

European Government Bond Dynamics and Stability Policies: Taming Contagion Risks

Zürcher Hochschule
für Angewandte Wissenschaften



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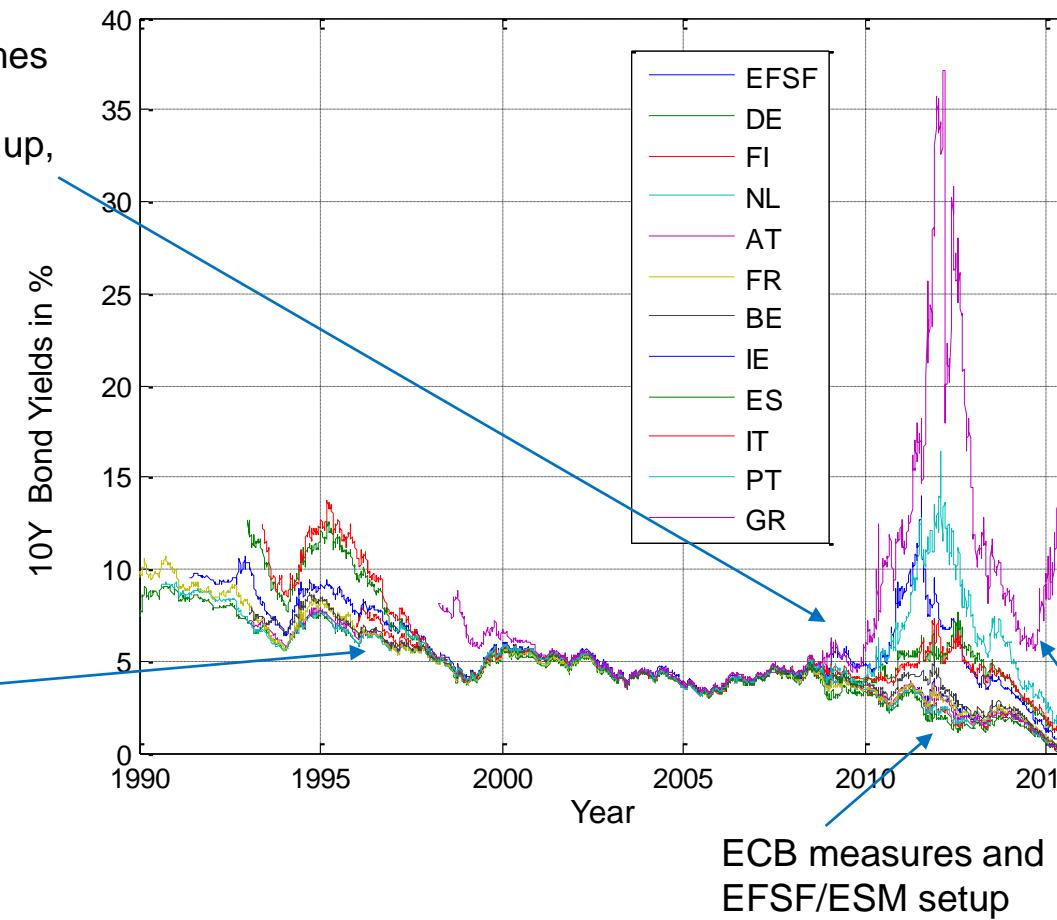


Cambridge, 9 September 2015

Case Study: Eurozone crisis

Data: Daily 10Y Government Bond Yields

Financial crisis becomes Eurozone debt crisis.
Yield volatilities spike up, yield levels diverge.

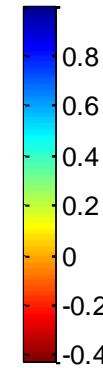
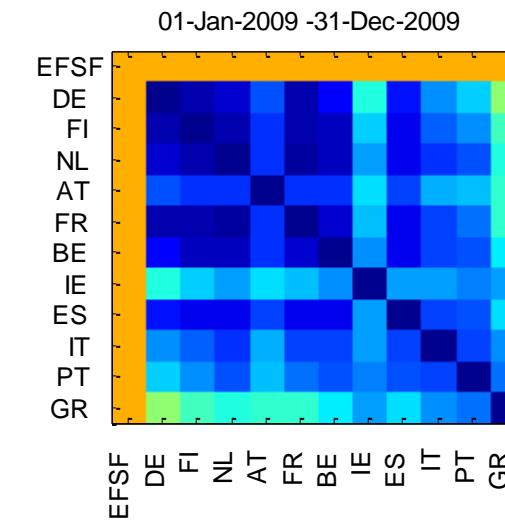
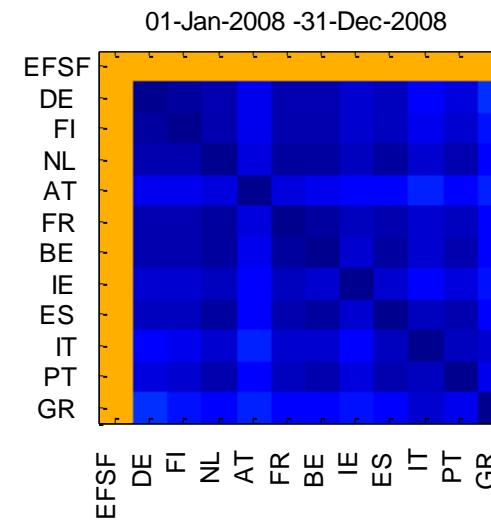
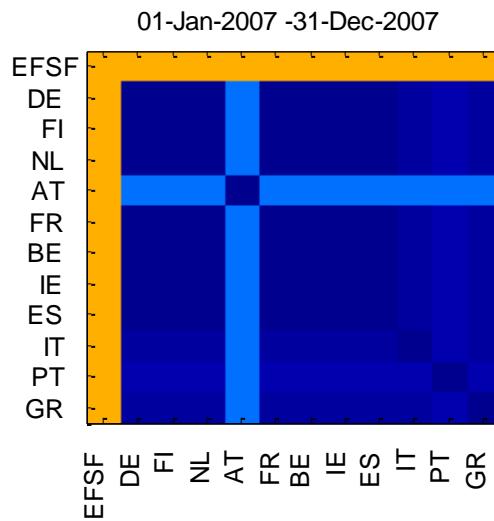
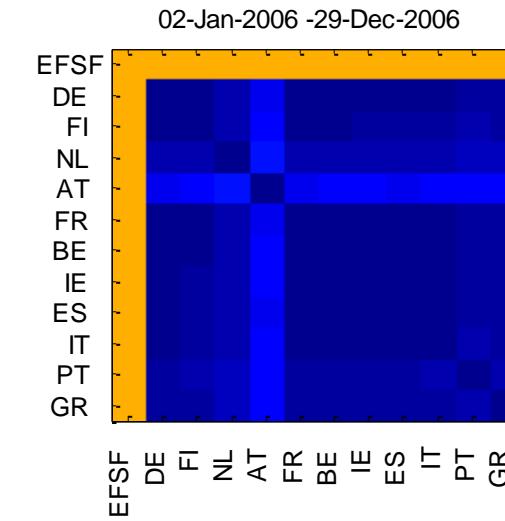
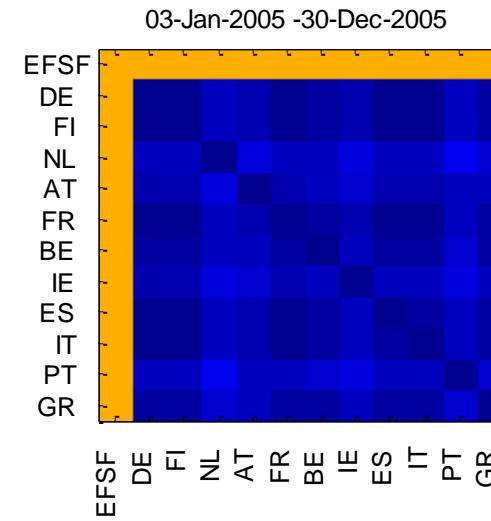
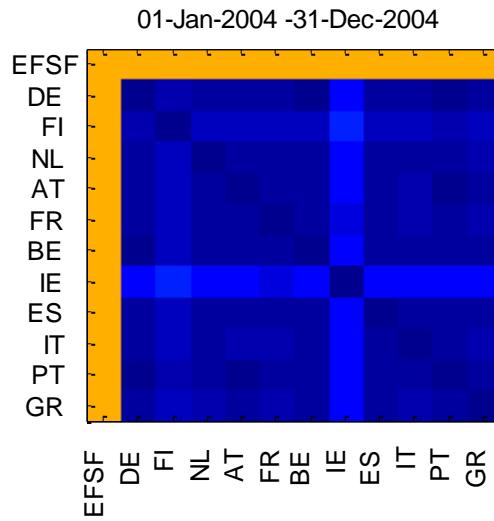


$$\text{daily bond returns} \sim \underbrace{(- \text{Duration}) \times [\text{yield}(t) - \text{yield}(t-1)]}_{\text{Duration Risk}} + \underbrace{\text{yield}(t-1) \times dt}_{\text{Bond Carry}}$$

