Discussion of

"COVID19 and The Macroeconomic Effects of Costly Disasters"

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The views expressed here are mine and are not representative of the views of Deutsche Bundesbank or the Eurosystem.

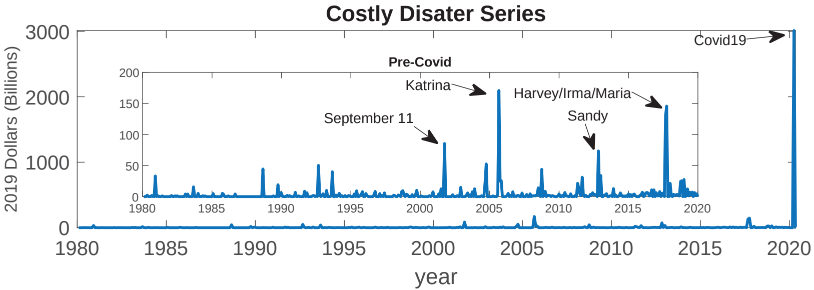
Outline

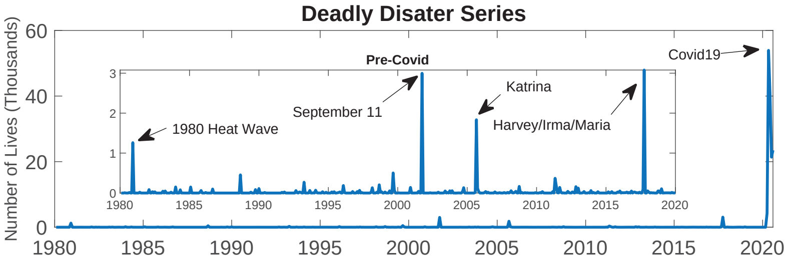
1. Summary
2. Comments
    - Tails and quantiles
    - Climate Change
3. Conclusion

High-level summary of the paper

- Nice paper studying a big question: how much will Covid19 cost us?
- LMN build time series of costly (deadly) disasters in the US.
- Estimate VARs to study the dynamic effects of disaster shocks for US economy.
- Focus on IP, claims, service sector employment, # flights.
- Key takeaway: based on (limited) previous experience, COVID19 likely to have **HUGE** effects on US economy for some time to come.

Contribution #1: Putting COVID19 into Perspective





Contr. #2: Tracing Dynamic Effects of Disaster Shocks

- VAR representation of the economy...

$$A(L)X_t = Be_t$$

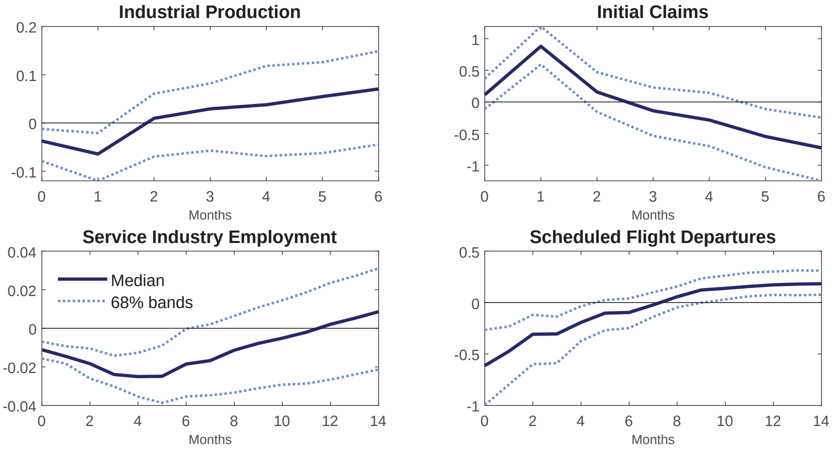
- ... gives rise to the VMA representation:

