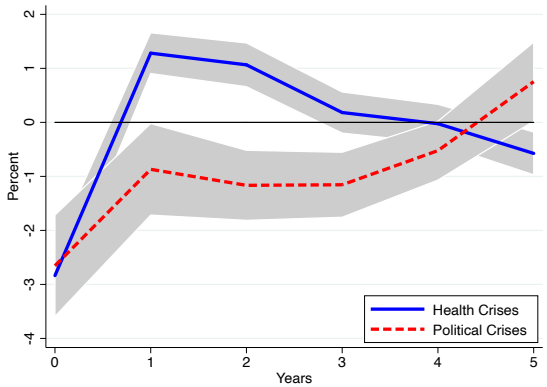


TFP (PWT)

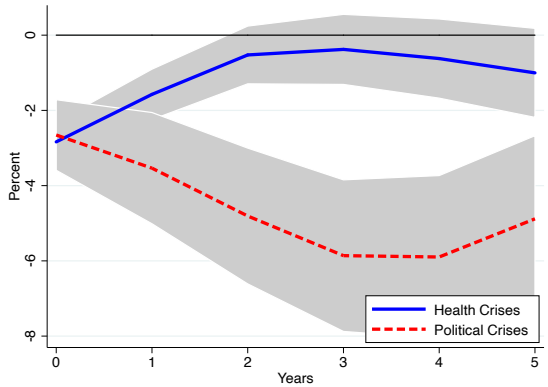


Comparing Pandemics with Political Crises

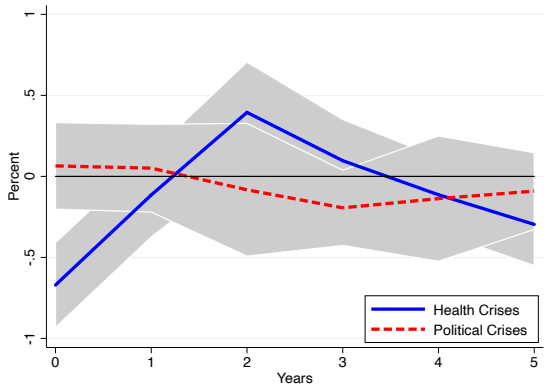
GDP (PWT)



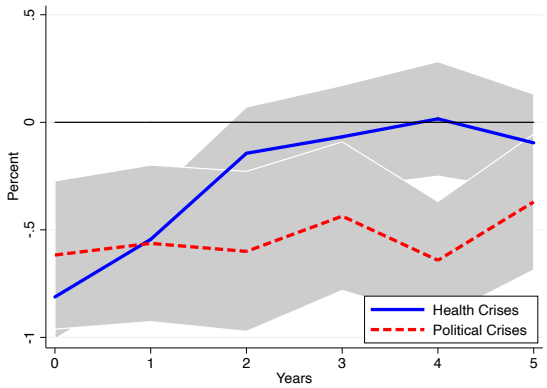
Cumulative GDP growth



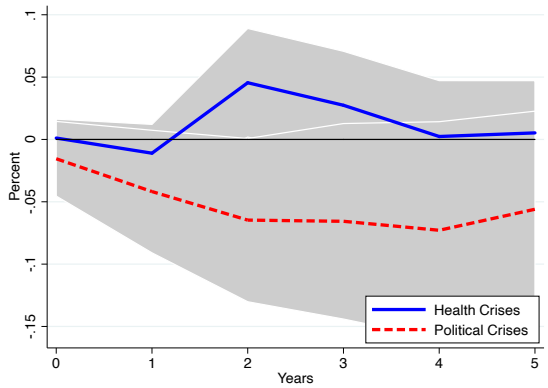
Employment (PWT)



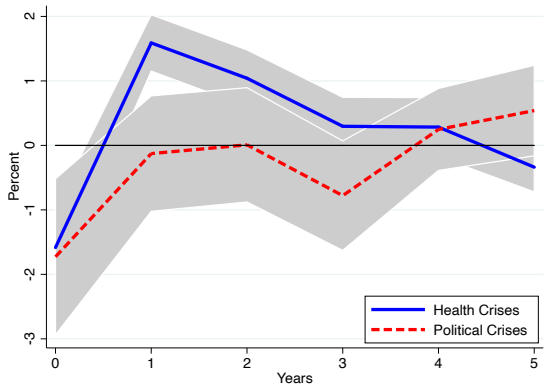
Physical capital (PWT)



Human capital (PWT)

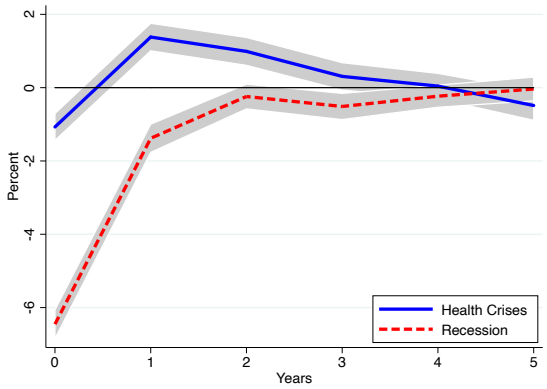


TFP (PWT)