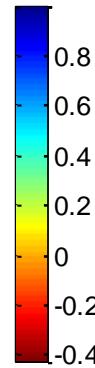
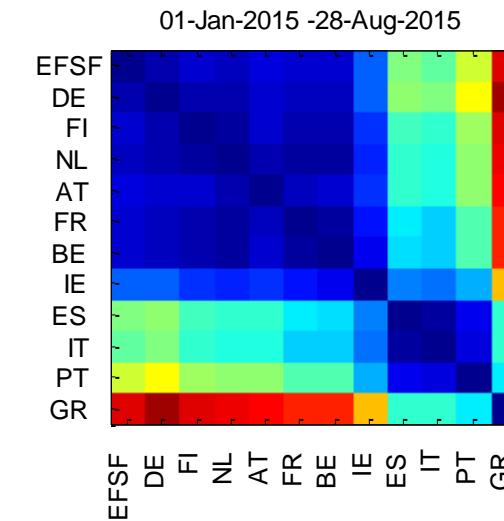
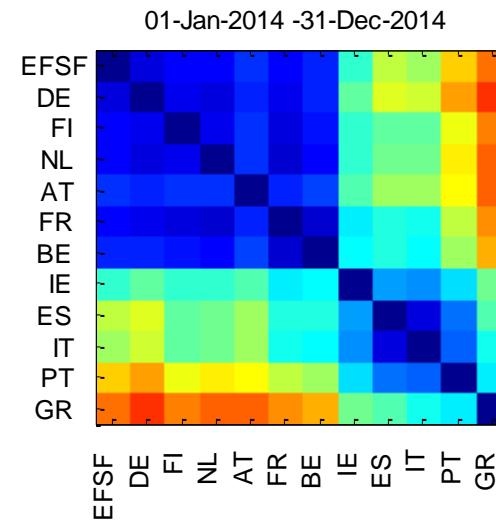
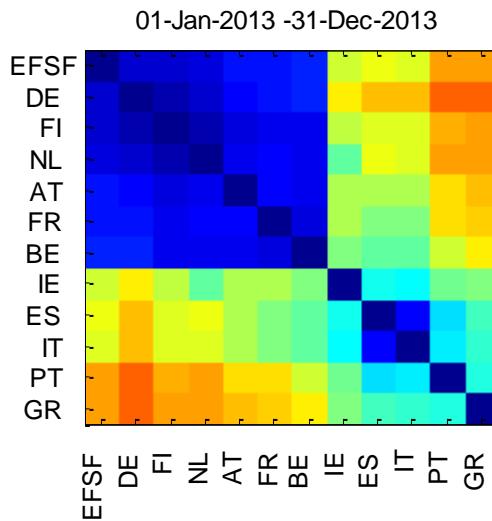
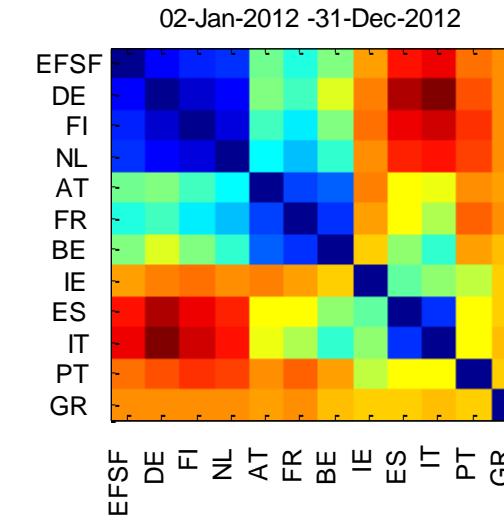
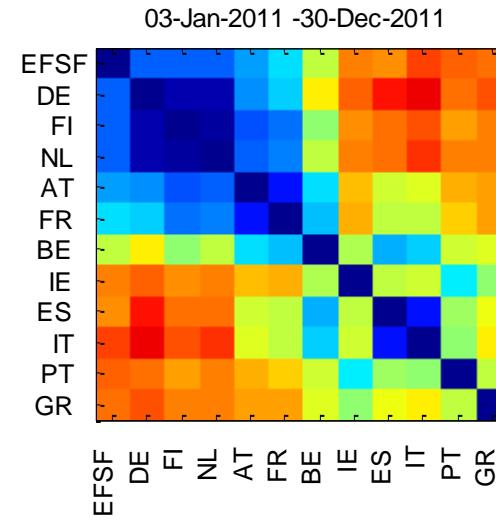
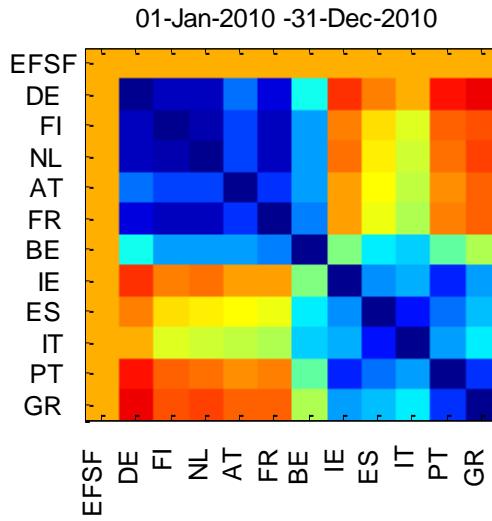
Issuer	Current 10Y Yields	
	28/8/2015	Yield Vol since 6/2011
EFSF	0.84	0.68
DE	0.74	0.76
FI	0.91	0.73
NL	0.94	0.73
AT	1.05	0.76
FR	1.09	0.76
BE	1.09	0.89
IE	1.40	1.55
ES	2.06	1.56
IT	1.92	1.50
PT	2.60	2.92
GR	9.19	11.45

Yield / Vol tradeoff makes market timing interesting.

Eurozone bond correlations in yearly intervals 2004 - 2009



Eurozone bond correlations in yearly intervals 2010 - 2015



Problems with yield correlations

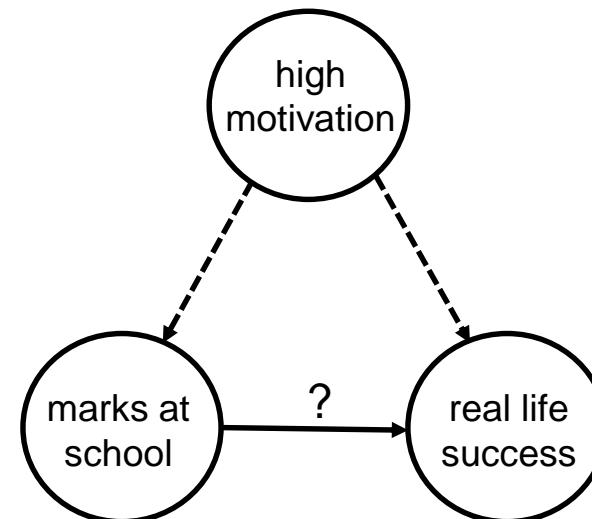
We aim to discuss yield dynamics as close to the market as possible.

