Discussion on “Are Banks too big to fail?” by dr Chen Zhou (DNB)

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Outline

- A bird's eye view on this paper
- Previous approaches to measuring/modelling systemic risk
- Selling points/inconveniences of this paper/MEVT approach
- Specific paper concerns
- Suggestions/extensions

Paper in a nutshell…

- Measuring systemic importance (systemic risk or SR) for individual banks
- Time constant, reduced form
- Multivariate extreme value analysis (MEVT)

  - Probabilistic measures of *extreme* co-movements between (daily) bank stock returns
- Poor cross sectional correlation with bank size

SR and size?

- Theoretical literature on SR: interbank interconnectedness (direct channel) and common portfolio exposures (indirect channel) cause SR
- Bigger banks may be expected to exhibit more interconnections but is that so?
- Bigger banks may be expected to be more diversified but is that so?
- This is ultimately an empirical issue

Previous empirical approaches

- Gropp et al. (2007) apply multinomial logit approach to bank contagion
- Segoviano and Goodhart (2009) estimate probabilistic SR measures
- CO-VaR (Brunnermeier/Adrian, 2008) apply bivariate quantile regression methodology
- Problem: rather technical and/or not going sufficiently far in the tail to model truly systemic events

MEVT approaches

- Hartmann et al. (2005): MEVT probabilities

(i) bank "contagion" measures of domino effect

$$P\left\{X_i > Q_i(p)\right\} \equiv p$$

$$P\left\{X_{l+1} > Q_{l+1},\ldots, X_N > Q_N \middle| X_1 > Q_1,\ldots, X_l > Q_l\right\}$$

(ii) extreme systematic risk or "tail-beta"

$$P\left\{X_1 > Q_1(p) \middle| M > Q_M(p)\right\}$$

Empirical MEVT approaches (2)

- De Jonghe (2009): panel data analysis on relation tail-beta and revenue diversity+control variables
  - log(size), trading income (+)
  - income from traditional intermediation (-)

Selling points of this paper…

- Truly multivariate SR measure: Expected number of banks in distress given a specific problem at one bank, i.e.

$$SII \equiv E\left\{\kappa \middle| X_i > Q_i(p)\right\}$$

$\kappa \equiv$ number of banks in simultaneous distress

$1 < \mathrm{E} \leq 28$

- Low frequency nature of systemic events (e.g. once in 50 or 100 years) can be tackled

→correspond with sig. levels p 100 (or more) times lower than usual 5-1% levels for calculating VaR

Selling points of the paper (2)

- SR measure estimated without need to model marginals provided common marg. sig. level p:

