Convergence and Divergence in European Bond Correlations

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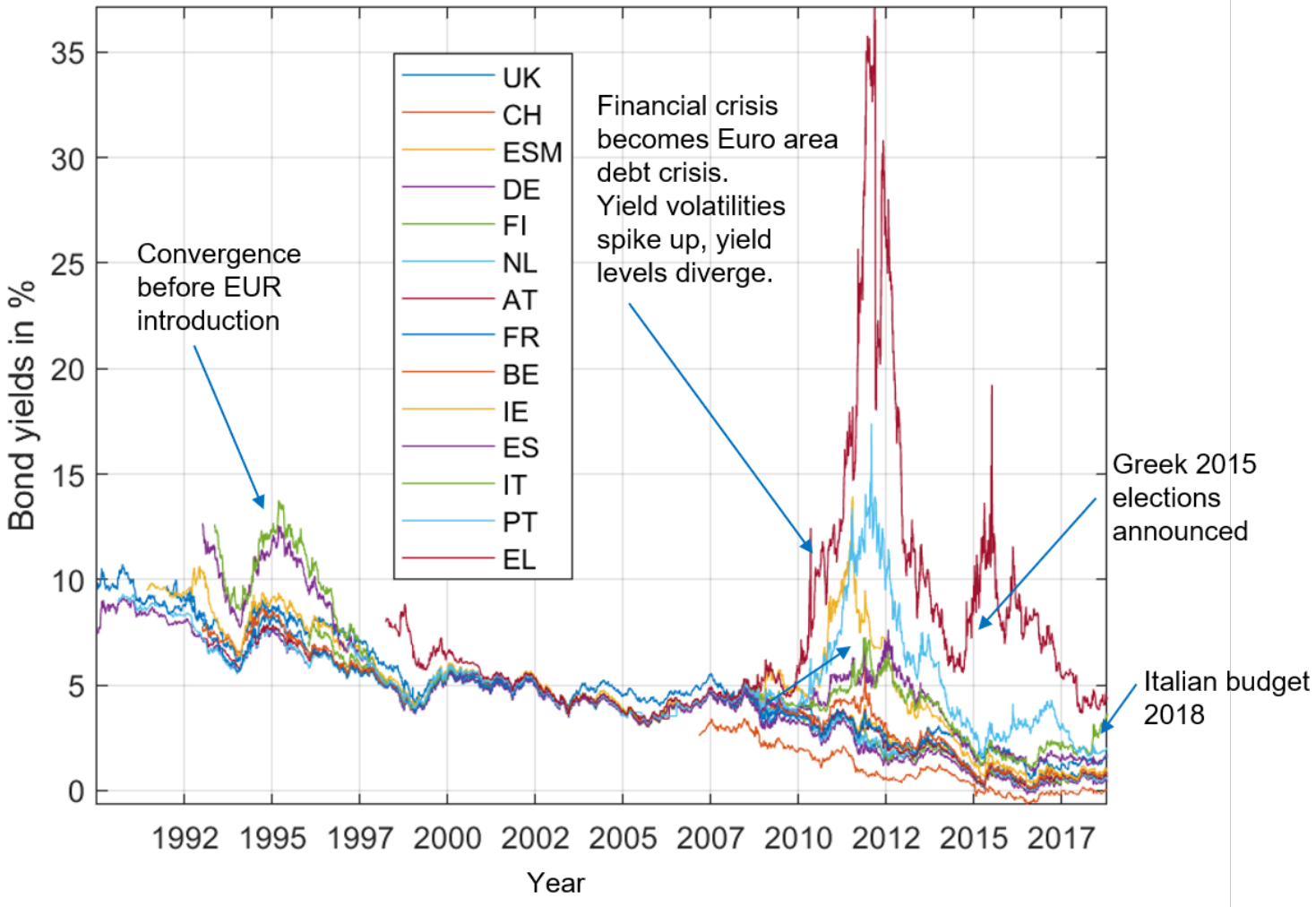
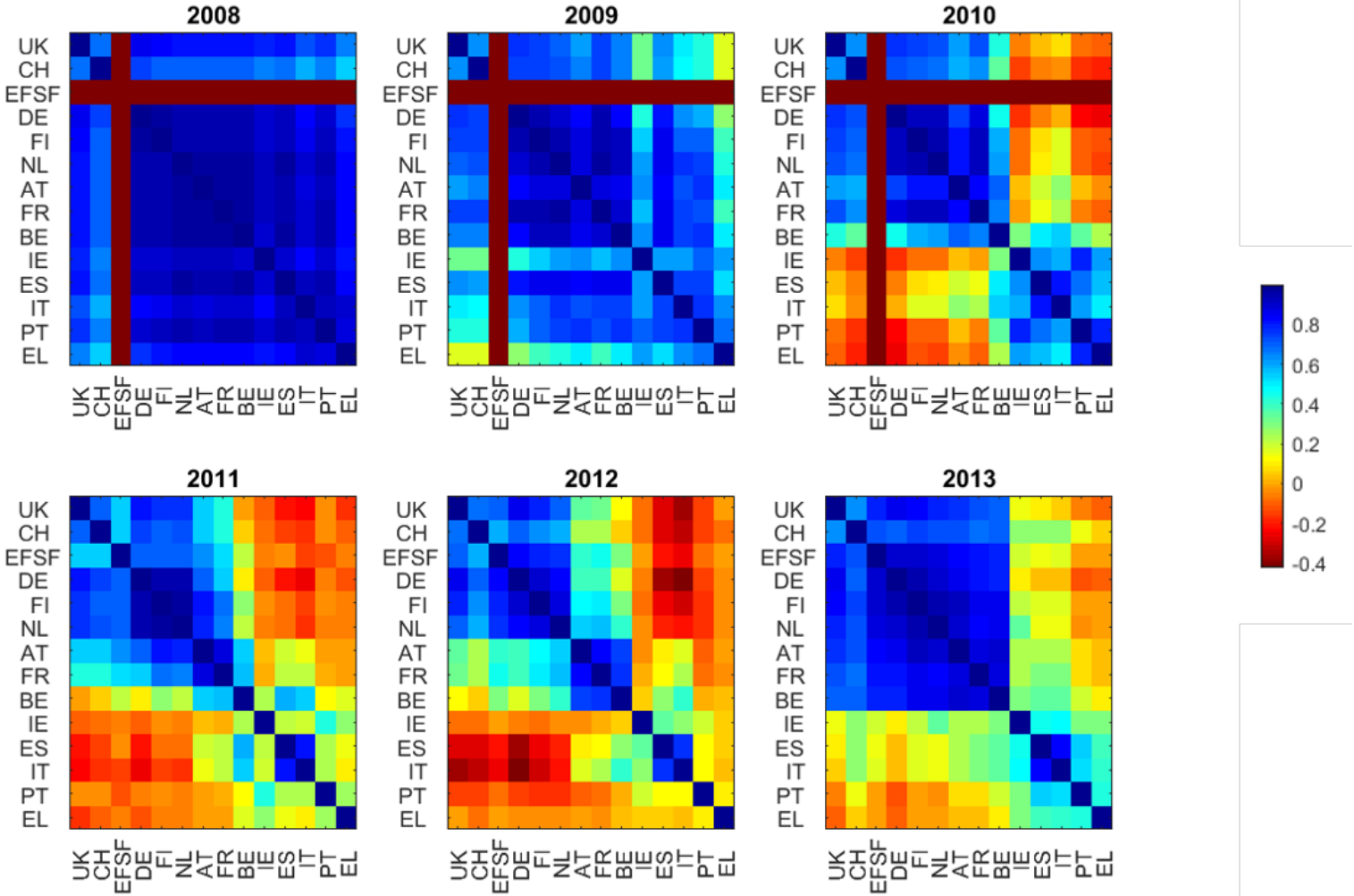
European Bond Yields (daily Bloomberg data)