Therefore, we use a model free approach, based on correlations.

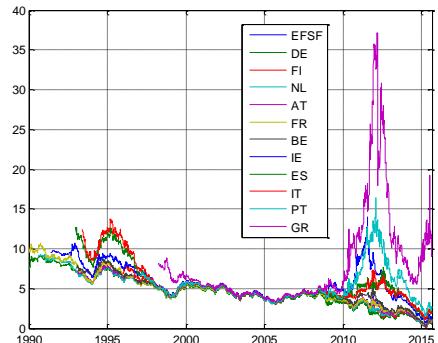
The Pearson Correlation coefficient is defined as:

$$r(X, Y) = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^n (X_i - \bar{X})^2} \sqrt{\sum_{i=1}^n (Y_i - \bar{Y})^2}}$$

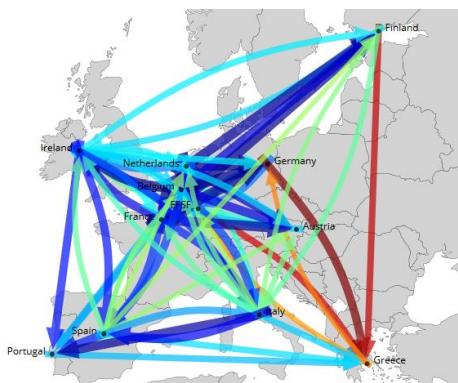
Problem with correlations: they are unstable, and hidden factors may lead to spurious correlations.



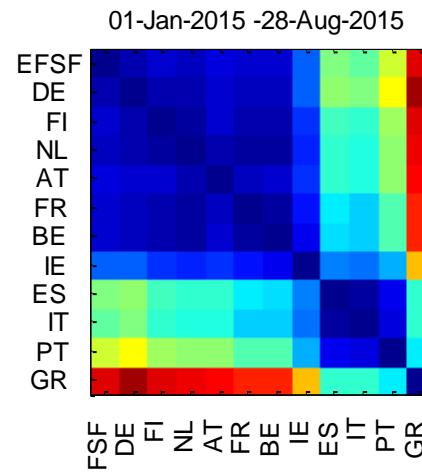
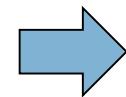
Method Overview: Filtered correlation influence networks



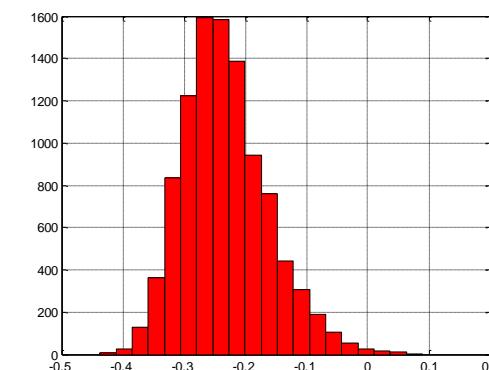
Bond yield time series



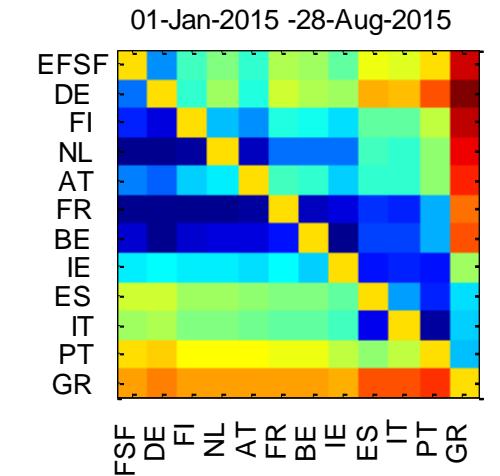
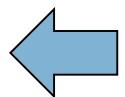
Filtered influence network



Correlation matrix



Bootstrap filter



Correlation influence

Partial correlation influence

The partial correlation measure is defined as

$$\rho(X, Y|Z) := \frac{r(X, Y) - r(X, Z) \cdot r(Y, Z)}{\sqrt{1 - r(X, Z)^2} \cdot \sqrt{1 - r(Y, Z)^2}}$$

The correlation influence is defined as

$$d(X, Y|Z) := r(X, Y) - \rho(X, Y|Z)$$

Small absolute value would mean
„Z strongly affects correlations between X and Y“

„How much of the correlation between X and Y is explained by their correlations to Z?“

The average correlation influence is defined as

$$d(X|Z) := \frac{1}{k} \sum_{i=1}^k d(X, Y_i|Z)$$

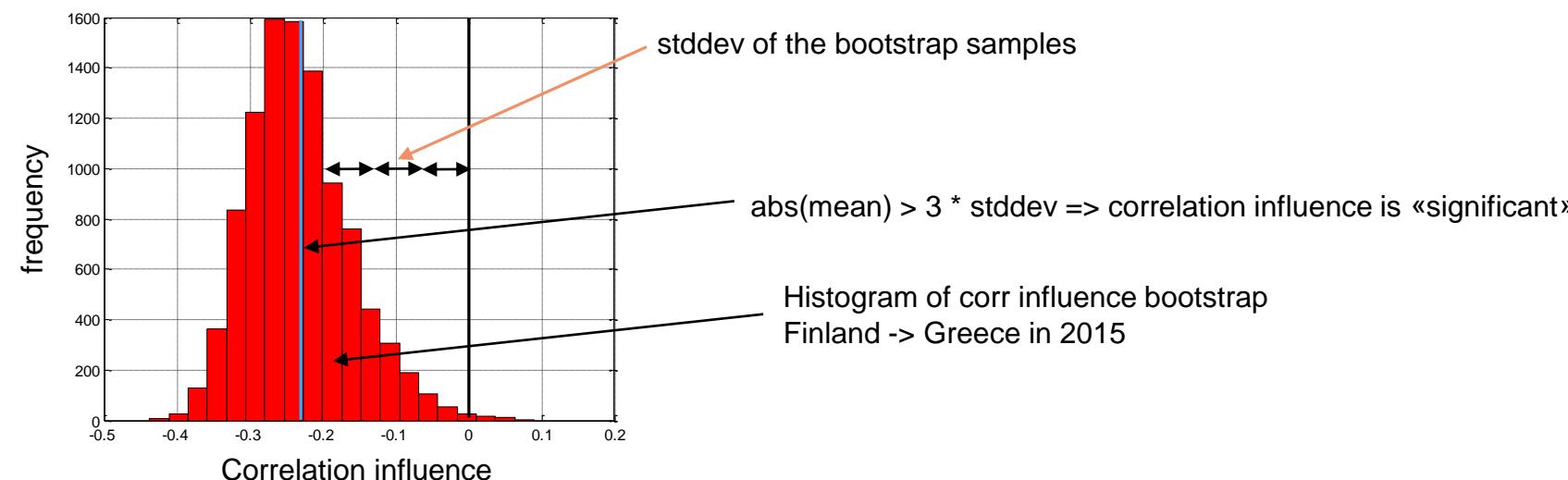
„How much does Z explain correlations between X and all other markets?“

