# Discussion of the paper:

## Econometric Measures of Connectedness and Systemic Risk in the Finance and Insurance Sectors

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# Summary

- Study of interconnectdess among returns based on the study of correlations and cross autocorrelations between returns
- Tools:
- Principal Components
- Networks based on cross autocorrelations

# A difficult problem

- Main problem: correlations depend on crisis but crisis depends on correlations
- And crises are (hopefully) infrequent
- A true study of interconnection should be based on position analysis but data on these are still lacking (for researchers)
- Need to use proxy methods

# PCs

- The Authors use correlation (PC)and cross/autocorrelation (Granger)
- PC give two kinds of information:
- Structure of maximum variance portfolios (eigenvectors)
- Variance of these (eigenvalues)
- It is important to choose between the correlation and the covariance matrix for the computation of PC

# PCs

- The measure of interconnectdedness given by the Authors is the percentage on the total of the first few eigenvalues
- This, by itself, is NOT a measure of dependence, it is so only if it corresponds to eigenvectors with roughly uniformly distributed weights
- This may not happen if some subset of the varriables decorrelate with the rest and increases its variance or if few variables decorrelate with the other but increase their correlation
- The first problem is solved ifprincipal components are extracted from the correlation matrix

# PCs

- This is what the Authors do (true?) but I would supplement their interconnectdness index with the study of a possible concentration of risk on subsets of returns (less uniform weights in the eigenvectors)
- Moreover the PCAS measure they use again depends on the variance of each single return and, by itself, is not a measure of interconnectdness.
- It is a measure of contribution to the variance of the first few PCs. Interconnectdness depends on the shape of the corresponding eigenvectors

# PCs

- Empirically the Authors estimate PC after dividing the dataset into five periods of 2/3 years
- They observe a change in the percentage of total eigenvalues due to the first few eigenvalues
- Interestingly this seems not to be true for the first component but is true for the first 10 components. I would think about the meaning of this result as the first component is, usually, the one with most similar coefficients
- Other components usually represent long short positions and an increase of their importance could be a sign of decorrelation not of increased correlation

# PCs

- Years ago as a thesis tutor I made students compute PCs of stock returns in order to assess changes in the structure of correlation
- The standard result (we used rolling PCs not windows: in a crisis mean an variances change and this creates problems for the estimation of correlations) was that eigenvectors were quite stable but eigenvalues changed a lot
- We could read this as the existence of fixed “models of variation” which generate different “market states” by mixing together with different weights
- But… sampling variability…

# PCs

- Some further possible suggestions are:
- report confidence levels for eigenvalues (they are estimated on a very short run)
- Do not analyze the correlation matrix of returns but the correlation matrix of extreme returns
- Do not analyze the correlation matrix of returns but the correlation matrix of excess returns
- Beware of subperiods: they are determined bay market events so they are endogenous and change the sampling properties of estimates

# Granger

- I have no time for discussing the second part of the analysis (which I do not like very much)
- Just three quick suggestions:
- You run MANY causality test (9900) on a little sample (180*100). You should evaluate their JOINT significance . Moreover mind breakpoints
- The two analysis are quite related, Granger causality could be compared with a PC analysis of the cross/auto correlation matrix. The weak spot of GC is its univariate nature
- Care should be taken with the use of graphs: it may well be that A “causes”B “causes” C but A ”does not cause” C

# Thanks

- Thanks to the Authors for a very interesting paper