Structural Estimation of Time-varying Spillovers: an Application to International Credit Risk Transmission in the Euro Area

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Motivation

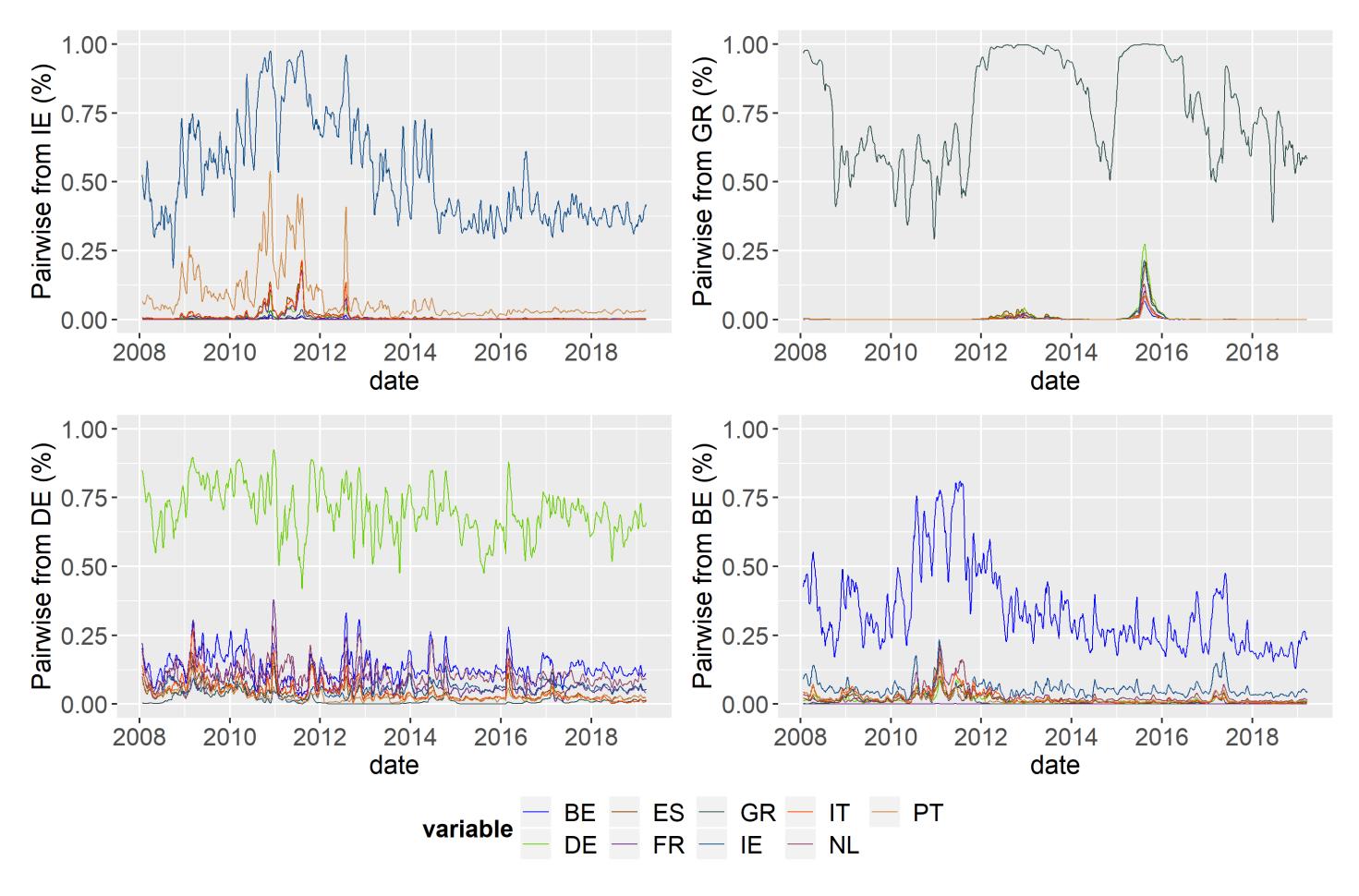
- Hard to gauge financial contagion with co-movement of asset prices
- Papers in the literature have:
 - Questionable identifications
 - Or rolling-window estimation
- We solve the two issues with a **SVAR**-**GARCH** & the contagion framework of **Diebold and Yilmaz**
- We apply the model to risk contagion between EA bank and sovereign CDS

Q: Who are the main drivers of risk spillovers? In which countries do we find a sovereign-bank nexus (vicious circle between bank and sovereign risk)?

