Discussion of "NETS: Network Estimation for Time Series" and "Networks of Common Asset Holdings: Aggregation and Measures of Vulnerability"

Galo Nuño

European Central Bank

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- Two very different papers.
- However, both employ network techniques in order to analyze financial stability
    - Barigozzi and Brownless (NETS): how to construct a network from multivariate time series data
    - Braverman and Minca (Vulnerability): given a network of portfolios, how to construct measures of vulnerability.

Barigozzi and Brownless: NETS

Aim of the paper

- Given multivariate time series, how to construct an undirected network where the edges are long run non-zero partial correlations.
- If the network is sparse, it can be estimated using a LASSO procedure (NETS).
- An example is provided using a panel of US bluechips.

Barigozzi and Brownless: NETS

Approach

- Assume a multivariate process $\mathbf{y}_t$

$$\mathbf{y}_t = \sum_{k=1}^{\infty} \mathbf{A}_k \mathbf{y}_{t-1} + \boldsymbol{\epsilon}_t, \quad \boldsymbol{\epsilon}_t \sim w.n.\left(0, \Gamma_\epsilon\right)$$

- The long run covariance matrix of $\mathbf{y}_t$ is

$$\Sigma_L \equiv \lim_{M \to \infty} \frac{1}{M} \mathrm{Cov}\left(\sum_{t=1}^{M} \mathbf{y}_t, \sum_{t=1}^{M} \mathbf{y}_t \right).$$

- The long run concentration matrix

$$\mathbf{K}_L \equiv \Sigma_L^{-1} = \left(\mathbf{I} - \sum_{k=1}^{\infty} \mathbf{A}_k' \right) \Gamma_\epsilon^{-1} \left(\mathbf{I} - \sum_{k=1}^{\infty} \mathbf{A}_k' \right) = \left(\mathbf{I} - \mathbf{G} \right) \mathbf{C} \left(\mathbf{I} - \mathbf{G} \right).$$

- The components of matrices $\mathbf{G}$ and $\mathbf{C}$ can be estimated using a LASSO method.

Barigozzi and Brownless: NETS

Empirical application

- Use stock returns to construct an estimate of the network of interconnections for a panel of 41 US bluechips (1M1990-12M2010).
- Common factors extracted using

$$r_{ti} = \beta_i r_{tm} + z_{ti},$$

- A BIC employed to find the penalties λ in the LASSO
  - Approximately 88% of the edges come from the contemporaneous network
- The linkages explain 15% of the variation observed in stock returns, compared to the common factor (25%)

Barigozzi and Brownless: NETS

Main comments

1. Are long run correlations stable in the data?
   - Evolving network
2. How can common factors be included? (when not observable)
3. Is the BIC the best criterion in this problem?

Braverman and Minca: Vulnerability

Aim of the paper

- Given a information about portfolios, how can we measure contagion among financial institutions?
- The paper introduces a weighted network representation
  - Nodes represent portfolios (N nodes, K assets)
  - Edge weights incorporate the price impact of trading
- It introduces three related measures of vulnerability
- An example is provided using data on mutual fund asset holdings

Braverman and Minca: Vulnerability

Approach

- Let $S = (s_1, ..., s_K)$ be the vector of stock prices and $[\beta_{ki}]$ the number of shares of stock k owned by portfolio i.
- The vale of portfolio i is $P_i = \sum_{k=1}^{K} \beta_{ik} s_k$.
- The edge weights are

$$w_{ij} = \sum_{k=1}^{K} \frac{\beta_{ki}}{\lambda_k} \beta_{kj} s_k,$$

where $\lambda_k = \frac{\text{average daily volume of trades}_k}{\tilde{\lambda} \sigma_k}$.

Braverman and Minca: Vulnerability

Three measures of vulnerability

1. Baseline

$$VI_i = \frac{1}{P_i} \sum_{j=1, j \neq i}^{N} w_{ji}.$$

2. Flow-adjusted

$$FAV_i = \frac{1}{P_i} \sum_{j=1}^{N} F_j w_{ji},$$

where F_j are the inflows (if $F_j > 0$) or outflows to be experienced over a unit of time.

3. To order imbalance

$$FAV_i^* = \frac{1}{P_i} \sum_{j=1}^{N} \beta_{ik} s_k \left(\left(\frac{\hat{N}_{B,k}}{\hat{N}_{S,k}} \right)^{1/3} - 1 \right),$$

where $\hat{N}_{B,k}$ and $\hat{N}_{S,k}$ are estimators of the total number of potential buyers and sellers of stock k.

Braverman and Minca: Vulnerability

Comments

1. Robustness to theoretical assumptions
   - Especially linear price impact and value of λ_k.
2. Empirical analysis
   - How are the three vulnerability measures related? (basic statistical analysis)
   - May individual vulnerability forecast lower returns in the future?
   - Causality: is vulnerability exogenous from returns? (maybe employ VAR)
   - How well does aggregate vulnerability help to forecast "crisis"?

Conclusions

- Two complementary papers on network theory and financial stability:
  - Barigozzi and Brownless (NETS), less information needed, the network is stationary, traditional indicators (clustering, network centrality).
  - Braverman and Minca (vulnerability): more information needed, time-varying network, new indicators of vulnerability.
- Two very promising avenues for future research and policy:
  - From an individual point of view: which institutions are more vulnerable?
  - From an aggregate point of view: how is vulnerability evolving with time?