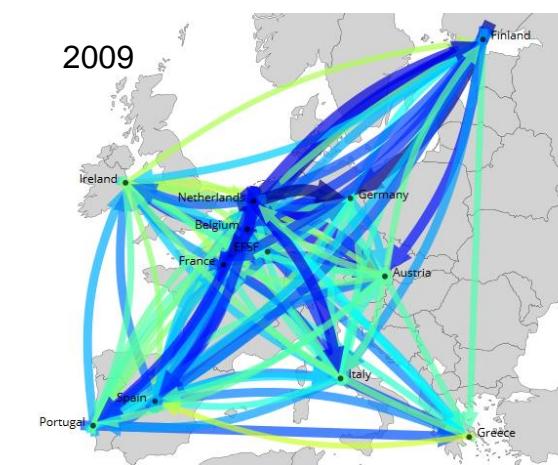
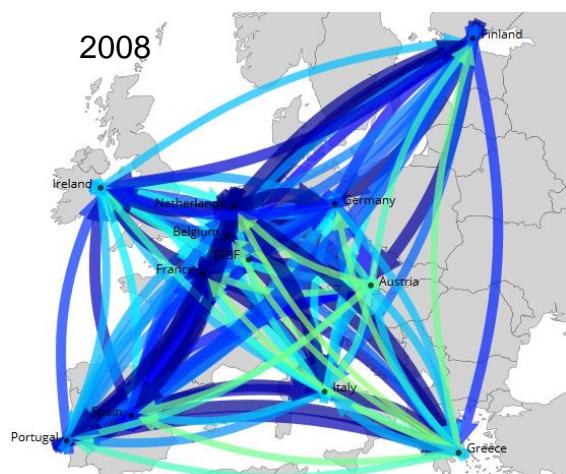
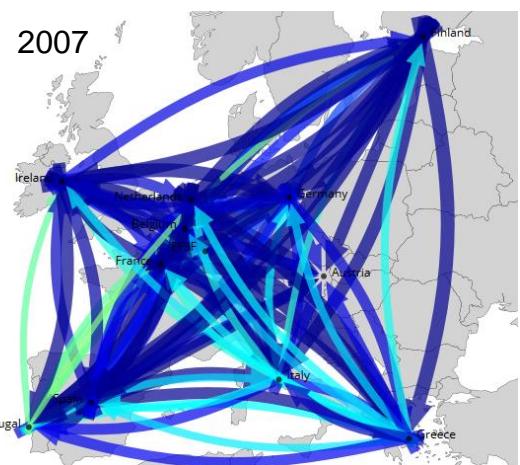
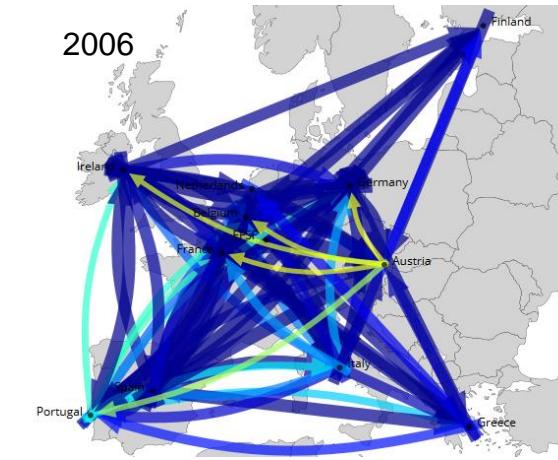
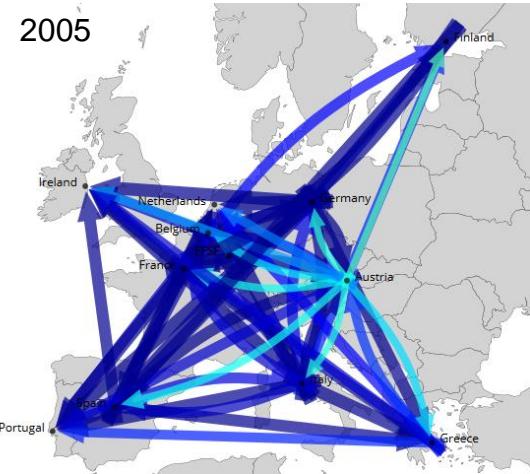
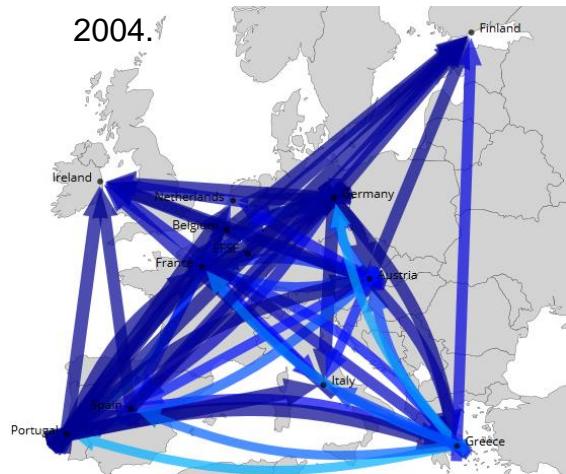
Constructing Filtered Partial Correlation Networks

The noise in the correlation influence estimator depends heavily on the specific pair: DE->FR is very stable, but DE->GR is very volatile. We need a filtering concept.

We bootstrap average influences

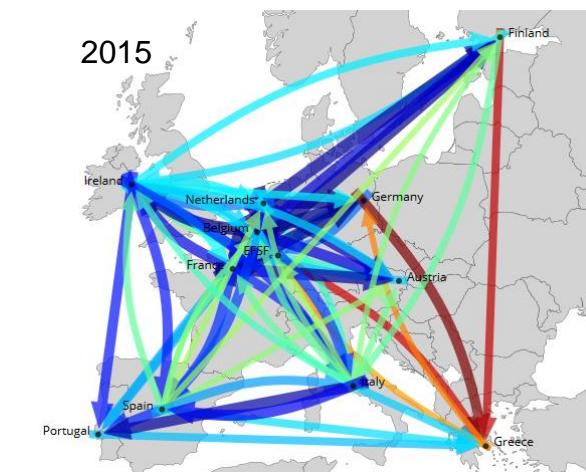
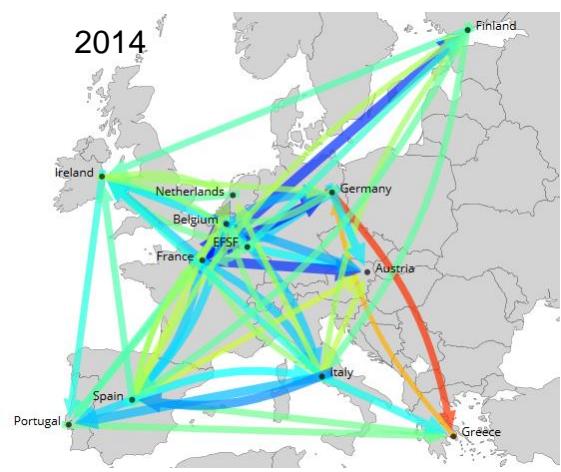
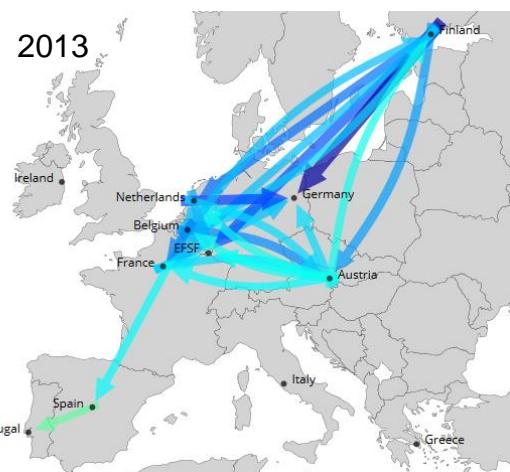
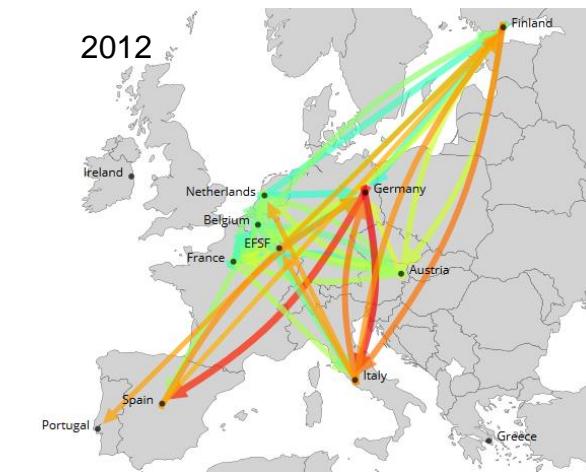
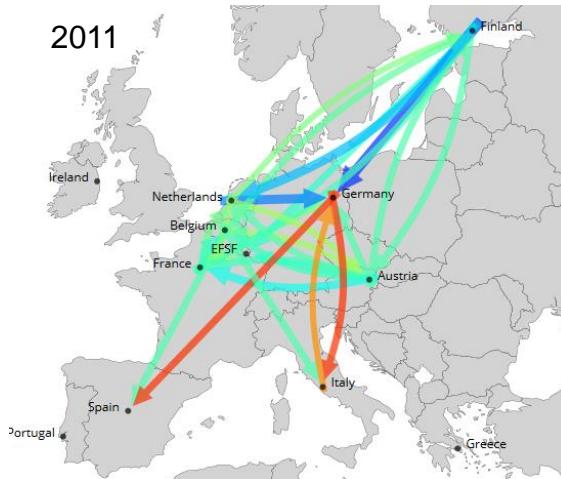
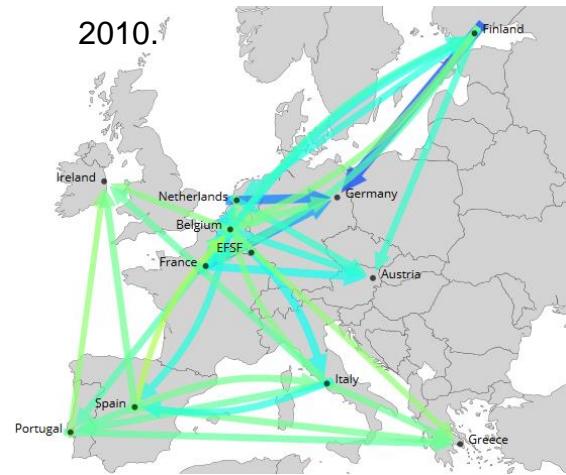
- We draw n times a sample (with replacement) from the data, using data blocks of length 1-10 days
- For each sample, we calc the average influence matrix and the stddev across the samples
- These standard deviations act as „blur“ indicator of the average influences





