Discussion

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Financial Stress Indexes (FSI)

1. Cleveland FSI (CFSI)

2. IMF FSI

3. CISS
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   - market variables
   - empirical CDF
   - credit weight

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2. IMF FSI
   - market/book variables
   - simple averages?

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Financial Stress Indexes (FSI)

1. Cleveland FSI (CFSI)
   - market variables
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   - credit weight

2. IMF FSI
   - market/book variables
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3. CISS
   - market variables
   - empirical CDF
   - correlation and impact weight
CFSI and CISS

\[ Y_t = \sum_{j}^{J} w_{jt} F_j(x_{jt}) \]

<table>
<thead>
<tr>
<th></th>
<th>CFSI</th>
<th>CISS</th>
</tr>
</thead>
<tbody>
<tr>
<td>( J )</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>( w_{jt} )</td>
<td>Credit in mkt. segment from flow of funds</td>
<td>Impact from quantile regression × time-varying correlation</td>
</tr>
<tr>
<td>( F_j )</td>
<td>emp. CDF of indicator ( x )</td>
<td>emp. CDF of indicator ( x ), possibly recursively estimated</td>
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</tbody>
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Robustness of idea is nice – Hollo, Kremer and Lo Duca point out the reclassification problem and this appears to help
These Papers

- Oet, Bianco, Gramlich, Ong (JBF forth)
  - Early-warning system predicting CFSI
  - Financial variables
- Christensen and Li (2013)
  - Early-warning system predicting IMF FSI
  - Macro variables
- Hollo, Kremer, Lo Duca (2012)
  - Construct CISS
  - Financial variables

I start with the EWS
• Key idea: imbalances
• Different models
  • identify stresses accumulating to act (long-lag model)
  • predict near-term (short-lag model)
• Brings to forefront idea of policy endogeneity
  • Can confound any prediction exercise
• A lot going on in paper
  • I may have gotten lost somewhere in the middle
Short-lag model

\[ Y_t = \sum_{k=1}^{7} \beta_{S,k} SL_{kt} + \left( 1 - \sum_{k=1}^{7} \beta_{S,k} \right) SL_{8t} \]

Long-lag model

\[ Y_t = \sum_{k=1}^{7} \beta_{L,k} LL_{kt} + \left( 1 - \sum_{k=1}^{7} \beta_{L,k} \right) SL_{8t} \]

\( SL \) and \( LL \) from individual regressions selected using \( t \)-tests, Granger tests, collinearity statistics, and judgmental selection

A lot of work behind the scenes
A concern I have – $SL_j$ (or $LL_j$) contain intersecting subsets of variables

\[
Y_t = a_0 + a_1 X_{1t} \quad \rightarrow \hat{Y}_{at}
\]

\[
Y_t = b_0 + b_1 X_{1t} + b_2 X_{2t} \quad \rightarrow \hat{Y}_{bt}
\]
A concern I have – $SL_j$ (or $LL_j$) contain intersecting subsets of variables

\[ Y_t = a_0 + a_1 X_{1t} \quad \rightarrow \hat{Y}_{at} \]
\[ Y_t = b_0 + b_1 X_{1t} + b_2 X_{2t} \quad \rightarrow \hat{Y}_{bt} \]

\[ Y_t = w\hat{Y}_{at} + (1 - w)\hat{Y}_{bt} \quad \rightarrow Y_t - \hat{Y}_{bt} = w(\hat{Y}_{at} - \hat{Y}_{bt}) \]
\[ \downarrow \]
\[ \hat{w} \approx 0 \]

So probably these $SL_j$ don’t contain exactly the same variables, due to different lag choices?
Equity imbalances: “increase in real equity should be positively related to systemic financial stress”
- A volatility paradox like Brunnermeier and Sannikov?
- If value ratio: past positive returns push up and therefore expected future returns lower

Liquidity imbalances: “asset liability mismatch will positively reflect greater systemic risk”
- greater roll-over risk – clear
- but also indicating greater ability to perform core financial intermediation?
Christiansen and Li: EWS

- Key idea: probability forecast
- Convert variables to indicator variables
- Brings to forefront idea of prediction
- Paper a work in progress
  - Some things to clarify
Use the IMF FSI for nation $j$.

High-stress event $H$ is

$$H_{jt} = \begin{cases} 1 & Y_{jt} > \mu_j + 1.5\sigma_j \\ 0 & \text{otherwise} \end{cases}$$

Imminent even $G$ is

$$G_{jt} = \begin{cases} 1 & H_{j,t+j} \text{ for any } j = 1, 2, 3, 4 \\ 0 & \text{otherwise} \end{cases}$$

Predict whether today is $G$ using market variables $X_{kjt}$
Christiansen and Li: EWS

Market variable $X_t$ (subsume $j, k$) is converted to signals in three ways

\[
O_t = \begin{cases} 
1 & X_t \notin (-X^*_O, X^*_O) \\
0 & \text{otherwise} 
\end{cases} \quad \text{Ordinary signal}
\]

\[
M_t = \begin{cases} 
1 & X_t \notin (-X^*_M, X^*_M) \text{ and } X_t \in (-X_E, X_E) \\
0 & \text{otherwise} 
\end{cases} \quad \text{Mild signal}
\]

\[
E_t = \begin{cases} 
1 & X_t \notin (-X_E, X_E) \\
0 & \text{otherwise} 
\end{cases} \quad \text{Extreme signal}
\]