- Euro convergence for bonds yields during end of 90s.
- Wide spreads during European sovereign debt crisis 2010-2012.
- Since 2015, bond spreads primarily signal political divergence.



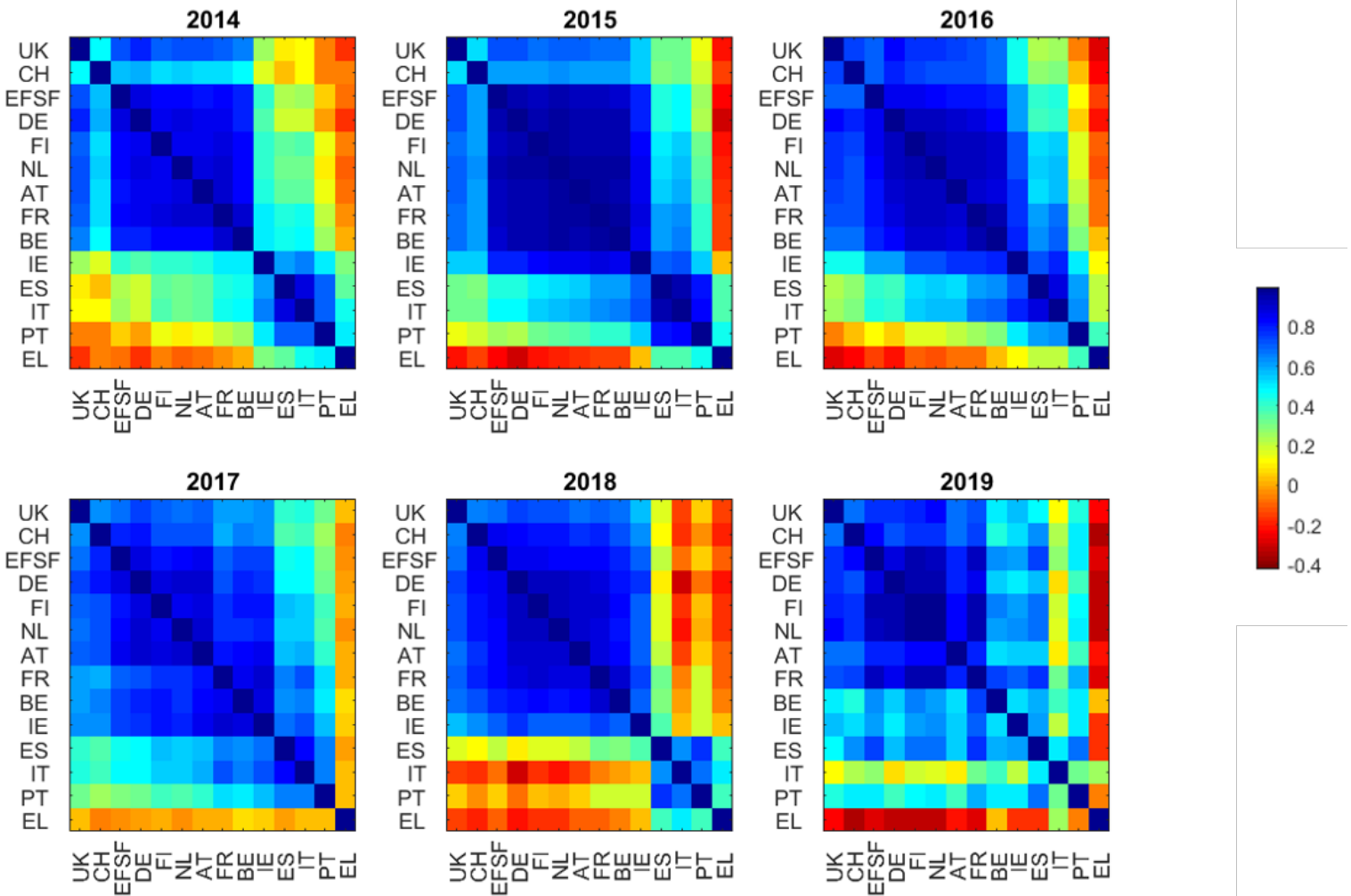
European Bond Return Correlations 2008 - 2013