$$X_t = \Psi_0 e_t + \Psi_1 e_{t-1} + \Psi_2 e_{t-2} + \dots$$

- Can be used to study dynamic effects of specific *shock profiles*, e.g.:

$$\begin{aligned} & \mathbb{E}[X_{t+h} | e_{1,t} = \sigma, e_{1,t-1} = 2\sigma, e_{1,t-2} = \sigma] \\ - \quad & \mathbb{E}\left[X_{t+h} | e_{1,t} = 0, e_{1,t-1} = 0, e_{1,t-2} = 0\right] \\ = \quad & \Psi_h + 2\Psi_{h-1} + \Psi_{h-2} \end{aligned}$$

Typical disasters have small and short-lived macro effects

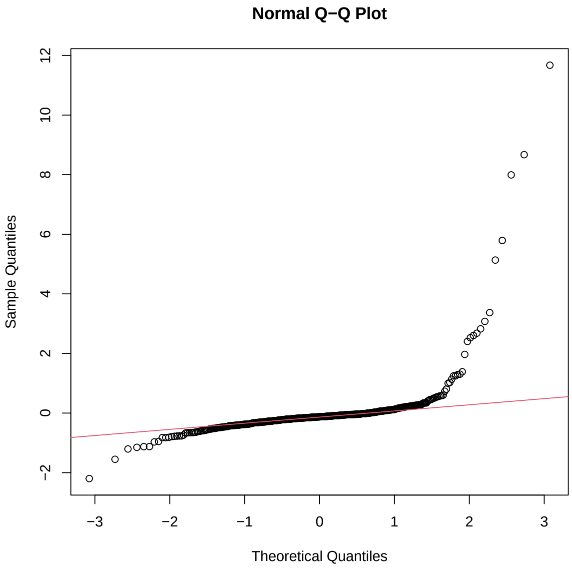


Contr. #3: Loss estimates for COVID19 shock profiles

Shock Profiles	Industrial Production	Initial Claims	Service Employment	Flights
	Calibration based on Relief Pacakage			
(192,0,0,0,100)σ	−11.80%	167.56%	−5.17%	−113.72%
Cumulative Losses	−20.17%	213.62%	−45.11%	−666.33%
(192,0,88,79,100)σ	−11.80%	167.56%	−7.98%	−164.09%
Cumulative Losses	−22.28%	288.80%	−68.55%	−1048.1%
	Calibration based on APCIA insurance cost			
(65,0,0,0,34)σ	−3.99%	56.73%	−1.75%	−38.50%
Cumulative Losses	−6.83%	72.32%	−15.27%	−225.58%
(65,0,30,27,34)σ	−3.99%	56.73%	−2.70%	−55.55%
Cumulative Losses	−7.54%	97.77%	−23.21%	−354.83%

- While historically disasters have had smallish macro effects, the sheer size of the COVID19 shock still implies huge economic costs.

Comment #1: LMN Disaster Shocks Have Very Fat Tails



Implications of Fat Tails for Estimation/Inference

- How robust are our standard tools to fat tails?
- Consider linear regression model $y_t = X_t\beta + u_t$
- Recall: OLS is **B**est **L**inear **U**nbiased **E**stimator
- From Gauss-Markov theorem which assumes u's have **finite variance**
- Inference relies on Central Limit Theorem $\Rightarrow$ sum of large number of independently distributed RVs **with finite variances** is approximately normally distributed.

Alternative Estimators

- There is a vast literature on estimation/inference in the presence of fat tails. For illustration, I focus on one alternative estimator.
- Blattberg-Sargent (ECMA 1971) derive BLUE for general symmetric stable Paretian distributions, including those with infinite variance.
- Special cases: normal distribution, Cauchy distribution.
- BS show BLUE for Cauchy distribution:

$$\hat{\beta}_{BS} = \frac{y_\tau}{X_\tau}$$

  where $\tau = \arg\max X_t$, i.e. observation for which regressor X is at maximum.