Composite indicators constructed (subsume $j$)

\[
I_{1t} = \sum_{k=1}^{n} O_{kt}
\]

\[
I_{2t} = \sum_{k=1}^{n} M_{kt} + E_{kt}
\]

\[
I_{3t} = \sum_{k=1}^{n} O_{kt} \frac{1}{\omega_k} \quad \omega_j \text{ noise-to-signal ratio}
\]

Then convert to probability based on historical relationship
Define noise-to-signal ratio

$$\omega = \frac{\text{CallWrong}}{\text{CallWrong} + \text{QuietCorrect}} \times \frac{\text{CallCorrect}}{\text{CallCorrect} + \text{QuietWrong}}.$$ 

Perfect signal $\rightarrow \omega = 0 \rightarrow \frac{1}{\omega} = \infty$: maybe not well-behaved

Instead, consider $y = x + e$ for independent $x, e$ and $x$ what you want to know. Try signal-to-noise ratio

$$\frac{\text{Var}(x)}{\text{Var}(x) + \text{Var}(e)} \in [0, 1]$$

So here

$$\frac{1}{\omega} = \frac{\text{CallCorrect} + \text{QuietCorrect}}{\text{CallCorrect} + \text{CallWrong} + \text{QuietCorrect} + \text{QuietWrong}}$$

Any difference?
One criterion is $QPS = \frac{1}{T} \sum_{t}^{T} 2(\hat{I}_{t} - G_{t})^{2} \in [0, 2]$

Suppose $T = 100$

Event 6.25%/time separated by many periods $\rightarrow G_{t} = 1$ 25%/time

$P_{t} = 0 \rightarrow QPS = 0.5 \quad P_{t} = 1 \rightarrow QPS = 1.5 \quad P_{t} = 0.25 \rightarrow QPS = 0.38$

Event 1.25%/time separated by many periods $\rightarrow G_{t} = 1$ 5%/time

$P_{t} = 0 \rightarrow QPS = 0.1 \quad P_{t} = 1 \rightarrow QPS = 1.8 \quad P_{t} = 0.25 \rightarrow QPS = 0.095$

Point of comparison would help
Not about the glam-rock band from New York City
Holmo, Kremer and Lo Duca: CISS

- Key idea: correlation between indicators
- Brings to forefront idea of widespread or contagious financial conditions
Overall index $Y_t$ constructed from 5 subcomponents $S_{it}$ which comprised of 3 inputs $Z_{ijt}$

- $Z_{ijt}$ from empirical CDF of underlying variable $X_{ijt}$
  - $Z$ is broad index of financial market segment
- $S_{it} = Z_{i1t} + Z_{i2t} + Z_{i3t}$
  - portfolio implication – $Z$s perfectly correlated

\[
Y_t = \begin{bmatrix}
  w_{1t}S_{1t} & \cdots & w_{5t}S_{5t} \\
  \vdots & \ddots & \vdots \\
  w_{1t}S_{1t} & \cdots & w_{5t}S_{5t}
\end{bmatrix} 
C_t \begin{bmatrix}
  w_{1t}S_{1t} & \cdots & w_{5t}S_{5t}
\end{bmatrix}'.
\]
$Y_t = \begin{bmatrix} w_{1t}S_{1t} & \cdots & w_{5t}S_{5t} \\ \vdots & \ddots & \vdots \\ w_{1t}S_{1t} & \cdots & w_{5t}S_{5t} \end{bmatrix} C_t \begin{bmatrix} w_{1t}S_{1t} & \cdots & w_{5t}S_{5t} \\ \vdots & \ddots & \vdots \\ w_{1t}S_{1t} & \cdots & w_{5t}S_{5t} \end{bmatrix}'$

$w_{it}$ is “real-impact” weight coming from lower-tail quantile regression of IP on $Z_i$

- Economic content being brought in
- Surprised these $w$ are so similar
- In Giglio, Kelly, Pruitt, Qiao we find some stress indicators much more informative of median/tails of future economic activity

$C_t$ is time-varying correlation matrix from exponentially-weighted moving-average

- Emphasizes *correlation* as key marker of stressful episodes
Hollo, Kremer and Lo Duca: CISS

Use Threshold VAR to analyze effect on IP during high- and low-stress times

- Idea that stress only matters sometimes
- Threshold value only breached in 2007 – all from recent episode

- About nonlinear model/solutions like Krishnamurthy and He (2013) or Brunnermeier and Sannikov (2012)
Wrapping up


- Oet, Bianco, Gramlich, Ong

  *Systemic risk is a condition in which the observed movements of financial market components reach certain thresholds and persist*

- Hollo, Kremer and Lo Duca

  *Systemic risk can be defined as the risk that instability becomes so widespread within the financial system that it impairs its functioning to the point where economic growth and welfare suffer materially (de Bandt and Hartmann 2000).*

- Christiansen and Li – prediction is important

  Elusive, and these are important efforts at narrowing in on the important mechanisms