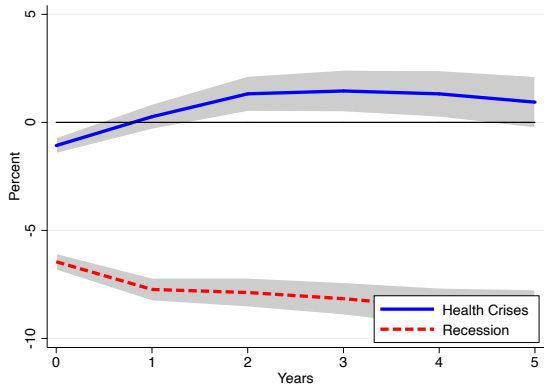


Comparing Pandemics with Recessions

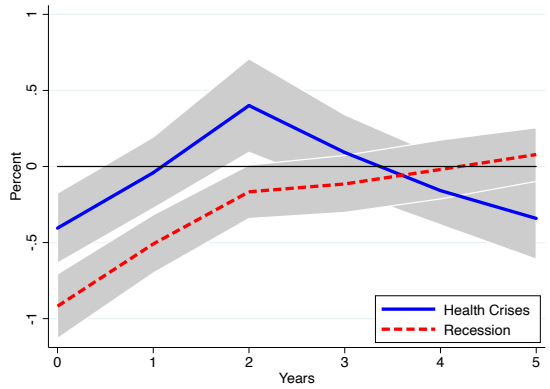
GDP (PWT)



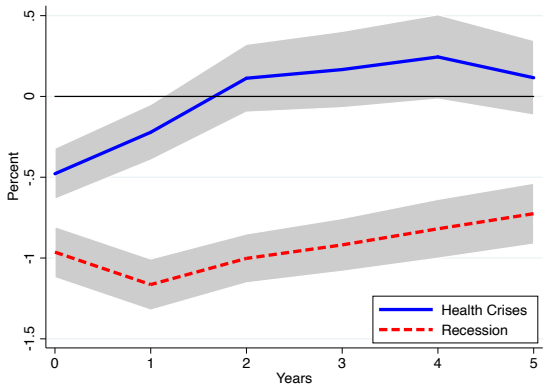
Cumulative GDP growth



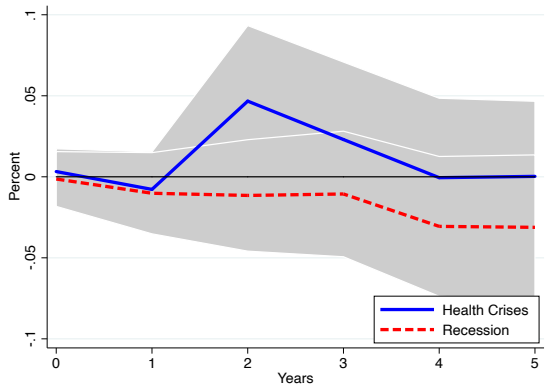
Employment (PWT)



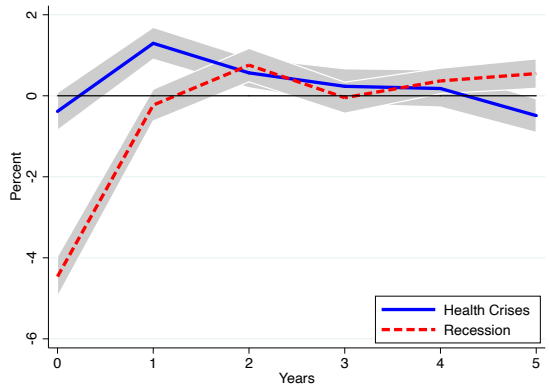
Physical capital (PWT)



Human capital (PWT)



TFP (PWT)



Panel Regression Tables

GDP Growth

- baseline specification also indicates approx. -3% impact effect
- robustness to excluding H1N1
- control for consensus forecast of GDP growth
- separate out all individual past episodes
- estimate using severity proxies (cases or deaths)
  - effect on GDP growth larger, approx -3.5% on impact
- estimate system of seemingly unrelated regressions
  - allows for feedback between health crisis probability, GDP growth, and government spending on health care
  - results also indicate approx. -3% impact effect on GDP growth
- firm-level regressions
  - Sales growth: large decline. Investment, employment, and profitability also fall. Leverage ratios rise.
  - Effects on firms more persistent than found at the country level.

Panel Regression Tables (Cont.)

	GDP growth rate %							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample Period:	1960-2019				1990-2019			
	All Events		All Events			Without H1N1		
Shock	-2.33**	-2.36**	-3.28***	-1.84***	-1.68***	-1.24***	-1.21***	-1.65***
	(1.09)	(1.09)	(0.94)	(0.26)	(0.33)	(0.29)	(0.29)	(0.37)
Consensus Forecast			0.49***	0.36**	0.48***	0.62***	0.54***	0.61***
			(0.13)	(0.13)	(0.15)	(0.14)	(0.14)	(0.16)
Trade/GDP	2.44***	2.25***	3.37***	3.10***	3.30***	2.73***	2.74***	3.16***
	(0.31)	(0.49)	(0.88)	(0.91)	(0.95)	(0.70)	(0.72)	(0.81)
Domestic Credit/GDP	-3.48***	-5.37***	-3.33**	-3.24**	-3.69**	-2.36	-2.45*	-3.28**
	(0.58)	(0.71)	(1.56)	(1.44)	(1.46)	(1.43)	(1.41)	(1.48)
Log(Population)	-0.23	0.05	2.09	2.55*	2.49	2.97*	2.93*	2.56
	(0.62)	(1.12)	(1.59)	(1.47)	(2.05)	(1.54)	(1.51)	(2.01)
Log(GDP per capita)	0.75*	2.63***	-0.87	-0.44	-1.00	-0.61	-0.47	-1.18
	(0.39)	(0.92)	(1.49)	(1.47)	(1.56)	(1.53)	(1.50)	(1.52)
Recession	-0.39*	-0.52*	-0.23			0.29		
	(0.20)	(0.28)	(0.35)			(0.22)		
Banking Crisis	-1.11***	-0.98**	0.29	0.40	0.06	-0.23	0.04	-0.09
	(0.42)	(0.41)	(0.63)	(0.44)	(0.43)	(0.46)	(0.45)	(0.48)
World GDP Growth				0.53***			0.22**	
				(0.09)			(0.09)	
Constant	1.32	-17.87	-24.69	-37.59	-31.18	-42.16	-43.20	-30.98
	(11.55)	(23.55)	(34.96)	(32.89)	(44.12)	(34.21)	(33.79)	(43.00)
Observations	6300	4177	511	511	511	484	484	484
Within R^2	0.06	0.08	0.25	0.28	0.33	0.21	0.21	0.26
Decade FE	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Year FE	No	No	No	No	Yes	No	No	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel Regression Tables (Cont.)

