The Dynamics of Value across Global Equity Markets: The Risk Contagion

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Motivation

- Valuation Metrics
  - Price-Earnings (P/E), Price-Book (P/B), Price-Earnings to Growth (PEG) Ratio
  - Debt/Equity Ratio
  - Free Cash Flow
- CAPE (Cyclically Adjusted Price Earnings Ratio) Campbell & Shiller (1988)
- Piotroski Score (2000) point based score between 0-9
  - Profitability (0-4)
  - Leverage, Liquidity and Source of Funds (0-3)
  - Operating Efficiency (0-2)

Previous Work

- Stock Market Valuation
  - Lakonishok et al. (1994); Chan & Lakonishok (2004)
  - Van der Hart et al. (2003)
  - Lander et al. (1997); Brown & Cliff (2002)
  - Bakshi & Chen (2005)
  - Bartov & Bodnar (1994); Frankel & Lee (1998)

Research Question

1. Cross sectional aspects of dynamics of valuation metrics across global equity markets.

2. The periods when markets are driven by euphoria and fear.

Computing CAPE

- CAPE is defined for a stock market index I at time t as

$$CAPE^{I}_{M;t} = \frac{rP^{I}_{t}}{Avg_{M;t}\left[rEPS^{I}_{t'}\right]},$$

where the numerator, rP^{I}_{t}, is the price level of the index I at time t expressed in real terms as

$$rP^{I}_{t} = P^{I}_{t} \cdot \frac{CPI^{I}_{\mathcal{T}}}{CPI^{I}_{t}},$$

where CPI^{I}_{t} is the last published consumer price index at the domestic country to index I at time t, $\mathcal{T}$ is the reference date taken as the last time in the sample and P^{I}_{t} is the price level of the index, and the denominator $Avg_{M;t}\left[rEPS^{I}_{t'}\right]$, is the average of the earnings per share, expressed in real terms, over a past window M.[1]

[1] EPS^{I}_{t} is published as 12-month trailing average.

CAPE

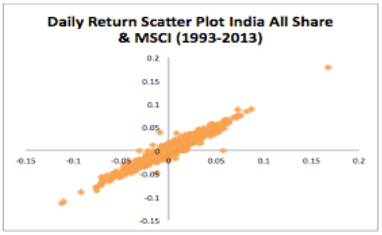
- We assume that $Avg_{M;t}\left[rEPS^{I}_{t'}\right] > 0$. As $Avg_{M;t}\left[rEPS^{I}_{t'}\right] \to 0+$, the $CAPE^{I}_{M;t}$ is diverging, where for negative average earnings, the CAPE is negative as well.

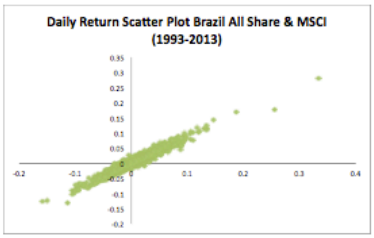
- We consider only those indices, for which $Avg_{M;t}\left[rEPS^{I}_{t'}\right] > 0$ and thus CAPE is well defined.

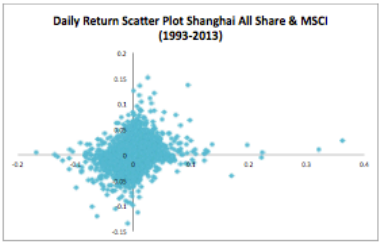
Empirical Data

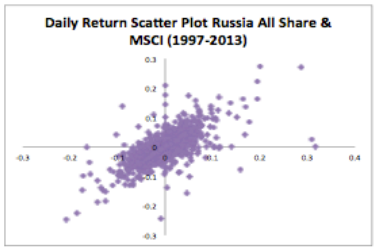
- We use 7 year moving average of inflation adjusted EPS to compute CAPE
- We have 34 equity markets for this study
- We use Weekly MSCI Index data starting from January 2002 till December 2014
- Our dataset has 21,216 observations

Market Index and MSCI Index Data









Market Clustering

Clustering of Markets based on their trading times with the GMT

Asia	Europe	America
Japan	UK	USA
Israel	Sweden	Brazil
South Africa	Ireland	Argentina
Russia	Norway	Colombia
India	Portugal	Peru
China	Poland	Mexico
Hong Kong	Switzerland	Chile
Malaysia	Finland	
Philippines	Austria	
Taiwan	Belgium	
Australia	Spain	
South Korea	Italy	
	Netherlands	
	France	
	Germany	

Volatility Modelling - GJR GARCH (1993)

$$r_t = \mu + \epsilon t \tag{1}$$

$$\epsilon t = \sigma tzt \tag{2}$$

$$\sigma_t^2 = \omega + (\alpha + \gamma I_{t-1})\,\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \tag{3}$$

where

$$I_{t-1} := \left\{ \begin{array}{l} 0 \ if \ r_{t-1} \geq \mu \\ 1 \ if \ r_{t-1} < \mu \end{array} \right\} \tag{4}$$

However ω,$\alpha, \gamma, \beta > 0$ (restrictions imposed) then the volatility can be modeled by the following expression,

$$\sigma^2 := Var(r_t) = \frac{\omega}{1 - \alpha - \frac{\gamma}{2} - \beta} \tag{5}$$