$$P\{X_i > Q_i(p)\} = p, \qquad \forall \mathrm{i}$$

- Stylized fact of "tail dependence" is taken care of

  - semi-parametric estimator for tail copula presupposes tail dependence

- General (nonlinear) dependence measure between banks

  - cf. literature on "nonlinear" crises/propagation

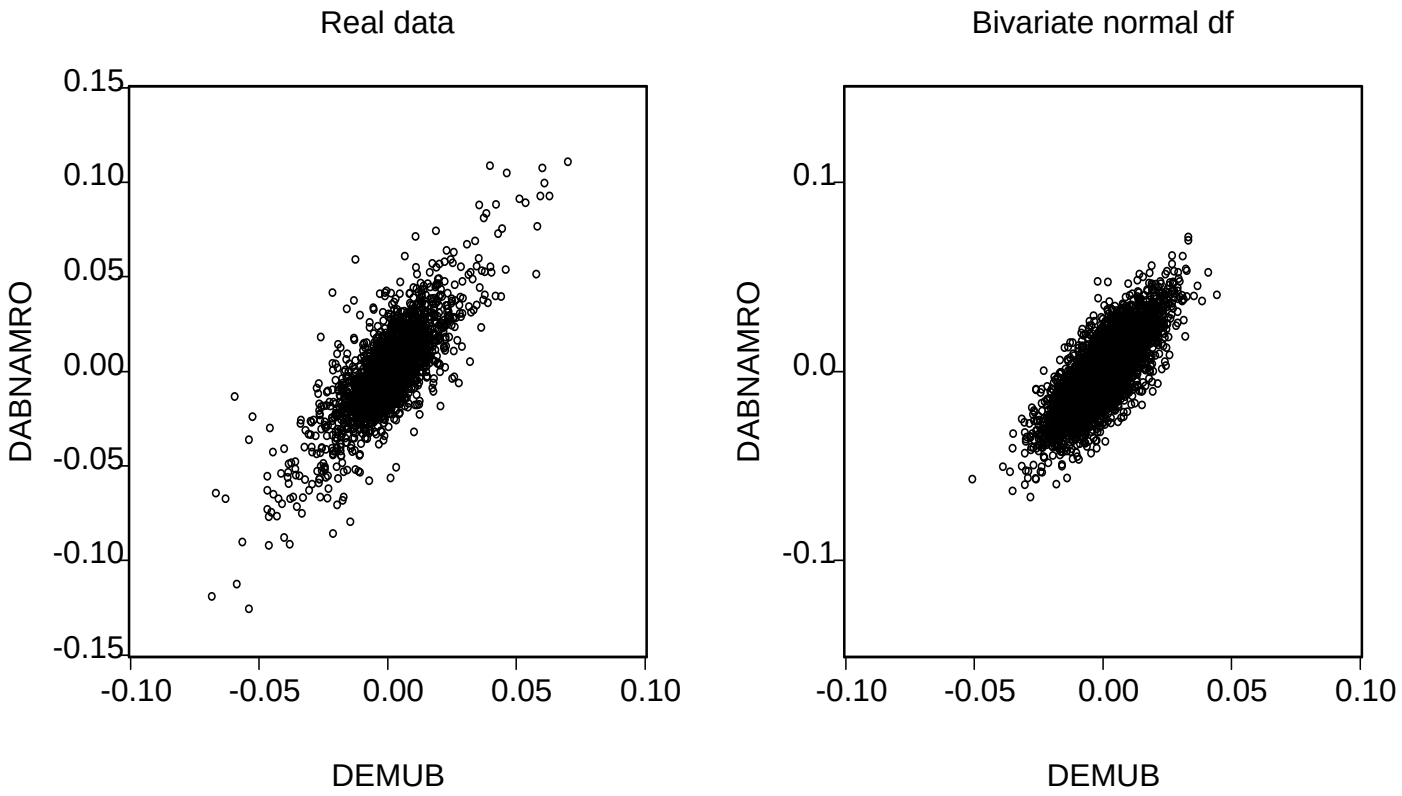
Tail dependence in bank stocks empirically

- Consider tail beta for banks: ABN AMRO w.r.t. a European bank portfolio index (EMUB)
- Assume ABNAMRO returns, EMUB returns are jointly normally distributed

$$\left(R_i, R_M\right) \rightarrow N\left(\mu_i, \mu_M, \sigma_i, \sigma_M, \sigma_{iM}\right)$$

- Redraw n=3,106 data pairs from this process and compare with original data cloud

Tail dependence in bank stocks (2)



Tail dependence theoretically

- Follows from the underlying fundamentals' tail fatness, i.e. consider common risky exposure like in

$$B_1 = X + Y$$

$$B_2 = X + Z$$

$$X \text{ is fat (thin) tailed} \Rightarrow \left(B_1, B_2\right) \text{are tail (in)dependent}$$

$$\lim_{s\to\infty} P\left\{B_1 > s \middle| B_2 > s\right\} > 0 \quad \text{(TD)}$$

$$\mathrm{E} > 1$$

Tail copula estimator

- Parametric model of tail should exhibit tail dependence (Gaussian copula clearly bad idea)
- Chen's nonparametric estimator implicitly assumes tail dependence: otherwise degenerate estimator
- *Theoretical* justification for tail dependence (fat tailed underlying common exposures) and *(casual) empirical* evidence (extreme pairs in data clouds)
- Future suggestion: statistical test for tail dependence to convince nonbelievers

Disadvantages of MEVT

- Reduced form; no model of systemic risk propagation
- Time invariant measures

  - does not condition SR measures on candidate trigger variables in a e.g. time series/panel framework or quantile regression

Specific concerns with this paper

- OLS is problematic for SR/size regression because $1<E\leq 28$ is truncated
- Sample selection: cross section of 28 banks representative sample?
- Is 28 enough for a stable cross sectional relation between SR/size? R2?
- (block bootstrapped) confidence bounds for SR?

Potential extensions

- Rank correlation/copula between SR and size as alternatives to cope with potential nonlinear relation/marginal differences
- Alternative SR measure that reflects impact in money terms on financial sector: bivariate expected shortfall

$$B : \text{individual} \quad \text{bank}$$

$$M : \text{Bank} \quad \text{market} \quad \text{index}$$

$$E\left[M > Q_M(p) \middle| B > Q_B(p)\right]$$

Potential extensions (2)

- Systemic contribution of banks prior to bankruptcy (Lehman/Bear Stearns)? Measure's predictive ability?
- Robustness of SR measure: rank correlation with SR measures based on dd, CDS spreads etc.
- Time varying SR model conditioned on SR triggers (bank specific/macro)

  - size, revenue composition (trading/nontrading income)..
- Other variables that do correlate/predict SR can be basis of preventive action (SR reduction)

Concluding remarks

- MEVT natural approach to measuring SR
- Size does not seem to matter for SR
- Question remains: what about other variables?