	GDP growth rate %					
	(1)	(2)	(3)	(4)	(5)	(6)
Sample Period:	1960-2019	1990-2019		1960-2019	1990-2019	
High Mortality Rate	-3.45***	-3.60***	-4.25***			
	(0.97)	(0.98)	(1.06)			
Medium Mortality Rate	-3.08***	-3.10***	-4.15***			
	(0.81)	(0.88)	(0.47)			
Low Mortality Rate	-0.95	-0.95	-1.16**			
	(0.95)	(0.87)	(0.49)			
High Cases/Pop				-2.73**	-2.83**	-4.21***
				(1.17)	(1.25)	(1.21)
Medium Cases/Pop				-3.21**	-3.12**	-3.79***
				(1.51)	(1.47)	(0.70)
Low Cases/Pop				-0.77	-0.87	-1.83*
				(0.56)	(0.53)	(0.91)
Consensus Forecast			0.48***			0.49***
			(0.12)			(0.12)
Trade/GDP	2.46***	2.27***	3.51***	2.44***	2.26***	3.35***
	(0.30)	(0.49)	(0.95)	(0.31)	(0.50)	(0.99)
Domestic Credit/GDP	-3.46***	-5.34***	-3.11*	-3.46***	-5.36***	-3.17**
	(0.58)	(0.71)	(1.57)	(0.57)	(0.71)	(1.50)
Log(Population)	-0.18	0.13	2.43	-0.28	0.01	2.14
	(0.61)	(1.11)	(1.61)	(0.61)	(1.11)	(1.62)
Log(GDP per capita)	0.76*	2.66***	-0.91	0.73*	2.60***	-0.88
	(0.38)	(0.91)	(1.45)	(0.38)	(0.90)	(1.44)
Recession	-0.37*	-0.49*	-0.12	-0.40*	-0.55*	-0.29
	(0.19)	(0.26)	(0.32)	(0.20)	(0.28)	(0.36)
Banking Crisis	-1.10**	-0.98**	0.15	-1.11***	-0.99**	0.32
	(0.42)	(0.41)	(0.59)	(0.41)	(0.40)	(0.61)
Constant	0.52	-19.35	-30.32	2.26	-16.92	-25.48
	(11.34)	(23.28)	(34.98)	(11.35)	(23.16)	(34.84)
Observations	6300	4177	511	6300	4177	511
Within R^2	0.07	0.09	0.26	0.07	0.09	0.25
Decade FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Seemingly Unrelated Regressions

System 1	Shock$_t$	Shock$_{t-1}$	GDP growth$_{t-1}$	Health Expenditure$_{t-1}$	Obs	R^2
GDP growth	-2.26***	1.00***	0.22***	0.18***	2615	0.40
	(0.21)	(0.21)	(0.02)	(0.07)		
Health Expentidure	0.25***	-0.02	0.00	0.78***	2615	0.96
	(0.04)	(0.04)	(0.00)	(0.01)		
Shock		-0.07***	-0.00**	0.01	2615	0.14
		(0.02)	(0.00)	(0.01)		
System 2						
GDP growth	-2.20***	1.16***	0.24***	0.16**	2749	0.40
	(0.21)	(0.21)	(0.02)	(0.07)		
Shock		-0.07***	-0.00**	0.01	2749	0.14
		(0.02)	(0.00)	(0.01)		

Firm-level Results

- We estimate the following specification at firm-level.

$$y_{ijt+h} = \alpha_i + \beta D_{jt} + \gamma X_{it-1} + \mu Z_{jt-1} + \varepsilon_{ijt}, \text{ for } h = 0, 1, \cdots, 5.$$

Dependent variable	h=0	h=1	h=2	h=3	h=4	h=5
Panel A: Sales growth						
Shock	-7.06***	1.64***	1.78***	-1.33***	-0.12	2.54***
	(0.37)	(0.36)	(0.37)	(0.39)	(0.41)	(0.42)
Panel B: Wage						
Shock	0.08***	-0.20***	0.04**	0.08***	-0.11***	0.04***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Panel C: Investment						
Shock	-0.74***	0.31***	0.50***	-0.30***	-0.12**	0.05
	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
Panel D: Profit						
Shock	-0.94***	1.21***	0.02	-0.56***	0.02	-0.16
	(0.10)	(0.11)	(0.12)	(0.12)	(0.13)	(0.14)
Panel E: Leverage						
Shock	0.28***	-0.06	0.01	0.07	0.23***	-0.03
	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
Panel F: Employment						
Shock	-0.03***	-0.03***	-0.02***	0.00	0.02***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