Illustration for IP Response to Disaster Shocks

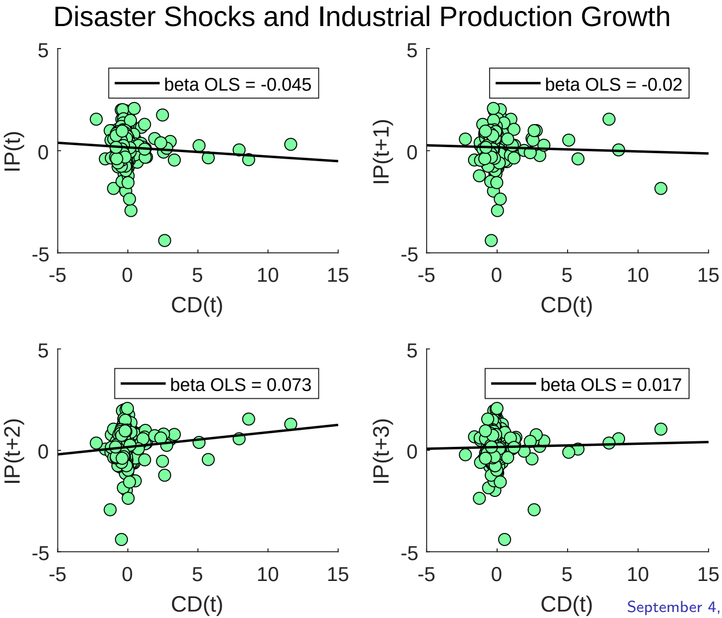
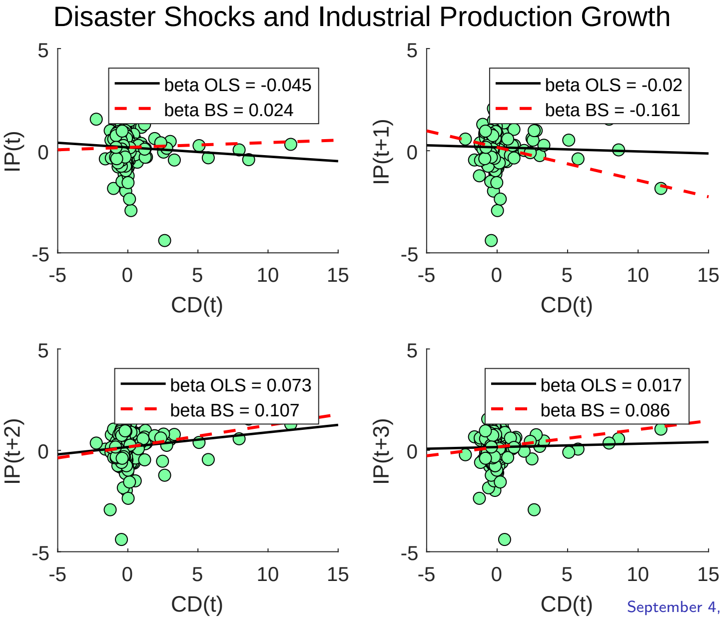
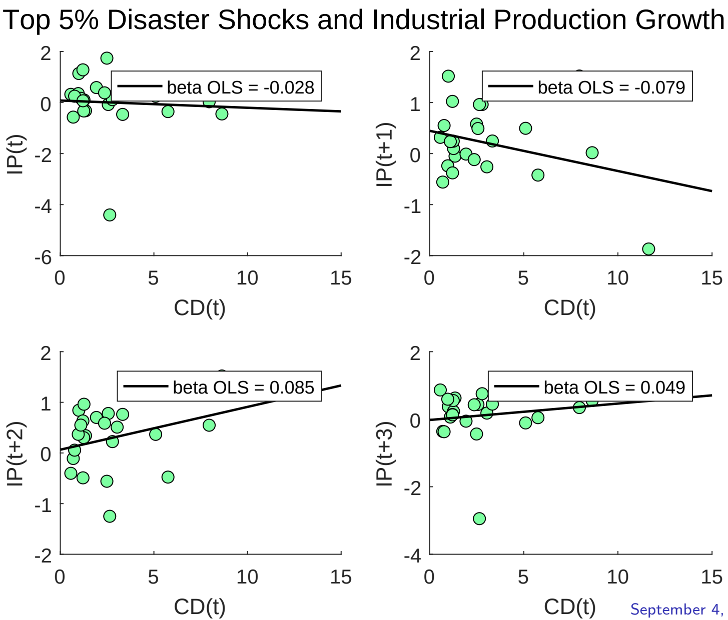