Blue arrows: dominating positive correlations => reinforcing movements

Red arrows: dominating negative correlations => diverging movements

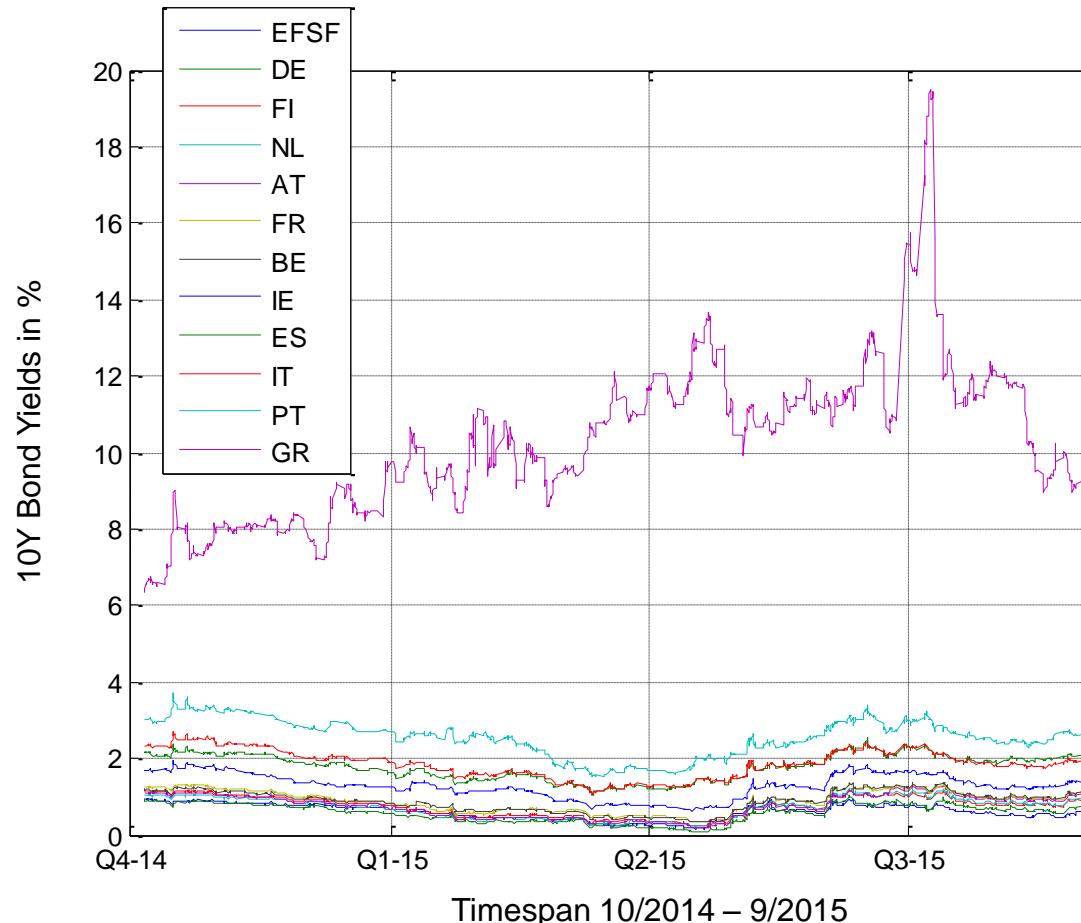


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Case Study: Negotiations of third Greek bailout

Data: Hourly 10Y Government Bond Yields



Question: as the negotiations between Greece and the Eurozone developed, did the market imply contagion risk to other Eurozone countries beyond Greece?

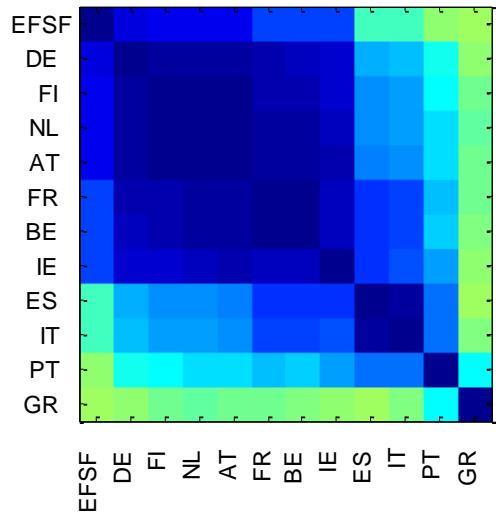
Reuters, 19 April 2015:
“Greece's Varoufakis warns of Grexit contagion”

Reuters, 27 June 2015:
“Euro zone prepared to guard against Greek risks – Dijsselbloem”



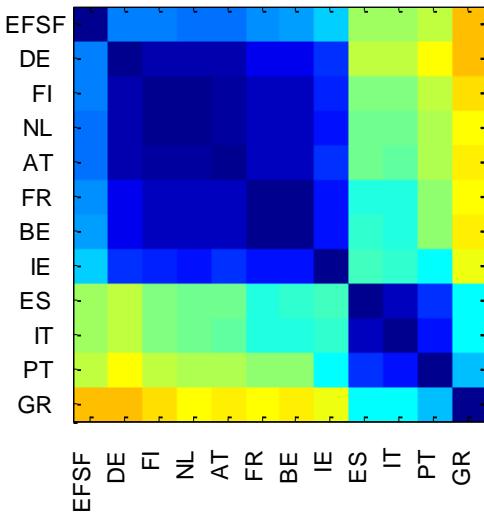
© European Union

19-Jan-2015 08:00:00 -23-Jan-2015 17:00:00



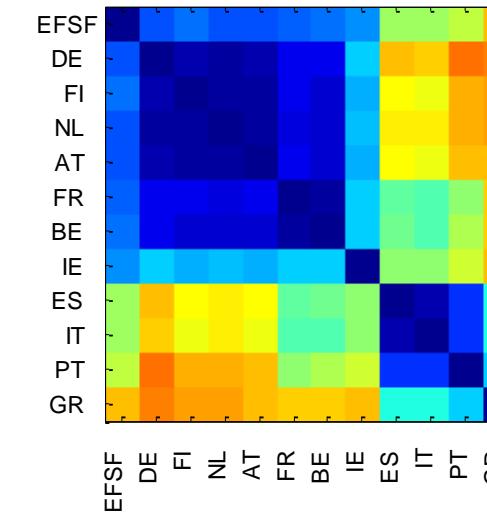
Before Greek elections

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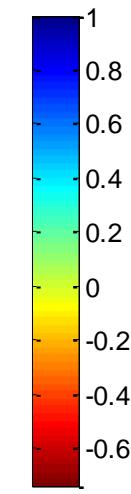