- Containment of the 2010 sovereign bond crisis



European Bond Return Correlations 2014-2019

- From financial crisis to political divergence



Problems with correlations

- They are unstable in time
- Common factors may lead to spurious correlations
- Too many links: each market is correlated to any other market. Who is driving what?
- Idea: "Correlation influence" shows driving factors of correlations. Bootstrap resampling to simulate statistical noise in return blocks of random length ("wild bootstrap").

Original return matrix

UK	CH	...	PT	EL
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7

One of 10.000 bootstrap resamples

UK	CH	...	PT	EL
3	3	3	3	3
5	5	5	5	5
2	2	2	2	2
3	3	3	3	3
6	6	6	6	6
1	1	1	1	1
2	2	2	2	2

Correlation influence Network

- The partial correlation measure is defined as

$$\rho_{ij:k} = \frac{C_{ij} - C_{ik}C_{kj}}{\sqrt{1 - C_{ik}^2}\sqrt{1 - C_{kj}^2}}. \tag{1}$$

- Correlation influence is defined as

$$d_{i,j:k} = C_{ij} - \rho_{ij:k}. \tag{2}$$

- The average correlation influence is defined as

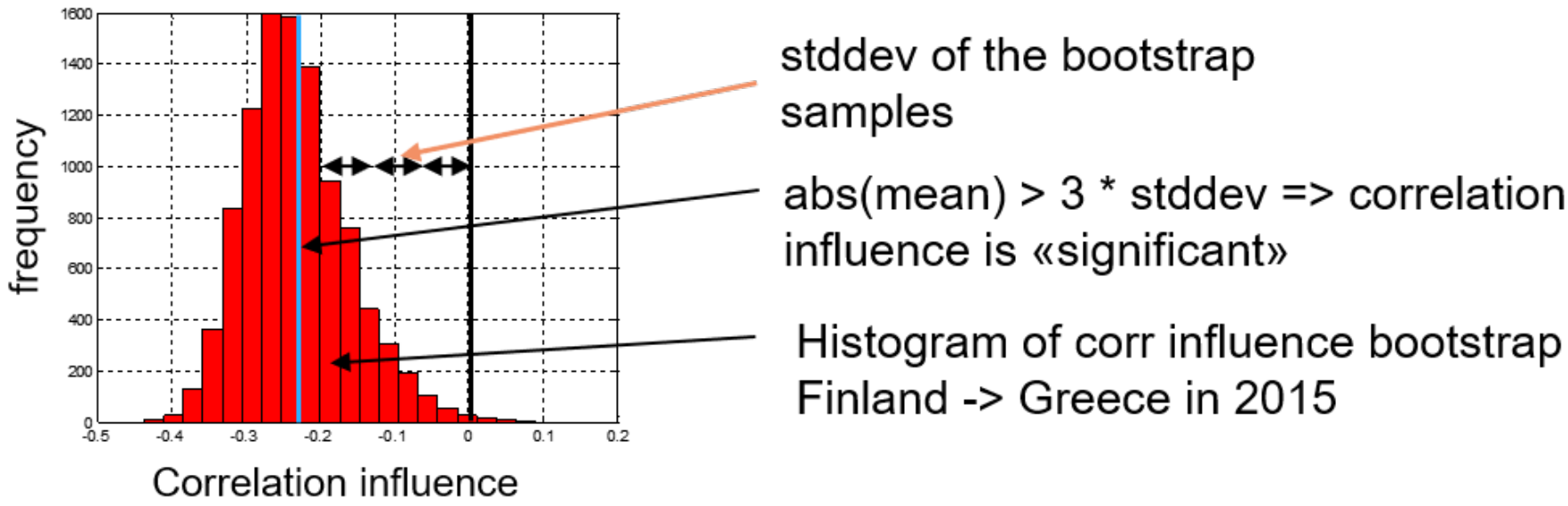
$$d_{i:k} = \left\langle d_{i,j:k} \right\rangle_{j \neq i,k}. \tag{3}$$

This is a directed arrow from market k pointing to market i.

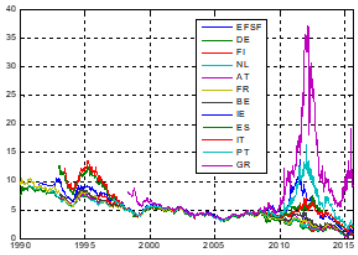
Ref.: Kenett D. Y. et. al.: Dominating clasp of the financial sector revealed by partial correlation analysis of the stock market. PLoS ONE 5(12): e15032.