Illustration for IP Response to Disaster Shocks



Studying Only Large Disasters Also Suggests Larger Effects



A Better Tool? Quantile VARs

- Instead of just checking robustness of estimated *mean* effect, instructive to study dynamic interaction at different quantiles of distribution ⇒ Quantile VAR (e.g. Manganelli & Chavleishvili 2019):

$$X_t = \omega^\theta + \sum_{j=1}^{p} \Phi_j^\theta X_{t-j} + \Gamma^\theta X_t + \epsilon_t^\theta$$

where $\theta \in (0,1)$, Γ^θ lower triangular w/ zeroes on diagonal.

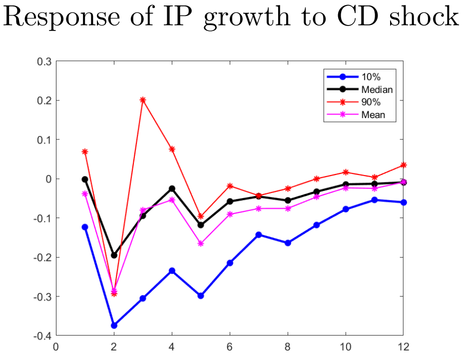
- Can be used to compute conditional quantile functions and quantile impulse response function (QUIRF):

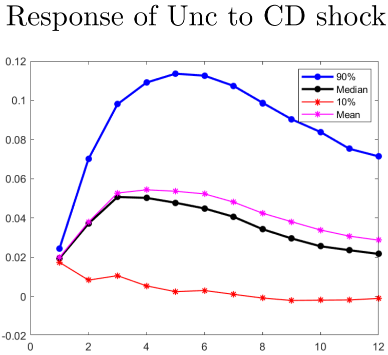
$$\mathbf{\Delta_h}(\theta) = Q_{X_{t+h}}(\theta|\mathbf{F_t}, X_{i,t} = \epsilon_t) - Q_{X_{t+h}}(\theta|\mathbf{F_t})$$

⇒ difference of conditional quantiles "with and without" shock ϵ_t.

QIRFs for IP growth and Macro Uncertainty

Reestimate baseline LMN VAR (CD, IP, Unc) as QVAR[1]:





⇒ Much more action in the tails!

[1] I thank Sulkhan Chavleishvili for providing QVAR estimates.

Comment #2: Climate Change

- Most disasters climate-related: hurricanes, droughts, floods, wildfires.
- Climate change increases frequency and size of such disasters.
  "A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing ofweather and climate extremes, and can result in unprecedented extremes." [IPCC 2018]
- May even increase prob of future pandemics:
  "Owing to evolving land-use, bat populations are setting up in areas closer to human dwellings. . . This increases the risk of transmission of viruses through direct contact, domestic animal infection ..." [Afelt, Frutos, Devaux in Front. Microbiol. 2018]
- Need more (mainstream) research on economic costs of climate change and benefits of mitigation policies.

Conclusion

- Very nice paper that helps us assess macroeconomic costs of COVID19.
- Disasters are tail events. By not taking that into account we may under-/overestimate their effects.
- Climate change increases the severity and frequency of disasters.
- Analyses as in this paper can help assess the potential costs.
- **I encourage the authors and everybody else to do it.**