Discussion of:

“Identifying Contagion in a Banking Network”

by Alan Morrison, Michalis Vasios, Mungo Wilson, Filip Zikes

Christian Julliard

London School of Economics, FMG, and CEPR

In a Nutshell

- A test of spillovers in the CDS markets.

Key idea: If A bought CDS protection from B, negative shocks to B will increase the riskyness of A.

Strategy: regress CDS spreads of protection buyers on the (weighted) CDS gains and losses of their protection sellers.

Findings: bank's own CDS spread increases whenever counterparties from whom it has purchased default protection themselves experience losses on their CDS portfolio.

Claim: *"the first micro-level evidence of the transmission of shocks through financial networks."*

$\Rightarrow$ Kidding, right? e.g. Bilio, Getmansky, Gray, Lo, Merton, Pelizzon (2013), Diebold and Yilmaz (2014, 2016), Demirer, Diebold, Liu, Yilmaz (2015), Denbee, Julliard, Li, Yuan (2016) etc. etc.

Network mechanics

- In (linear-quadratic) network games we typically have equilibrium relations of the form

$$z_{i,t} = \mu_{i,t} + \phi \sum_{j \neq i} g_{i,j,t} z_{j,t} + \varepsilon_{i,t} \quad (1)$$

$$\Rightarrow \mathbf{z}_t \left(I - \phi \mathbf{G}_t \right) = \mu_t + \varepsilon_t \quad (2)$$

where $\mu_{i,t}$ is some parametric function of covariates, $g_{i,j}$ is the link from i to j and form the adjacency matrix $\mathbf{G}_t$

$\Rightarrow$ spatial econometrics counterpart: z_i can be an outcome variable ("spatial autocorrelation"), a shock ("spatial error") or a combination of the two ("spatial Durbin").

Needs:
1) $\mathbf{G}_t$ and μ_t contemporaneously independent of ε_t.
2) $|\phi$ max-e-value$(\mathbf{G}_t)| < 1$ to be well-defined.
3) $rank(\mathbf{G}_t) > 1 \ \forall t$, to identify ϕ.

$\Rightarrow$ well defined Equilibrium and QMLE and (with full rank $\mathbf{G}$)

$$\mathbf{z}_t = \mathbf{M}(\mathbf{G}_t, \phi)\mu_t + \mathbf{M}(\mathbf{G}_t, \phi)\varepsilon_t$$

$$\mathbf{M}(\mathbf{G}_t, \phi) = I + \phi \mathbf{G}_t + \phi^2 \mathbf{G}_t^2 + \phi^3 \mathbf{G}_t + \ldots = (I - \phi \mathbf{G}_t)^{-1}$$

This paper

$$R_{i,t} = \beta \sum_k NP^{Ent}_{i,k,t-1} R_{k,t} + \gamma \sum_{j \neq i} NP^{bank}_{i,j,t} \sum_k NP^{Ent}_{j,k,t-1} R_{k,t}$$

$$+\delta \sum_{j \neq i} \sum_k NP^{Ent}_{j,k,t-1} R_{k,t} + \zeta \sum_{j \neq i} NP^{bank}_{i,j,t} + controls + \varepsilon_{i,t}$$

A particular spatial autocorrelation model where:

1. **z**'s are CDS spreads
2. $\mathbf{G}_t = \mathbf{G}(\theta, \mathbf{NP_t}, \mathbf{NP_{t-1}})$ – parametrized network of CDS exposures with zero links/feedback from i to k
   $\mathbf{G}_t = \theta_1 \mathbf{G}^{(1)}_t + \theta_2 \mathbf{G}^{(2)}_t + \theta_3 \mathbf{G}^{(3)}_t$
3. $\mu_{i,t}$ linear function of controls and $\sum_{j \neq i} NP^{bank}_{i,j,t}$

Issues:

1. ε_t is not orthogonal to $\mathbf{G}_t$ and $\mu_{i,t}$. Maybe typos?
2. LS is not generally consistent for spatial models (Lee (2002))
3. focus on γ but to quantify the economic network spillover one needs to construct ϕ from the various parameters... but ϕ cannot be recovered due to linearity of $\mathbf{G}_t$ (e.g. can double the θ's and halfen the ϕ) $\Rightarrow$ needs a normalization
4. if $|$ max-e-value$(\mathbf{G}_t)| < 1$ the normalization $\phi = 1$ is legitimate (if not, the model is not well defined).