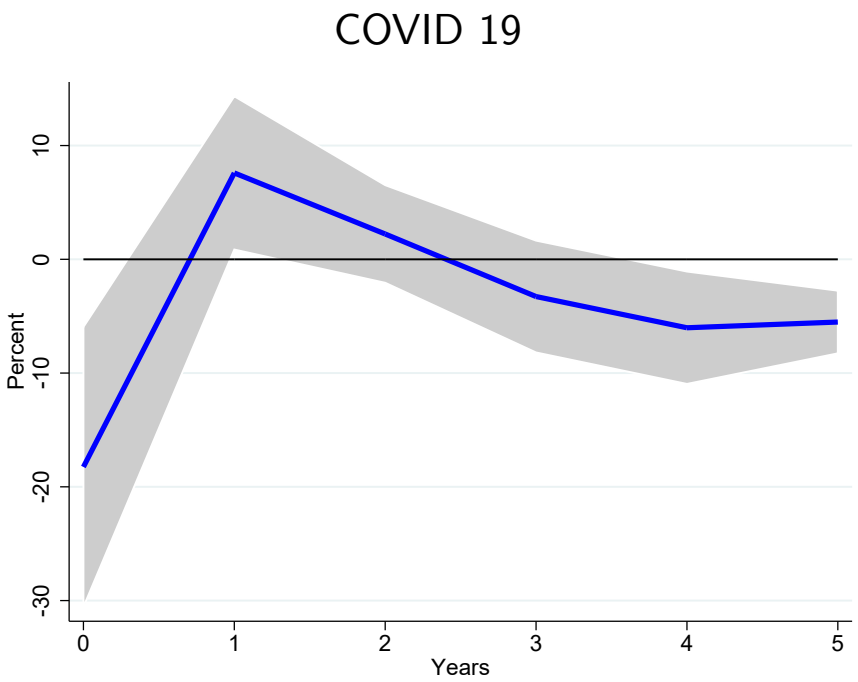
Trade Network Effects

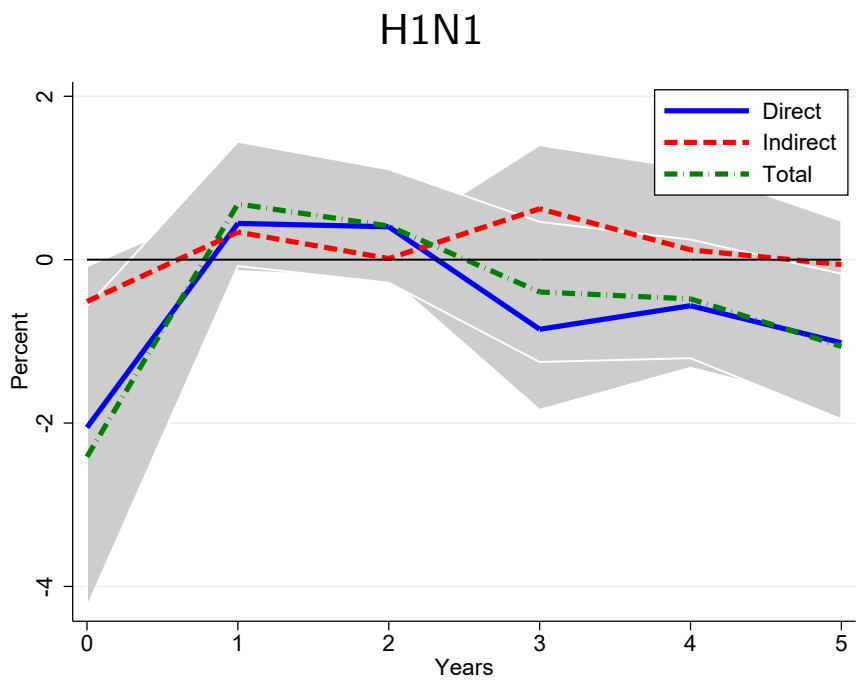
Your GDP hurt even if you don't get sick but your trading partner does

Calculate for each country a trade partner pandemic intensity measure

- how sick was each trading partner, weighted by your trade with them

Heat maps: measure much larger now than in the past





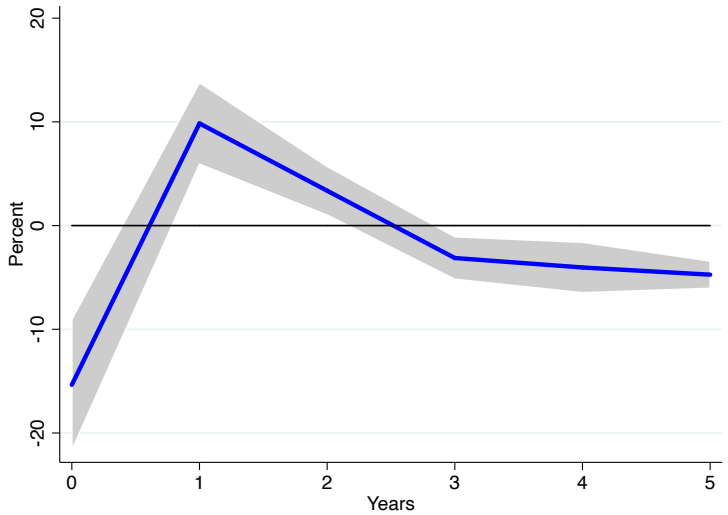
International Trade

(1) Estimate the effect of pandemics on trade growth (l.h.s. panel)

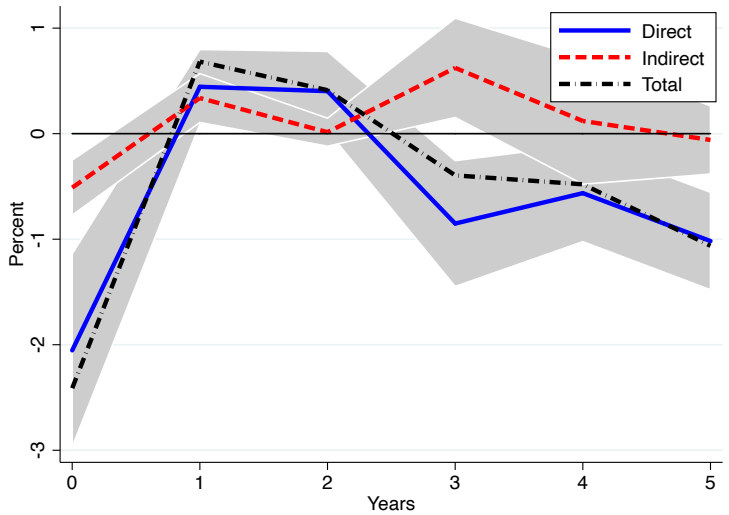
(2) Add trade partners pandemic intensity measure to GDP growth regressions

