

# How is risk transmitted across industries in the US?

Evidence from Covid-2019

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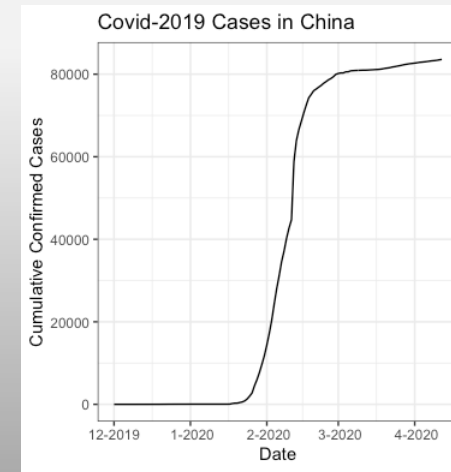
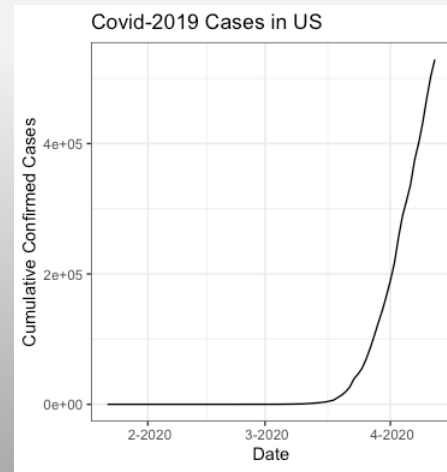
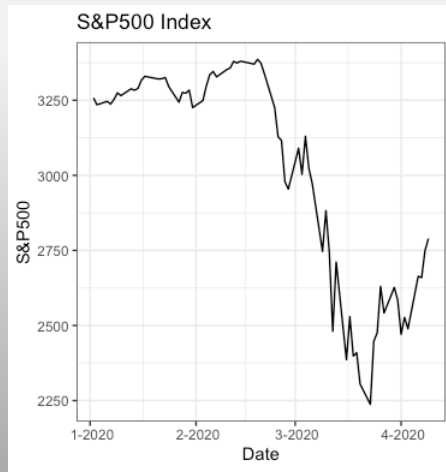
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# Motivation

- Big events (financial crisis, natural disaster, epidemic) can produce negative impact (risk) to related industries.
- Risk can be transmitted among relative industries (finance, electronic, agriculture and so on).

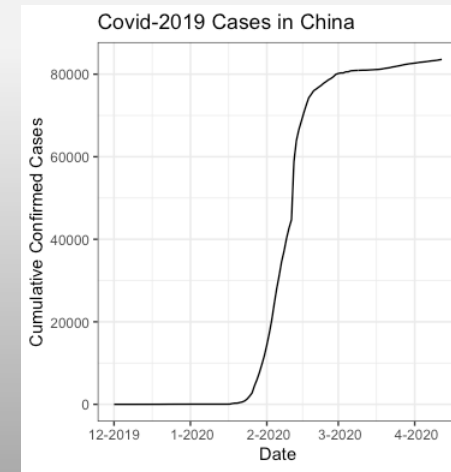
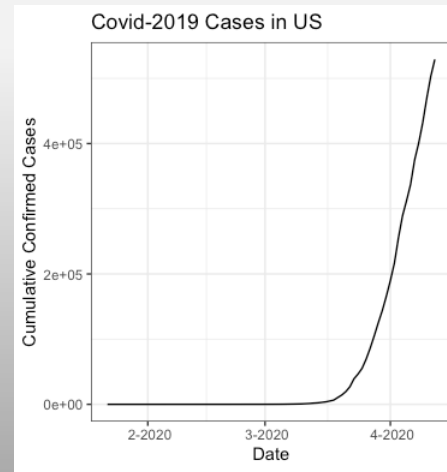
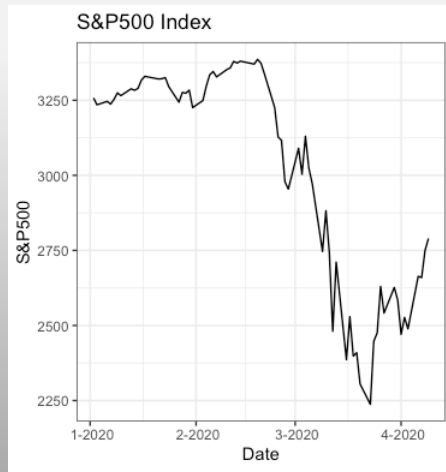
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# Introduction

- *Estimating global bank network connectedness* (Mert Demirer et al., 2016) propose a Vector Auto Regression (VAR) model to estimated the risk connectedness among banks.
- *Econometric measures of connectedness and systemic risk in the finance and insurance sectors* (Monica Bilio et al., 2018) estimates the risk between finance and insurance sectors.
- How to deal with high-dimension data.

# Data

- Source: Stock index (S&P500, DOW) in the past 10 years across hundreds of industries from Yahoo Finance.
- Variable: OHLC Data ➡ Return Rate

Time	Oil extraction	Chemical Fiber	Petroche mical	Plastic	Rubber	Steel	...
2007/10/12	2767.1	3104.8	6678.77	2299.23	2360.61	7429.9	...
2007/10/15	2739.24	3133.56	7116.11	2304.99	2315.89	7859.34	...
2007/10/16	2712.45	3176.3	7021.68	2360.13	2352.69	7752.97	...
...	...	...	...	...	...	...	...

# Contribution

- Estimate the risk connectedness from a broader perspective - major industries in the society.
- Analyze the risk transmission mechanism both dynamically and statically.
- Handle the high-dimension data with a modified model.

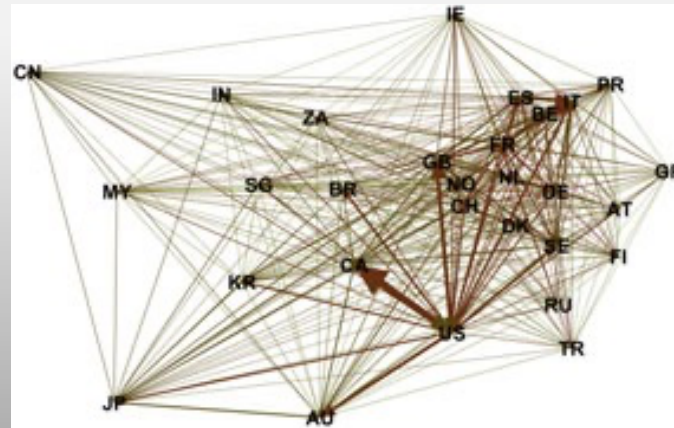
# Model: VAR-Lasso

- Build a VAR model:  $y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t$ , a VAR model describes the evolution of a set of  $k$  variables over the same sample period as a linear function of only their past values.
- Estimate the VAR model with lasso penalty term:  $\min_{\beta_0, \beta} \left\{ \sum_{i=1}^N (y_i - \beta_0 - x_i^T \beta)^2 \right\}$  subject to  $\sum_{j=1}^p |\beta_j| \leq t$ .  
which can handle the high-dimension data.



# Model: Network Analysis

- Variance Decomposition: To get the pairwise connectedness between different industries.
- Network Graph: To visualize the result of variance decomposition.



## Potential result

- Static analysis of risk transmission mechanism at a certain time (empirical study based on Covid-2019)
- Dynamic analysis of risk transmission mechanism over a long time period (overall risk connectedness).