Bootstrap filter

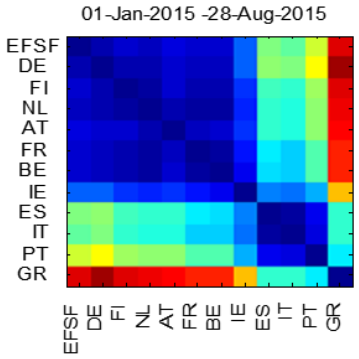
- For each resample, we compute the average correlation influence matrix.
- The standard deviation across all resamples is a measure for the noise in the correlation influence.
- We filter out correlation influences with a threshold of three standard deviations.



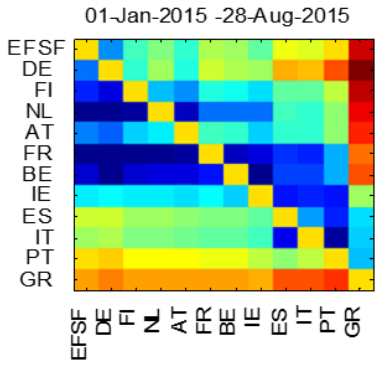
Overview: Generate Filtered Correlation Influence Network



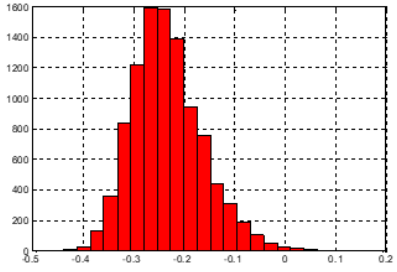
Bond yield time series



Correlation matrix of yield changes



Correlation influence



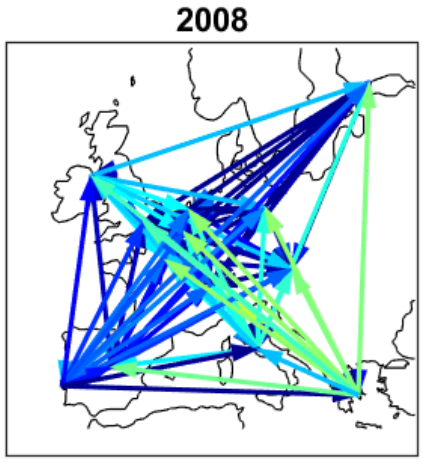
Bootstrap filter

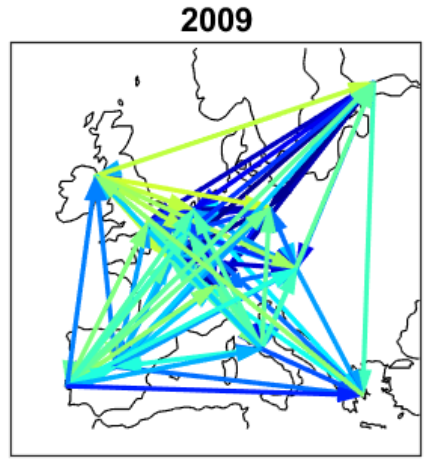
Filtered influence network

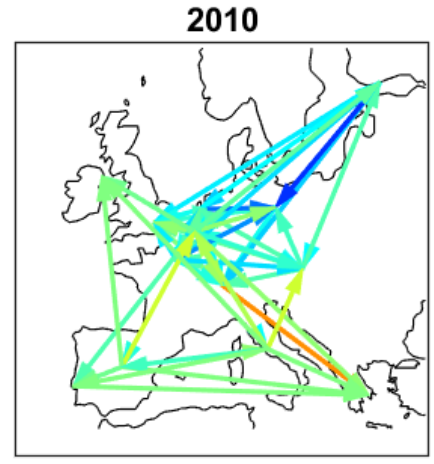
Positive correlation influences: blue arrows

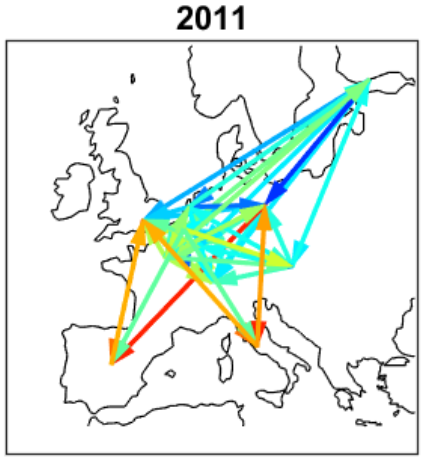
Negative correlation influences: red arrows

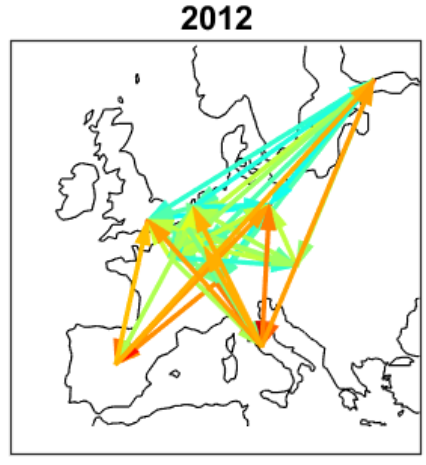
Filtered Correlation Influence Networks 2008 - 2013