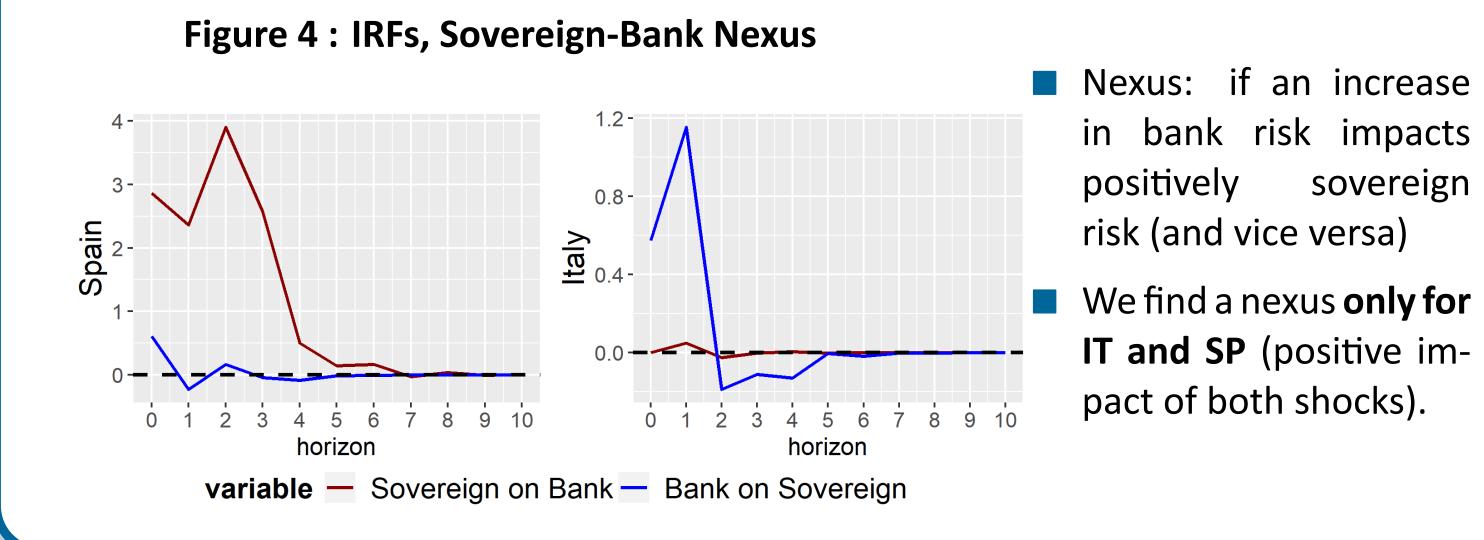
Figure 1: Theoretical Risk-Contagion Channels Direct exposures Common asset holdings Bank Country A Bank Country B Less credit Govies holding & Govies holding & used as collateral supply used as collateral Rating ceiling of Implicit & govies explicit state Less credit supply guarantee Impact on subsidiaries Sovereign Country A Sovereign Country B Bond holding (ESM) Trade/investment

Results

Figure 3: Pairwise Sovereign Spillovers



- N.: This Figure reports pairwise sovereign spillovers (how sovereigns affect other sovereigns)
- We find results in line with literature for main sovereign drivers (DE, BE, IE in 2010), but not for GR
- Spillovers magnitude explained in OLS regressions by: (i) Macro-links between countries (trade/investment) (ii) Portfolio links between banks (common asset holding)



Methodology

1. Estimated Model (SVAR-GARCH)

 \mathbf{y}_{t} (16x1) vector of bank and sovereign CDS, we estimate:

$$\begin{cases} \boldsymbol{B}_0 \boldsymbol{y}_t = \boldsymbol{B}(\boldsymbol{L}) \boldsymbol{y}_{t-1} + \boldsymbol{\epsilon}_t & \text{where:} \\ \boldsymbol{\epsilon}_{k,t} = \sigma_{k,t|t-1} \boldsymbol{e}_{k,t} & \text{with:} \quad \boldsymbol{e}_t \sim \text{i.i.d. N}(\boldsymbol{0}, \boldsymbol{I}_N) & \text{and:} \\ \sigma_{k,t|t-1}^2 = (1 - \gamma_k - g_k) + \gamma_k (\boldsymbol{\epsilon}_{k,t-1})^2 + g_k \sigma_{k,t-1|t-2}^2 \end{cases}$$

2. Identification Strategy

Variances of the structural $(\lambda_{t|t-1})$ and reduced-form $(\Sigma_{u,t|t-1})$ shocks are **time**varying:

$$oldsymbol{\lambda}_{t|t-1} = egin{bmatrix} \sigma_{1,t|t-1}^2 & 0 \ & ... & \delta_{N,t|t-1} \end{bmatrix} = oldsymbol{B}_0 oldsymbol{\Sigma}_{u,t|t-1} oldsymbol{B}_0'$$

This allows to statistically identify B_0 by heteroskedasticity.