After Syriza won

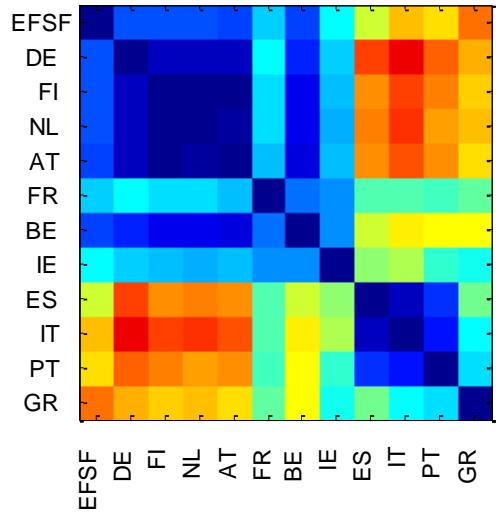
02-Feb-2015 08:00:00 -06-Feb-2015 17:00:00



Tsipras' tour across Europe

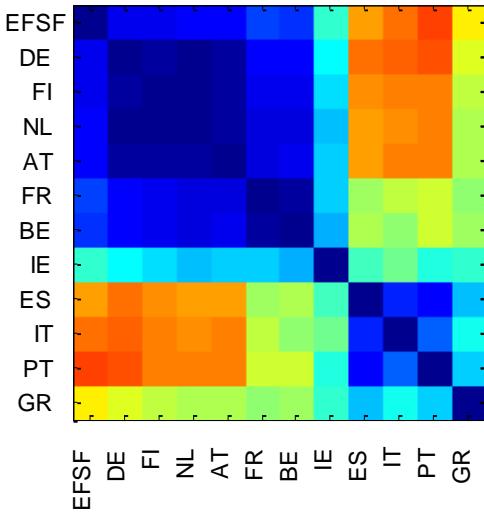


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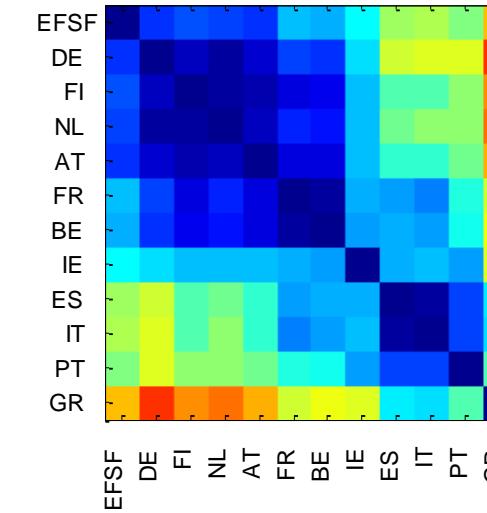
Tsipras confirms election
promises

16-Feb-2015 07:00:00 -20-Feb-2015 17:00:00



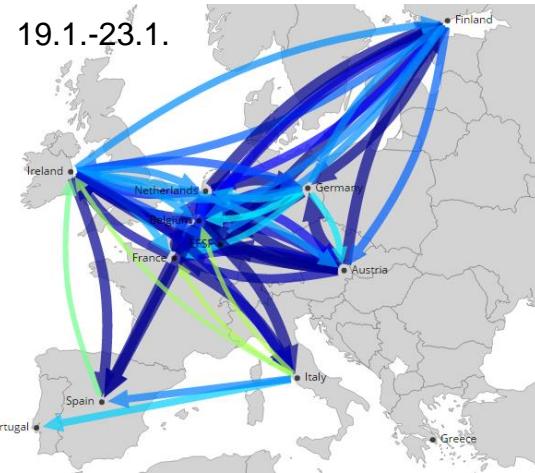
Nervousness before Eurogroup
Brussels

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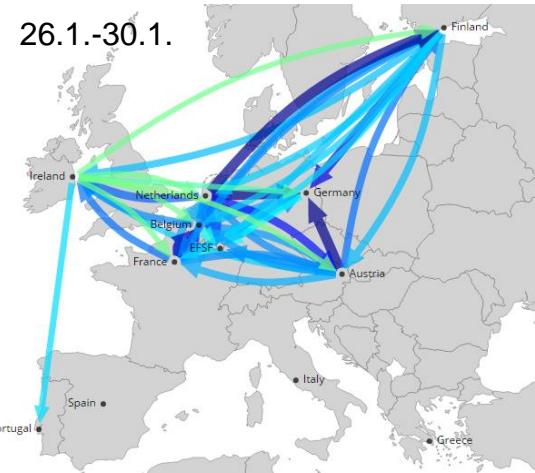


Greece commits to bailout extension;
«Troika» become «Institutions»

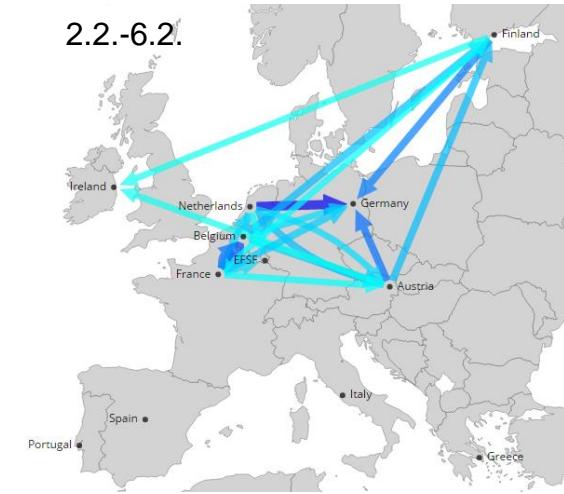
Correlations
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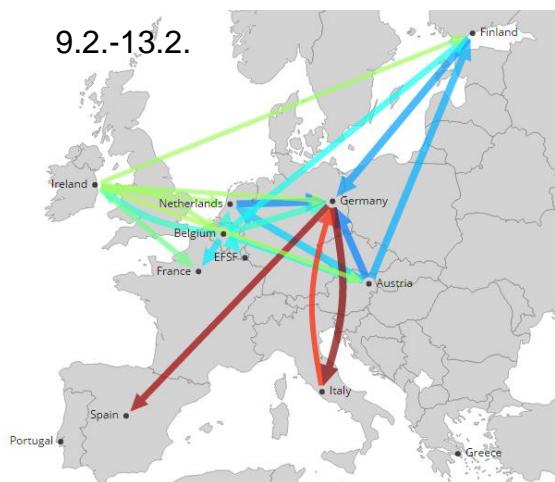
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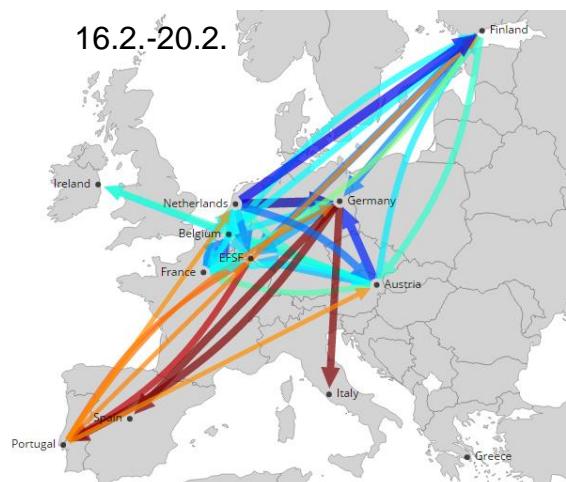
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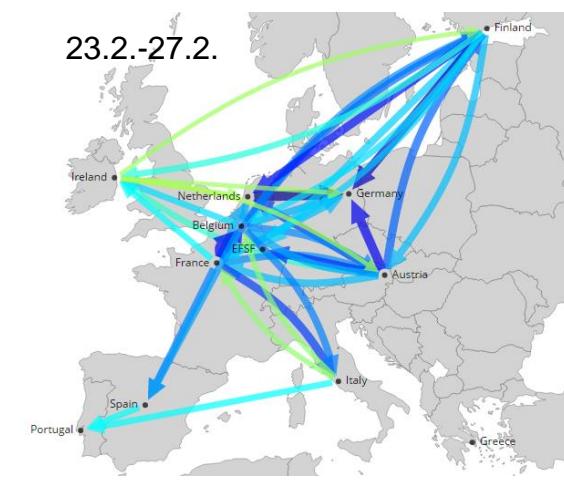
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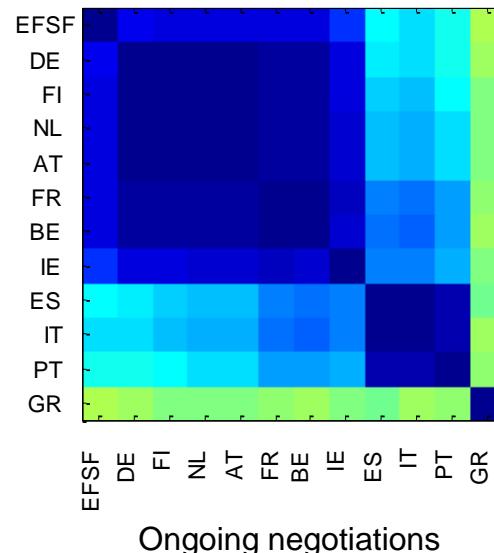