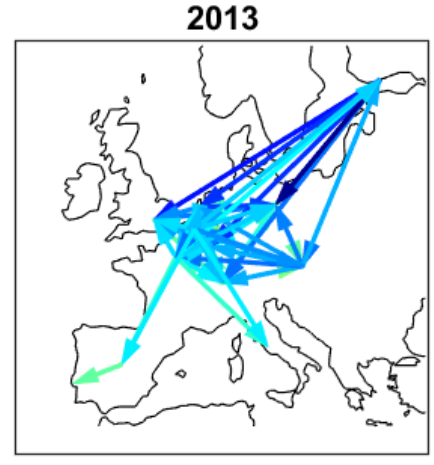




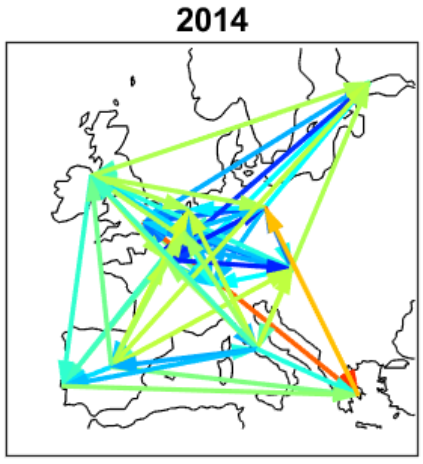


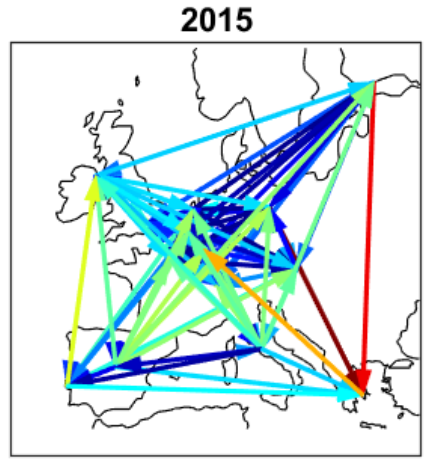


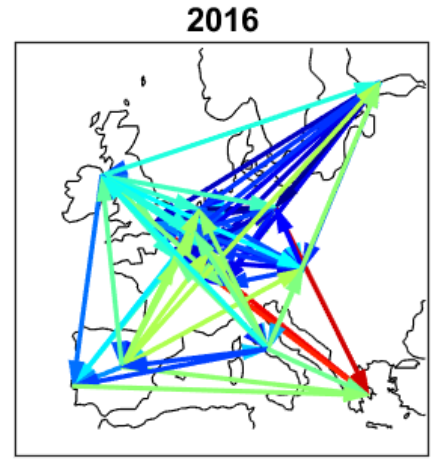


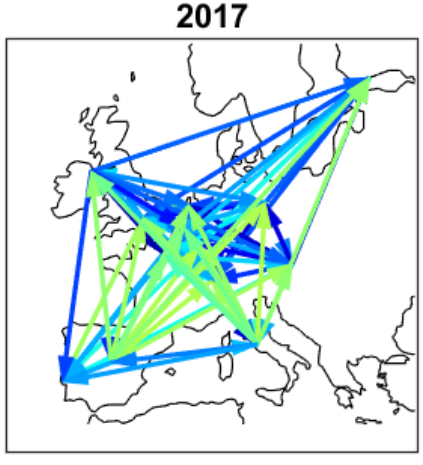


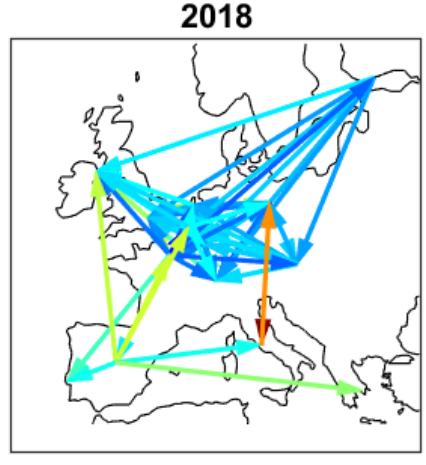
Filtered Correlation Influence Networks 2014 - 2019

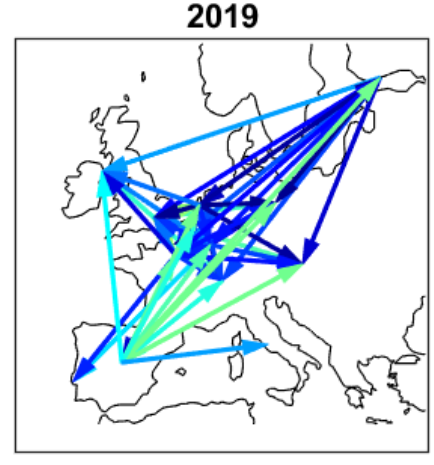






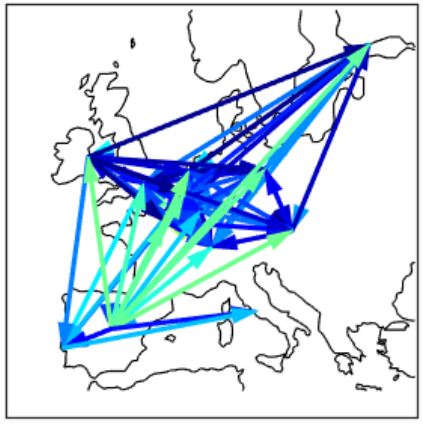






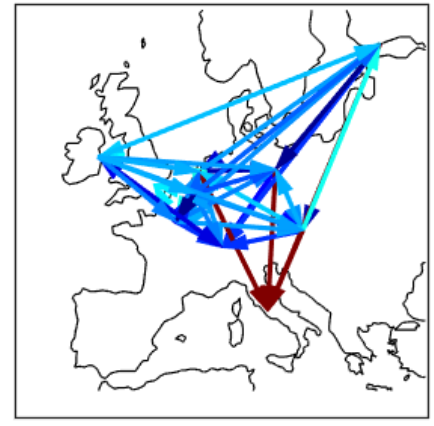
Filtered Correlation Influence Networks October 2018

