Detecting global financial crises over history: A multivariate nonlinear denoising strategy

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Existing literature
• Expert-based datations: require updates
• Model-based datations: do not handle highly multivariate data
► Cliometrics and complexity tool for crises detection on-the-fly.

3-step original model-based method
• Information from pairwise correlations in stock market prices
• Nonlinear multivariate denoising
• Crises detection from changepoint filtering
► Applies to any quantitative historical data.

Main results
• Detects all major benchmark crises
• Major crises impact jointly the 1st four moments of correlation distributions
► Original crisis typology.

Cliometrics And Complexity
IXXI project webpage
## Existing literature

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### 3-step segmentation

#### 2000

- **Eichengreen & Bordo 2002** Crisis criteria (banking, currency, twin)
- **Reinhart & Rogoff 2009** Crisis criteria (defaults, hyperinflation, banking, currency, etc.)
- **Laeven & Valencia 2012** Crisis criteria (banking, currency, systemic sovereign)

#### 2010

- **Benchmark datations**
- **Romer & Romer 2017** Expert based indicator from textual data
- **Drewhman Jusellius 2014** Ranking of macro indicators based on AUROC
- **Brave & Butter 2018** ROC on aggregated financial stress indicators
- **Lee & al 2020** AUROC on financial stress indicators à la Aikman et al 2017
- **Schularick & Taylor 2009** AUROC + Logit (long term money/credit relationship)

#### 2020

- **Chen & al 2020** Machine learning indicator from textual data
- **Brave & Butter 2018** ROC on aggregated financial stress indicators
- **Danielsson et al 2018** Regimes based on Hodrick Prescott filters on vol. + AUROC
- **Duprey et al 2017** MSM on financial stress indicators
- **Aikman et al 2017** Heatmaps on time series of aggregated financial indicators
- **Bastidon et al 2020** Network indicators and non linear segmentation

### Crisis detection & datation

- **Emerging crises**
- **Schularick & Taylor 2009** AUROC + Logit (long term money/credit relationship)
- **Duprey et al 2017** MSM on financial stress indicators
- **Aikman et al 2017** Heatmaps on time series of aggregated financial indicators
- **Bastidon et al 2020** Network indicators and non linear segmentation

### Existing literature

- **A new indicator of financial crises**

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Step 1. Correlations
From log returns of stock market prices to correlations summary indices

Step 2. Denoising
Multivariate piecewise linear segmentation of the correlation structure

Step 3. Crisis indicator
Segmentation and filtering of the changepoints

A new indicator of financial crises
Achieved typology of crises

Typical crises increase Stdev

Mean  Stdev  Skewness  Kurtosis
1973  -  +  +  +  1st oil shock
1976  0-  +  0-  0  End of the IMS
1987  -  0+  0-  +  Stock market crash
2007  -  +  +  -  GFC
2009  -  +  +  -  GFC
2010  -  0+  +  -  European debts crisis

Major crises decrease Kurtosis

Major crises increase Skewness derivative
Exceptions: institutional events of crisis resolution decreasing uncertainty (1976, 1987)

• Main results from summary of correlations
• Robustness from all pairwise correlations
• Complementary results from volatilities

Datation from volatilities

Datation from the distribution of correlations

• Fully data-driven method
• Handles unbalanced panels
• Handles non stationary data
• Applies to any multivariate historical time series

A new indicator of financial crises