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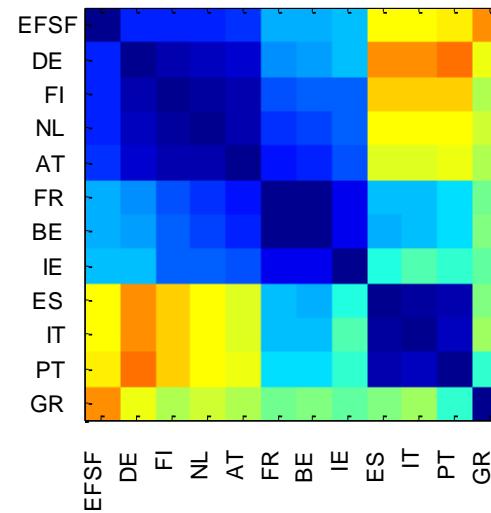
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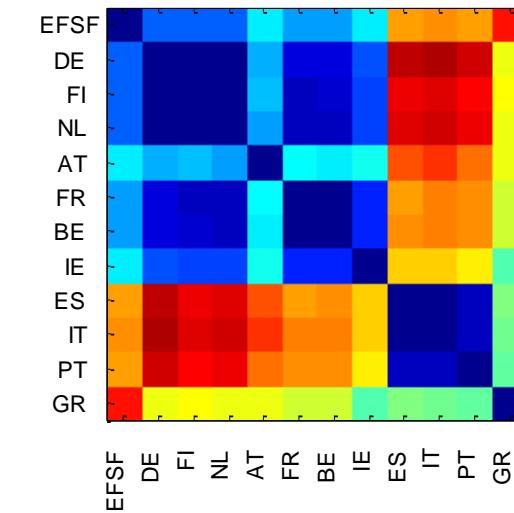
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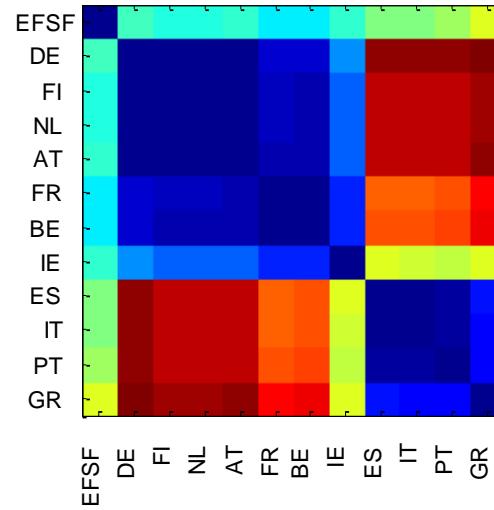
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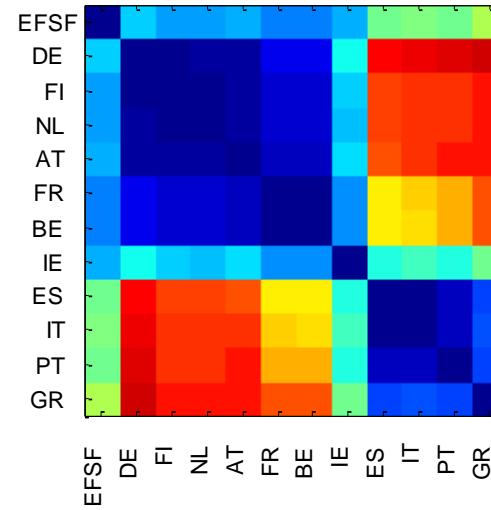
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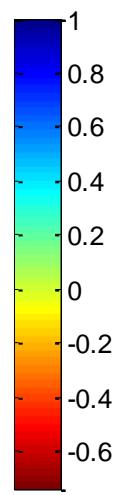
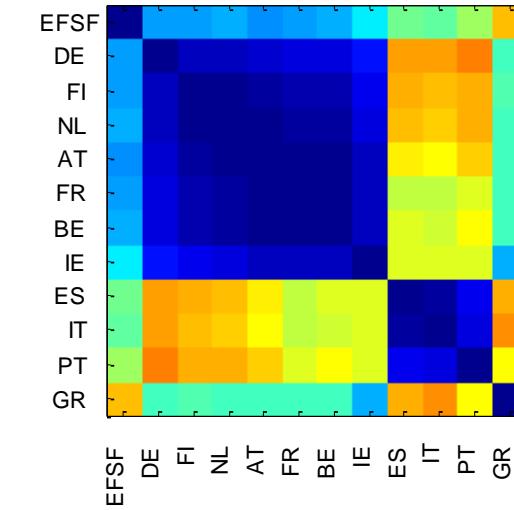
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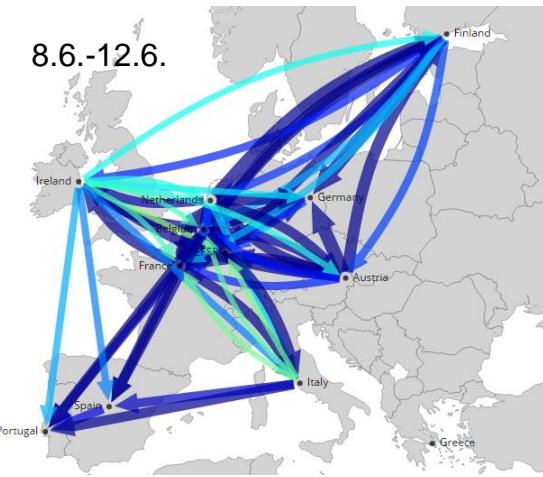
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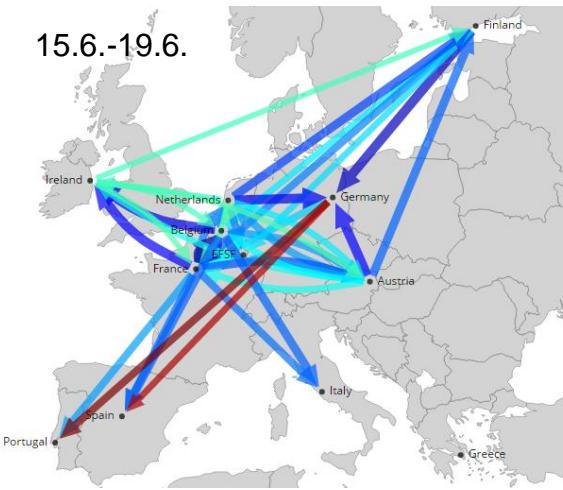
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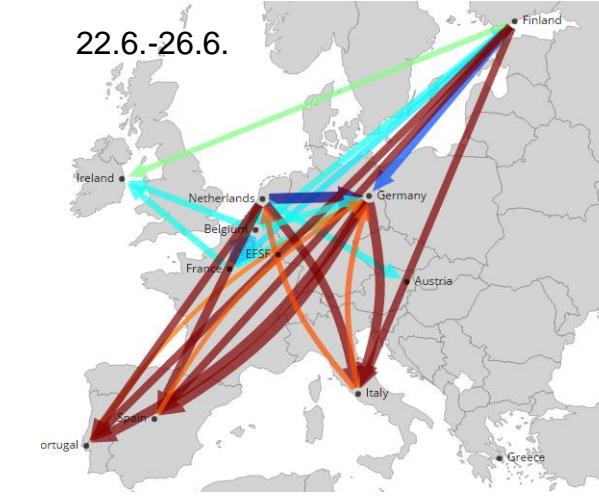
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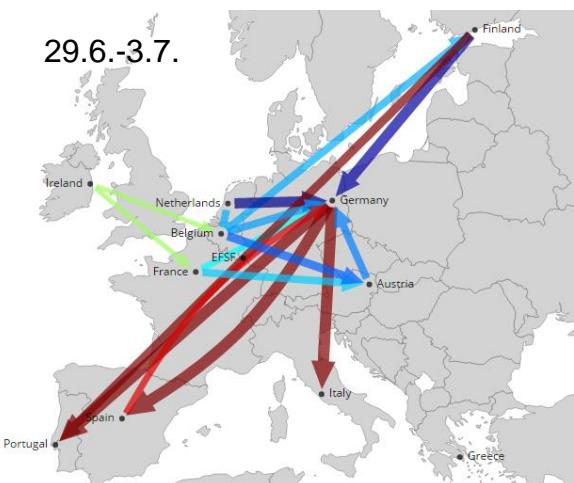
Ongoing negotiations