- "direct" and "trade network" effects of pandemics on GDP growth (rhs)

Trade growth (exports+imports)

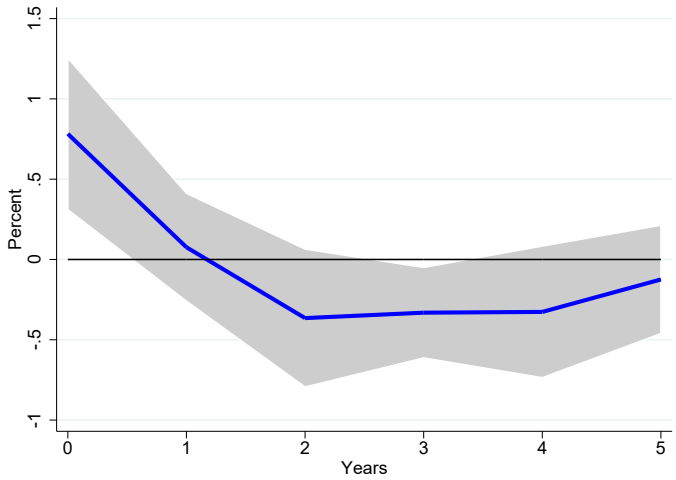


GDP growth: the trade channel

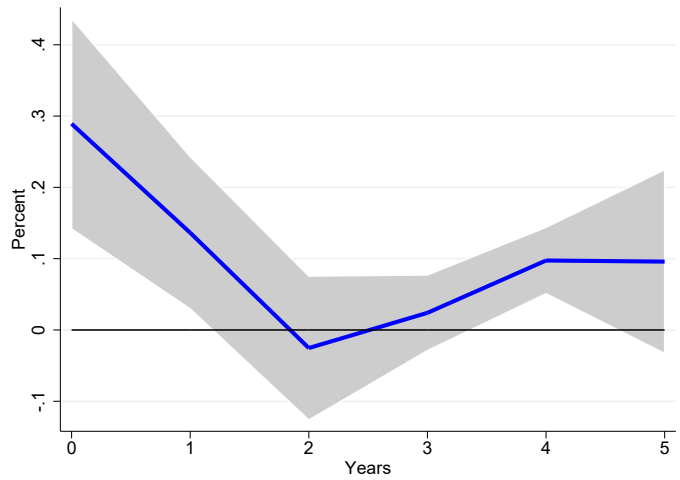


Effect on Government Budget

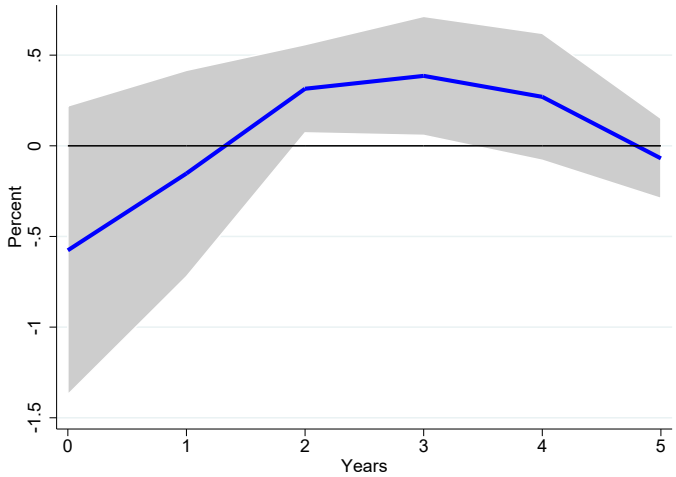
Panel A: Expense (% GDP)



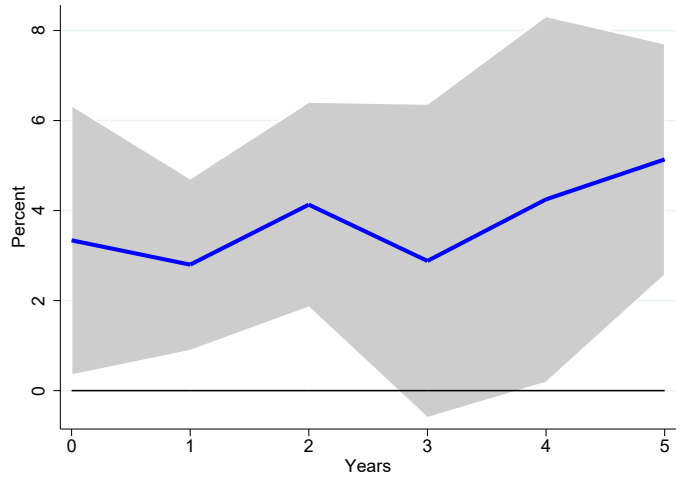
Panel B: Current Health Expenditure (% GDP)



Panel C: Revenue (% GDP)



Panel D: Central Government Debt (% GDP)



