Information, Instability and Fragility in Networks

Round Table
Networks across the Sciences → Finance
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1. Non-cascades contagion

• Systematic Risk (≠ systemic risk)
  (e.g. Brummitt: Model of banking crisis)
→ Common Factors (e.g. in expectations)

Correlation vs contagion (Forbes-Rigobon)

Not only the volatility increases during crisis (spurious increase of correlation) but the relative weights of common factors increases:


Non-linear extension → “mutual information” = measure of dependence between two processes
2. Contagion in networks

- Mutual information = a symmetric measure (possibly with time lag):

\[
\sum_{x,y} p(x, y) \log \left( \frac{p(x, y)}{p(x)p(y)} \right)
\]

- Transfer entropy (Schreiber, 2000, Physical Review letters)

\[
\sum_{x(t-k, t+1), y(t-h, t)} p[x(t-k, t+1)] \log \left( \frac{p(x(t+1)|x(t-k, t), y(t-h, t))}{p(x(t+1)|x(t-k, t))} \right)
\]
Kullback Causality Measures

- Geweke (1982) = Gaussian (linear) case
- Importance of “measuring”:
  (i) Strength of contagion (→ economic policy)
  (ii) Causality at horizon h>1

Dufour - Renault, 1998, indirect causality.

Network interactions, causal cores:
  (Seth-Edelman, Neural Computation, 2007).

(iii) Non-linearity of contagion
Econometric Issues

1. Markov, Granger vs Sims
3. Convergence rates of non-parametric estimators = depend on the dynamic structure
4. Aggregation theory for portfolio choice/asset pricing: not only Peso problem but also aversion to risk of cascades???