17.09.18 -21.09.18

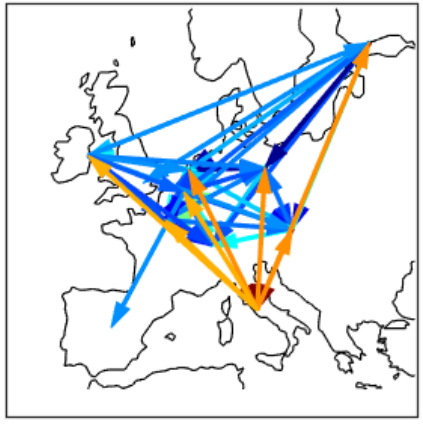


24.09.18 -28.09.18

01.10.18 -05.10.18



08.10.18 -12.10.18

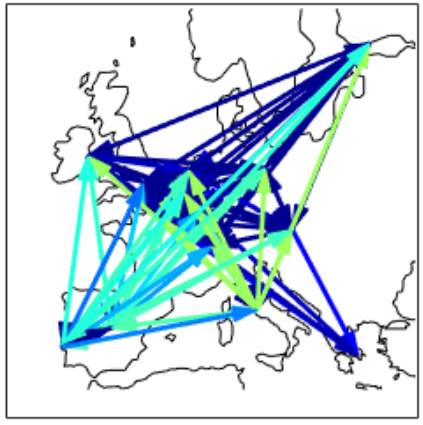


15.10.18 -19.10.18

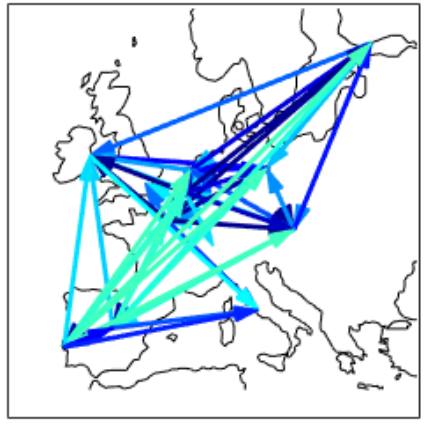
22.10.18 -26.10.18

Filtered Correlation Influence Networks August 2019

22.07.19 -26.07.19

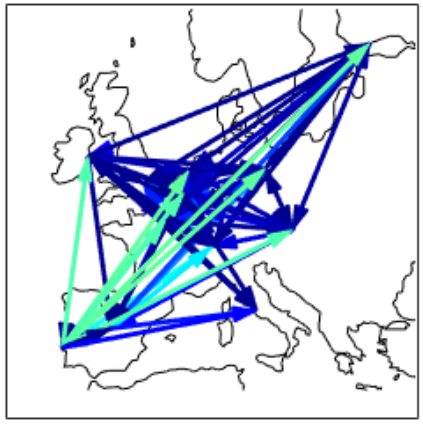


29.07.19 -02.08.19

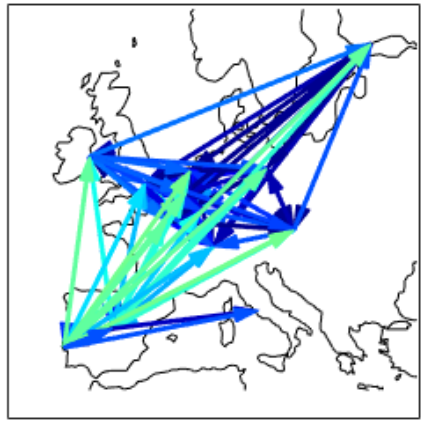


05.08.19 -09.08.19

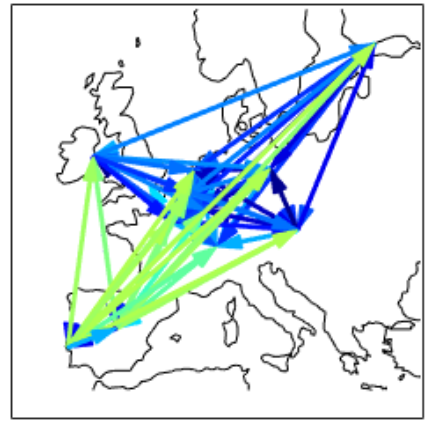