Fiscal policy makes a difference in recoveries

Compute each country's average impact-year fiscal response across crises:

$$\frac{\text{Spending}_0 - \text{Spending}_{-1}}{\text{GDP}_{-1}}$$

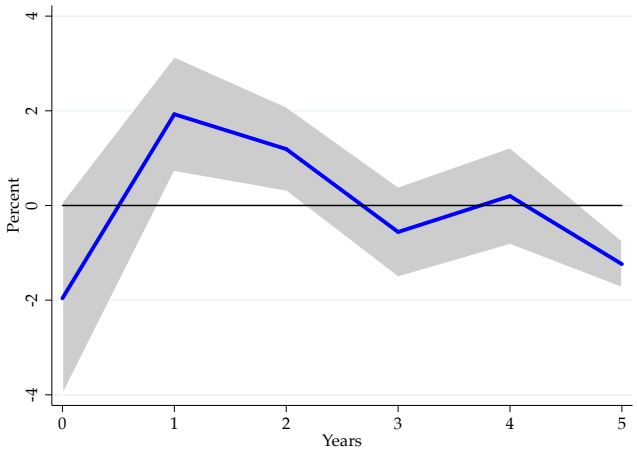
Re-estimate LP gdp growth IRFs separately on

- High response country-episodes (75th pctl)
- Low response country-episodes (25th pctl)