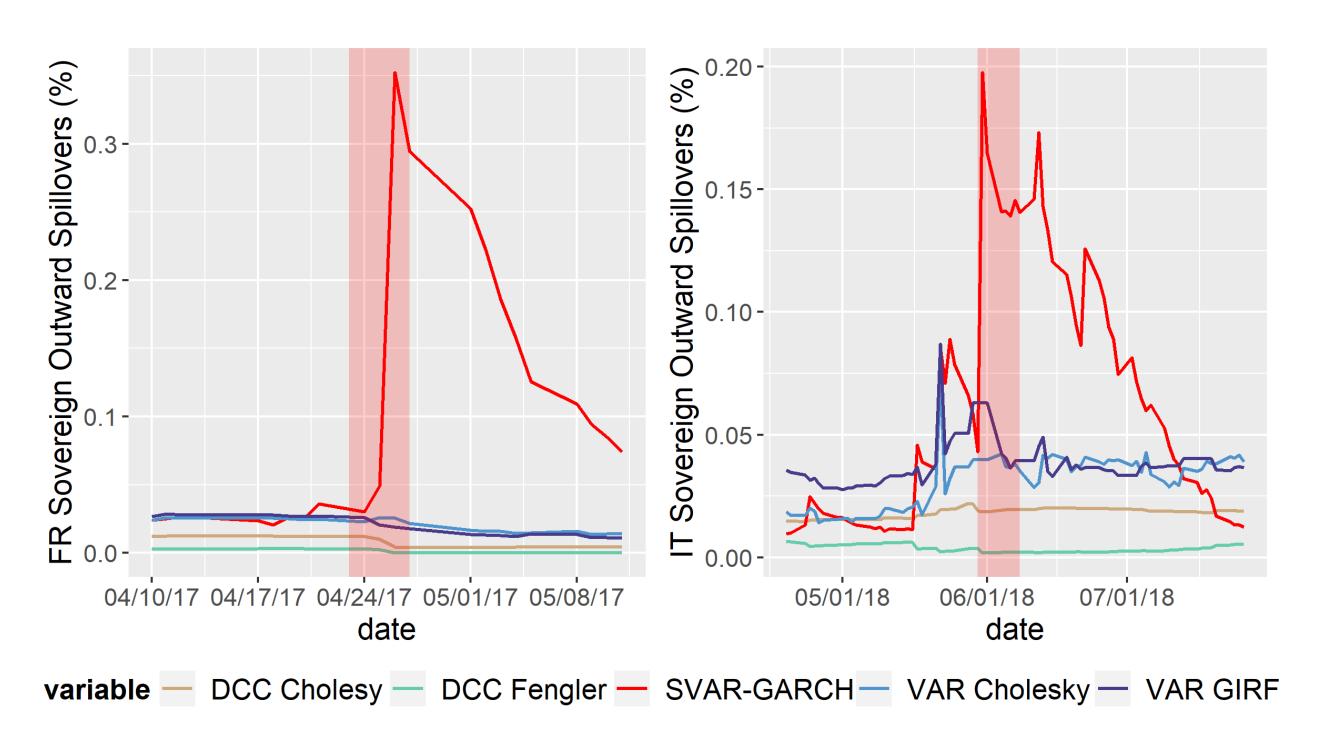
We corroborate this identification with the time series of the shocks ϵ_t . We manage to link the peaks of ϵ_t to 112 historical events.

3. Spillover indices

Time-varying $\lambda_{t|t-1}$ enable time-varying Forecast Error Variance Decompositions (FEVDs). The FEVDs indicate by how much a variable affects another variable's variance. We follow Diebold and Yilmaz and use them as contagion indices.

Model Comparison

Figure 2: Horse Race between Models, Event Identification



N.: Figure reports, for different models, outward spillovers of FR & IT sovereigns (how they affect other variables in the system)

We find that our methodology outperforms other models for event identification. For 2017-FR elections & 2018-IT political turmoil (red bars), our estimates are the only one to peak at the right time. This result is robust across a vast range of events:

	DCC Fen- gler	DCC Cholesky	VAR GIRF	VAR Cholesky	SVAR- GARCH
% of good identification	11.0%	22.0%	44.0%	39.0%	78.0%

N.: Table reports the % of good event identification by each model, relying on outward spillovers

As we rely on in-sample estimation, our contagion indices **Granger cause** estimates with rolling window estimation.

Contribution

- of Diebold-Structural version Yilmaz & up-to-date spillovers
- Methodological results:

sovereign

- Thorough identification of shocks (112 events)
- 2. Estimates **better** fit narrative other models & events c.w. increased reactiveness
- **E**conomic results: Similarities with literature (main drivers, sovereign-bank nexus) & Differences (Greece...)
- Our estimates more reliable: went under more scrutiny
- Methodology applicable to other data: market liquidity contagion, stocks, bond spreads etc.