12.08.19 -16.08.19



19.08.19 -23.08.19

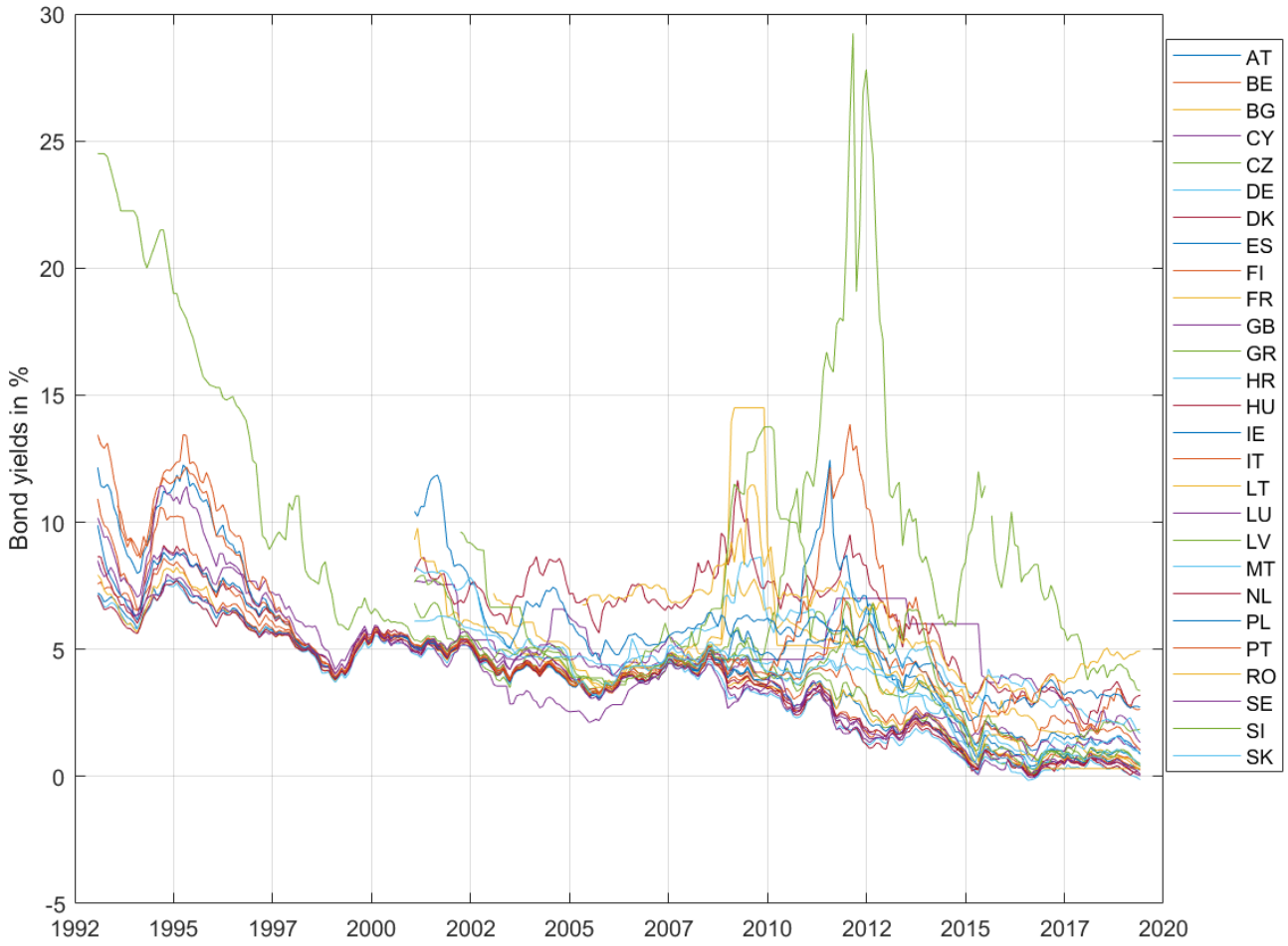


26.08.19 -30.08.19



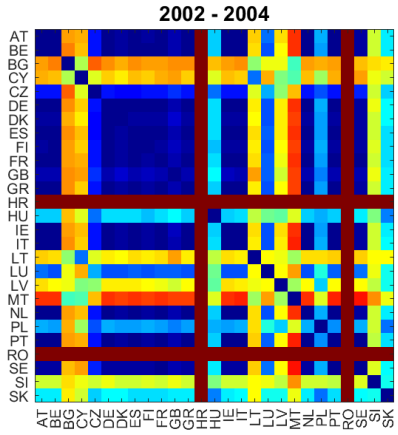
Publicly available European Bond Yield data

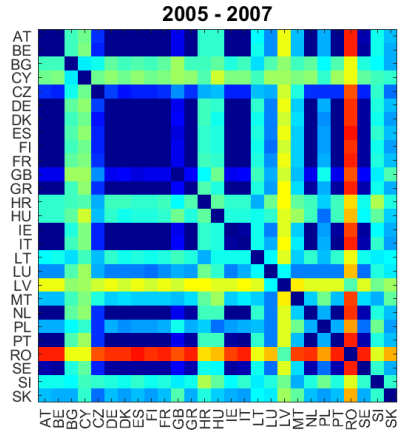
- Source: ECB https://sdw.ecb.europa.eu
- Only monthly, but 27 EU countries (all but Estonia)

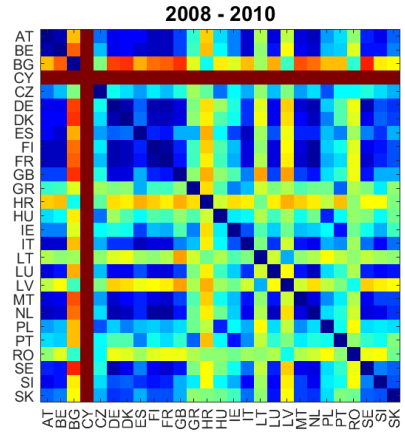


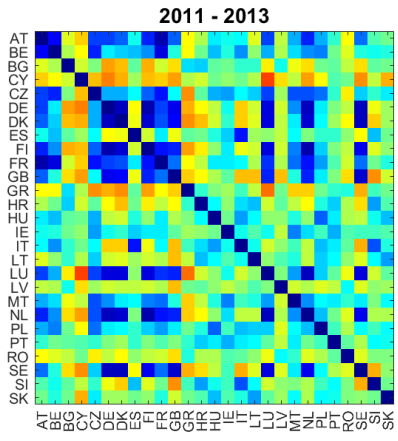
European Bond Return Correlations 2002 - 2019