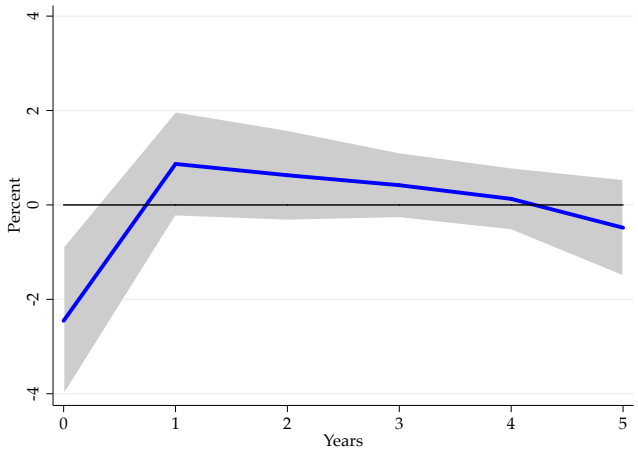
Do the same exercise on tax revenues

Role of General Expenditure and Tax Revenues

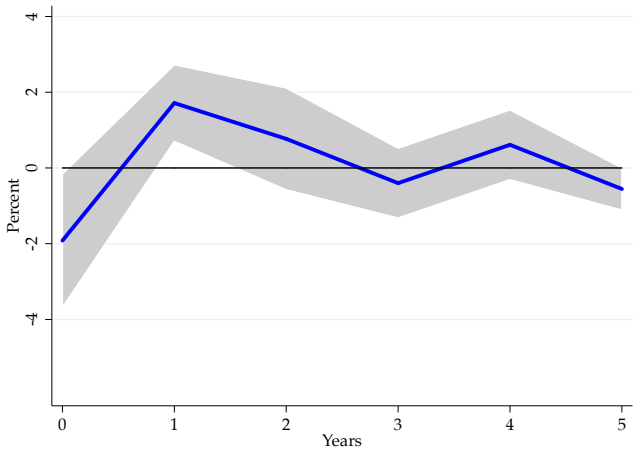
Panel A: High Expenditure Response



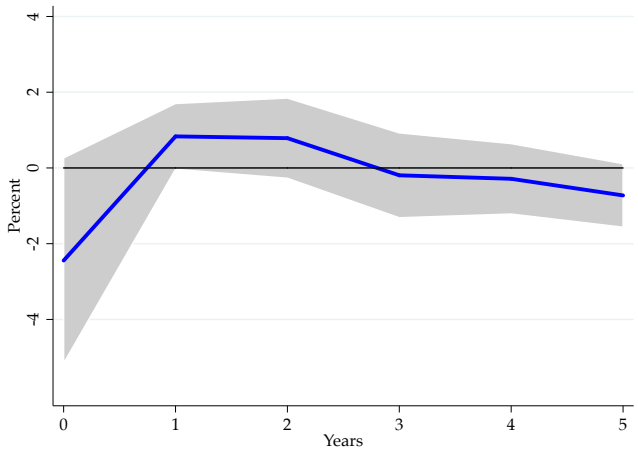
Panel B: Low Expenditure Response



Panel C: High Tax Response



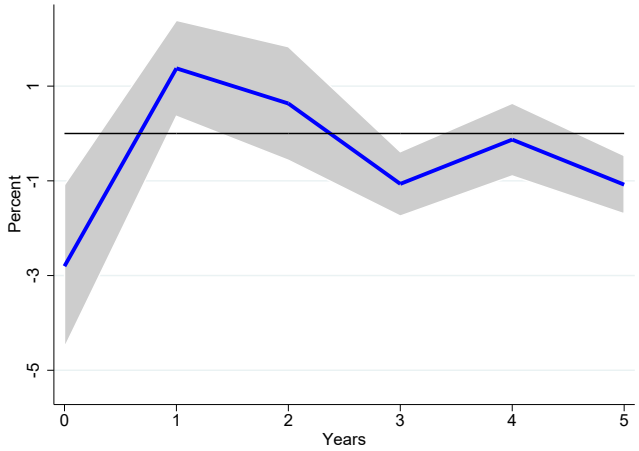
Panel D: Low Tax Response



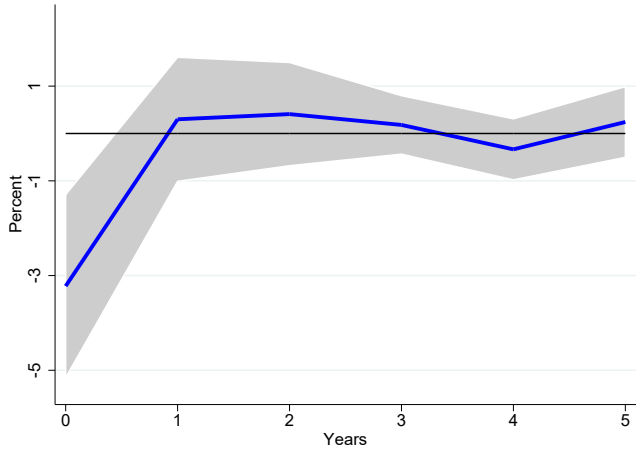
Role of Health Expenditure

Panel A: GDP growth

A1: High Health Expenditure Response

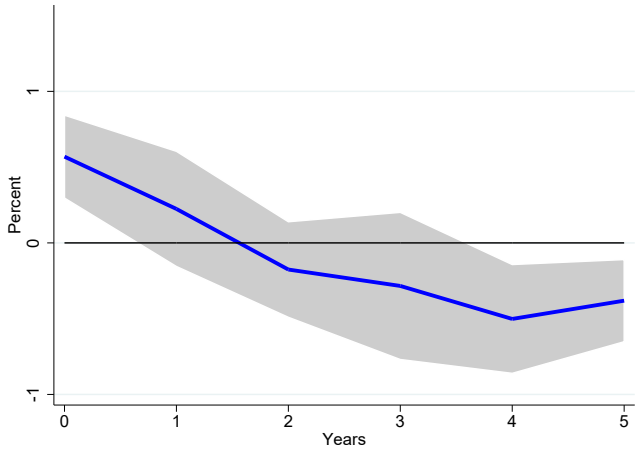


A2: Low Health Expenditure Response

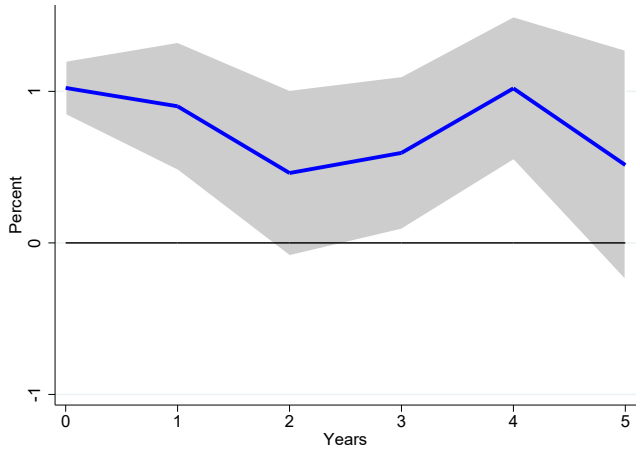


Panel B: Unemployment

B1: High Health Expenditure Response



B2: Low Health Expenditure Response



Comparing Historical Episodes with Covid-19

At least two distinct features

- Episode severity
- Government response

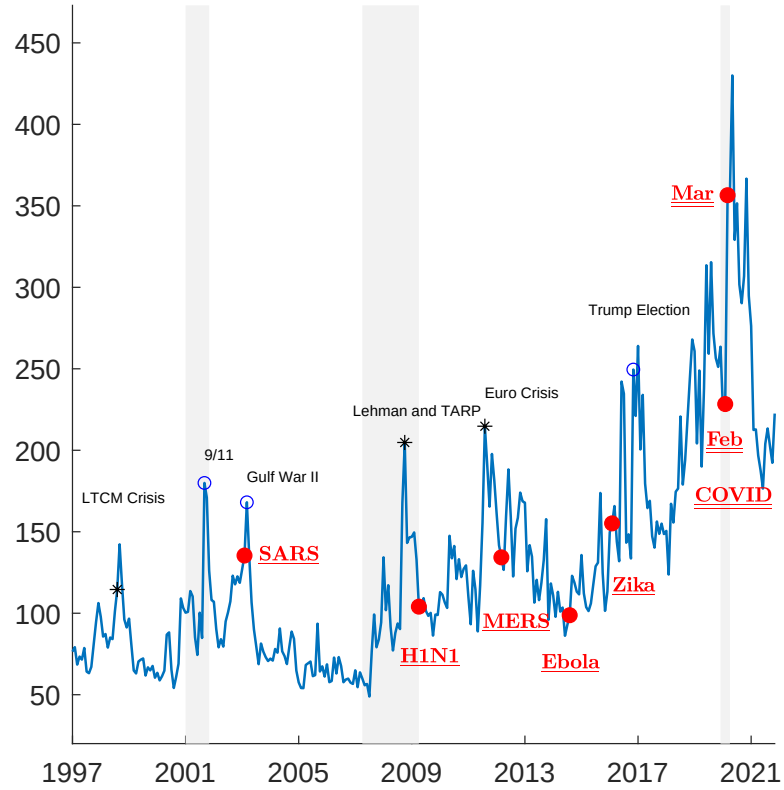


Figure: Economic Policy Uncertainty and Crisis Episodes

Comparison with Covid shock (world GDP growth)

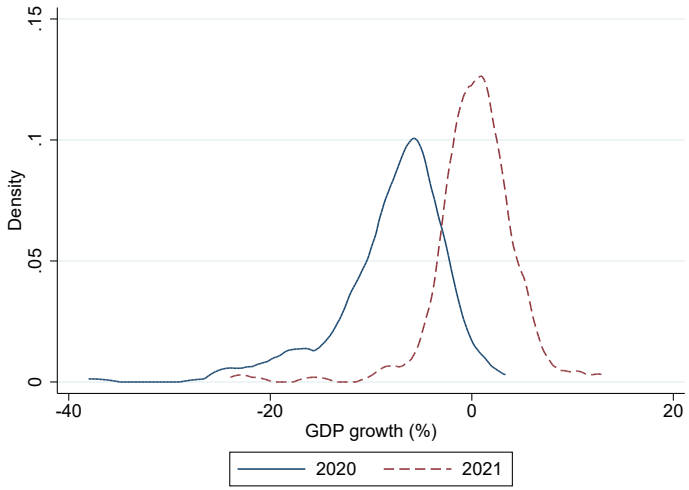
- IMF WEO forecast for 2020 world GDP growth
  - Pre-Covid forecast = 3.4%
  - Actual data = -3.1%
  - implies "Covid shock" to 2020 world GDP growth -6.5%