Suggestions

I. Cast the model formally in the spatial econometrics framework and do inference accordingly (i.e. see Anselin (1988), Elhorst (2010a, 2010b), Denbee, Julliard, Li, Yuan (2016)), and verify the appropriate conditions.

II. the assumption of no feedback from k to i is very strong (if i buys protection on k there are likely other economic links between the two) – test it! E.g. use the Diebold and Yilmaz (2014, 2016) LASSO-VAR-GIRF approach.

III. If you find (as you seem) evidence of spatial autocorrelation spillovers, you can't stop there: need to test against the spatial error and spatial Durbin (e.g. using Anselin's LM test) $\Rightarrow$ quite different economic interpretations.

IV. Consider non-CDS related shocks to CDS protection sellers' balance sheets.

Suggestions cont'd

V. Albeit you cannot recover ϕ, with the normalization $\phi = 1$ you can still quantify the spillovers – but looking at γ only is not enough!

If $\phi = 1 \rightarrow \mathbf{G}_t = \beta \mathbf{G}_t^{(1)} + \gamma \mathbf{G}_t^{(2)} + \delta \mathbf{G}_t^{(3)}$, therefore (u.r.c.):

$$\mathbf{z}_t = \mathbf{M}(\mathbf{G}_t)\mu_t + \mathbf{M}(\mathbf{G}_t)\varepsilon_t$$
$$\mathbf{M}(\mathbf{G}_t) = I + \mathbf{G}_t + \mathbf{G}_t^2 + \mathbf{G}_t + \ldots = (I - \mathbf{G}_t)^{-1}$$

Hence the spillover from k to i is:

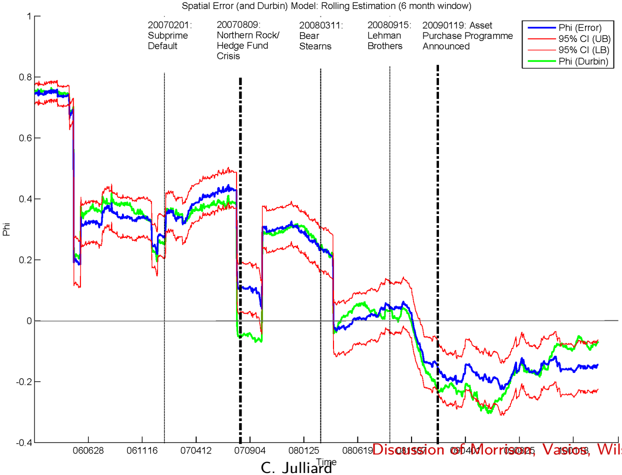
$$\frac{\partial z_{i,t}}{\partial \varepsilon_{k,t}} = \{\mathbf{M}(\mathbf{G}_t)\}_{i,k}$$

where $\{.\}_{i,k}$ returns the i, k element.

⇒ report the distribution of these, and can also identify the key risk players (Denbee, Julliard, Li, Yuan (2016))

VI. Worry about time variation of network parameters: these are a function of attitude toward risk and market conditions in structural models – hence likely to be time varying.

Example: Banking network liquidity ϕ (Denbee, Julliard, Li, Yuan (2016))



Overall

(+) very good idea and important question

(+) very good data

(-) inference/modeling/positioning needs cleaning up

$\Rightarrow$ A lot of upside potential – I look forward to the next draft!