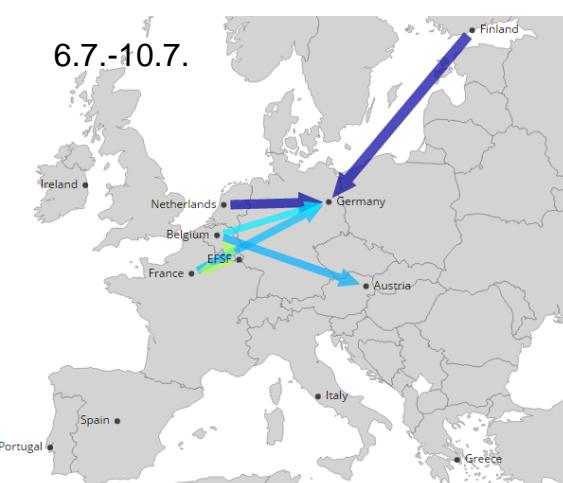
Tsipras meets Putin



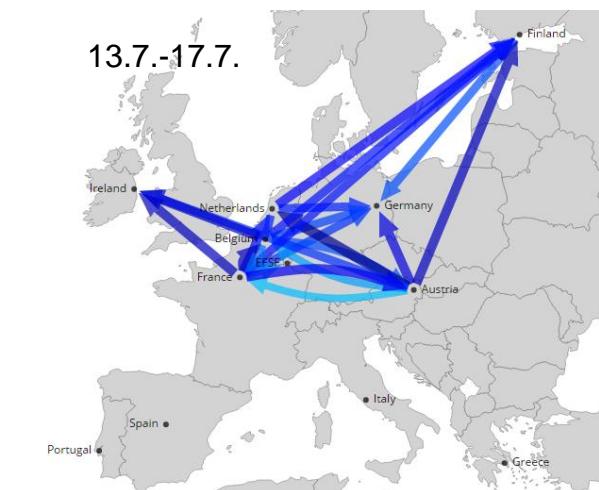
Many Eurogroup meetings without results



Referendum announced.
ECB does not raise ELA.
Capital controls.



Referendum against bailout,
ECB still does not raise ELA limit



Greece commits to third bailout

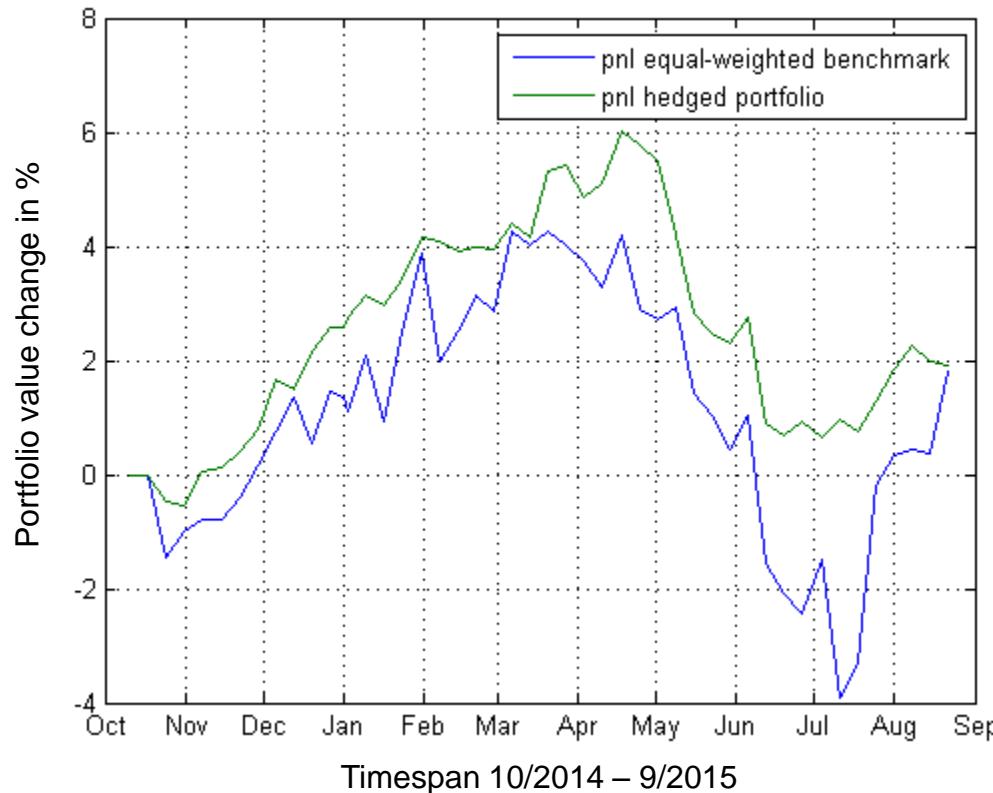
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Conclusions

- Correlation heat maps show pronounced core / periphery block structure that maps the clusters of yield levels.
- Correlation influence networks directly show the shearing forces in the Eurozone with high sensitivity. Noise filtering allows to focus on the statistically significant influences.
- No fixed separation line between core and periphery. Fluctuating correlations between the blocks.
- Increasing negative correlations from 2010-2012 imply risk of capital flights from periphery to core.
- Market believes in guarantee structure of EFSF bond issues, EFSF is part of the core.
- Since 2013, rescue mechanisms show success. Yields converge.
- Greece decoupled; during the negotiations, market implied contagion risk reappeared. Currently, Greek bonds still play an isolated role in the network.

Outlook: Use correlation influence information for dynamic hedging and market timing purposes



Dynamically hedging Eurozone bonds that were exposed to negative correlation influences in the previous week reduces portfolio volatility.

$$\text{daily bond returns} \sim \underbrace{(-\text{Duration}) \times [\text{yield}(t) - \text{yield}(t-1)]}_{\text{Duration Risk}} + \underbrace{\text{yield}(t-1) \times dt}_{\text{Bond Carry}}$$