- Our analysis of six postwar pandemics
  - use panel regression estimates from all cases and "severe" country cases only
  - impact effect on world GDP growth -2.6 to -3.5%
  - implies that Covid is about 3-4 std dev worse (MRZ s.e. around 1.1)
  - IMF mark *up* of 2021 outlook consistent with bounce-back in past episodes

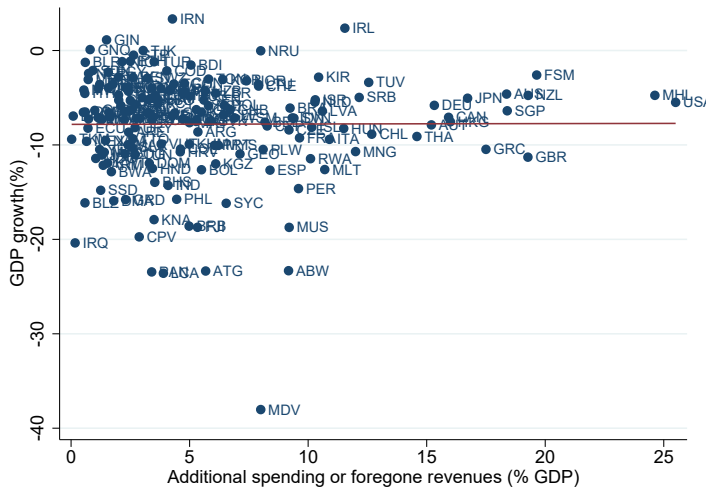
	Panel A: 2020 (Onset year)			Panel B: 2021 (Bounce-back)		
	IMF	World Bank	Consensus	IMF	World Bank	Consensus
Actual	-3.1	-3.4	-4.0	5.9	5.5	4.9
Pre-Covid forecast	3.4	2.7	2.5	3.6	2.8	2.6
Shock	-6.5	-6.1	-6.5	2.3	2.7	2.3

Covid Effect on GDP and Immediate Fiscal Response

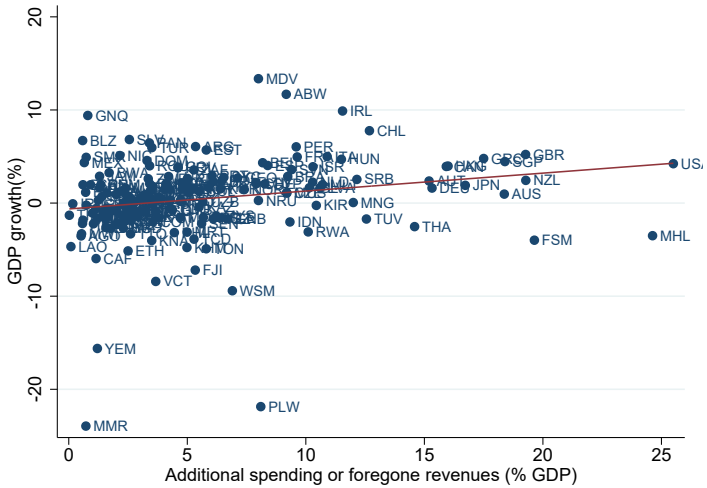
Panel A: Covid Shock on GDP



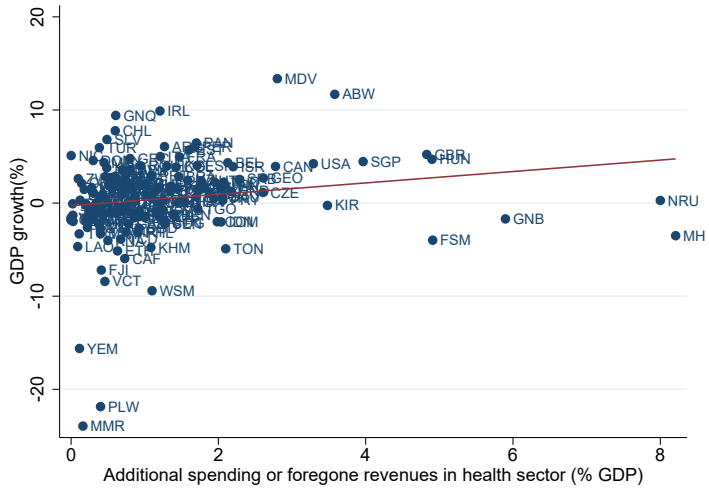
Panel B: Fiscal Response and 2020 Covid Shock



Panel C: Fiscal Response and 2021 Covid Shock



Panel D: Health Spending and 2021 Covid Shock



Conclusions from Postwar Pandemics

- Large and persistent effects of pandemics on GDP and unemployment
  - Covid looking like a 4-sigma event
- Distributional consequences
  - less educated suffer larger, more persistent unemployment; less-educated females suffer most; suggests Covid recovery could be k-shaped
  - recovery policies help distribution, not only aggregate outcomes
- International trade plummets
  - on par with US trade collapse in 2008-09
  - open trade linkages benefit macro recovery, but is globalization dead?
- Fiscal policy helps
  - recovery stronger for countries with larger initial govt spending responses, especially on health care, but fiscal space now lower than in 2009