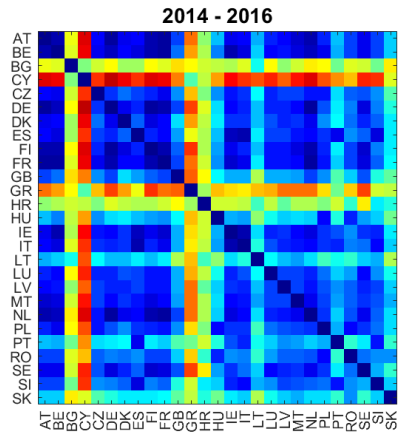
- We define 3-year-windows as we only have monthly data

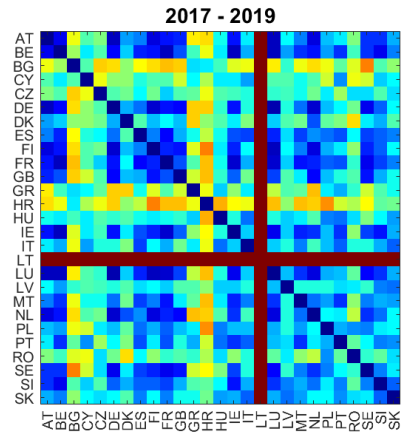






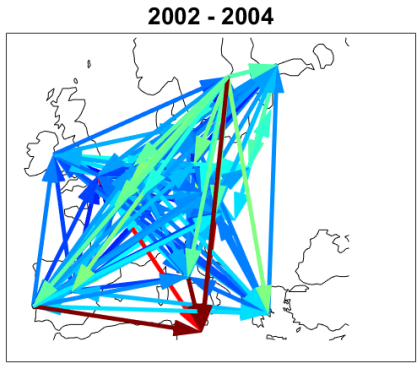


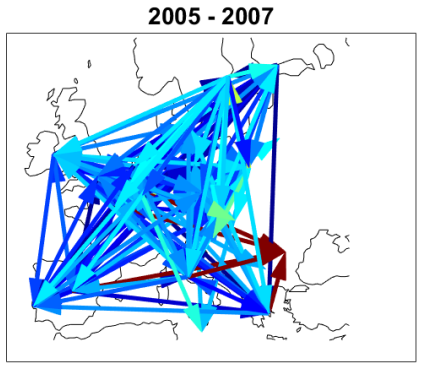


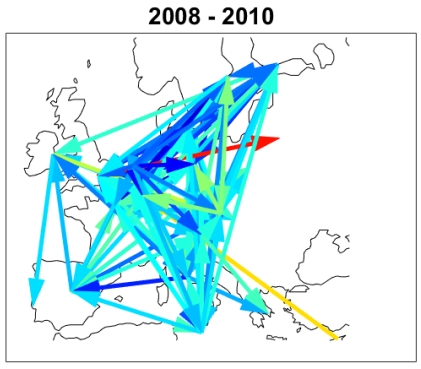


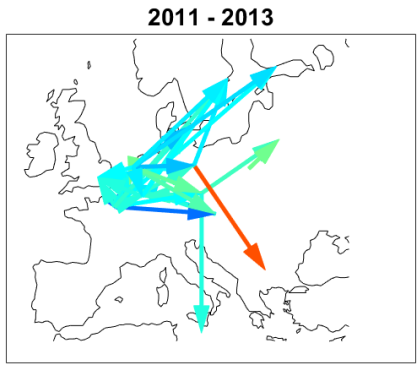
Filtered Correlation Influence Networks 2002 - 2019

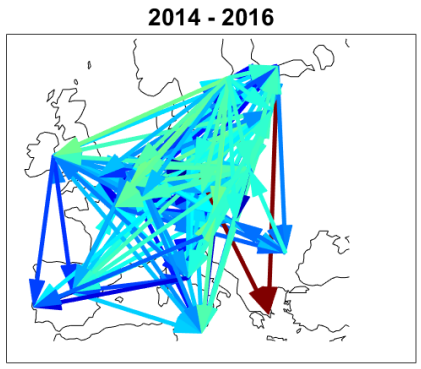
- Also with monthly data, the networks replicate the core-periphery dynamics

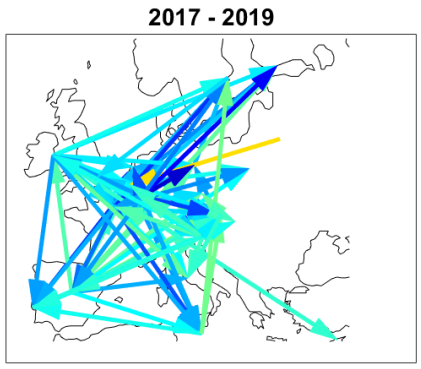












Conclusions

- Since 2010, European bonds cluster into core and periphery groups according to their return correlations. We use filtered correlation influence networks to show the most significant drivers of convergence and divergence.
- During the European sovereign debt crisis 2010 - 2012, negative correlation influences between the core and periphery groups are the dominating force. Since 2013, the situation improved a lot.
- In 2015 during the negotiations between Greece and the Eurogroup and in 2018 during the Italian budget negotiations, the warning signals of negative correlation influences reappeared for short periods, although the absolute level of spreads is substantially smaller than during 2010 - 2012.
- The findings point to markets becoming more politically driven.

Full papers: ESM Working Paper #8 (2015), Working Paper "Sentiment Analysis of European Bonds 2016 - 2018" (2019).