Multivariate Asymmetric Dynamic Conditional Correlation Model (Cappiello et al. 2006)

$$r_t|\zeta_{t-1} \sim \mathcal{N}(0, H_t) \tag{6}$$

$$H_t = D_t P_t D_t \tag{7}$$

$$Q_t = (1 - a - b)\bar{P} + a\varepsilon_{t-1}\varepsilon_{t-1}' + bQ_{t-1} \tag{8}$$

$$P_T = Q_t^{*-1} Q_t Q_t^{*-1} \tag{9}$$

Contd.

$$Q_t = \left(\overline{P} - A'\overline{P}A - B'\overline{P}B - G'\overline{N}G\right) + A'\varepsilon_{t-1}\varepsilon_{t-1}^{'}A \tag{10}$$

$$+G'n_{t-1}n_{t-1}^{'}G + B'Q_{t-1}B \tag{11}$$

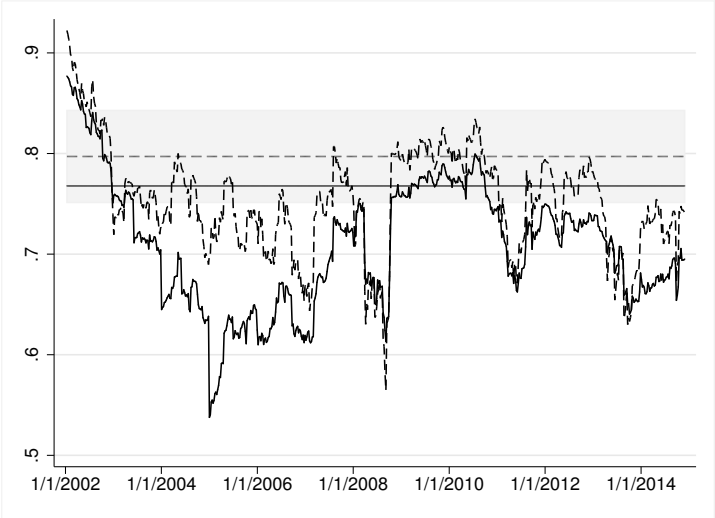
$$Q_t = \left(\overline{P} - a^2\overline{P} - b^2\overline{P} - g^2\overline{N}\right) + a^2\varepsilon_t\varepsilon_{t-1}' + g^2 n_{t-1}n_{t-1}' + b^2 Q_{t-1} \tag{12}$$

$$a^2 + b^2 + \delta g^2 < 1 \tag{13}$$

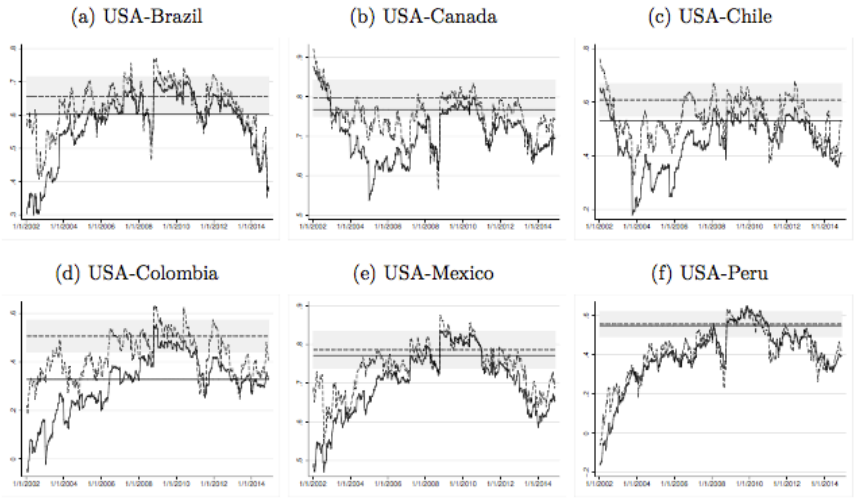
$$\textit{where } \delta = \textit{maximum eigenvalue}\left[\overline{P}^{-1/2}\overline{NP}^{-1/2}\right] \tag{14}$$

Empirical and Dynamic Conditional Correlations Canada

Results

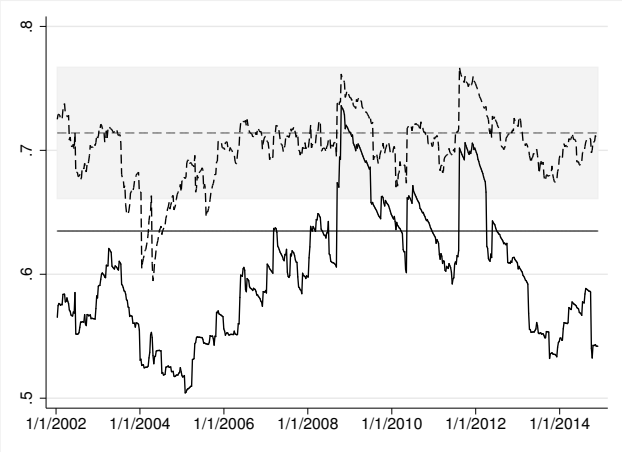


Empirical and Dynamic Conditional Correlations (America)

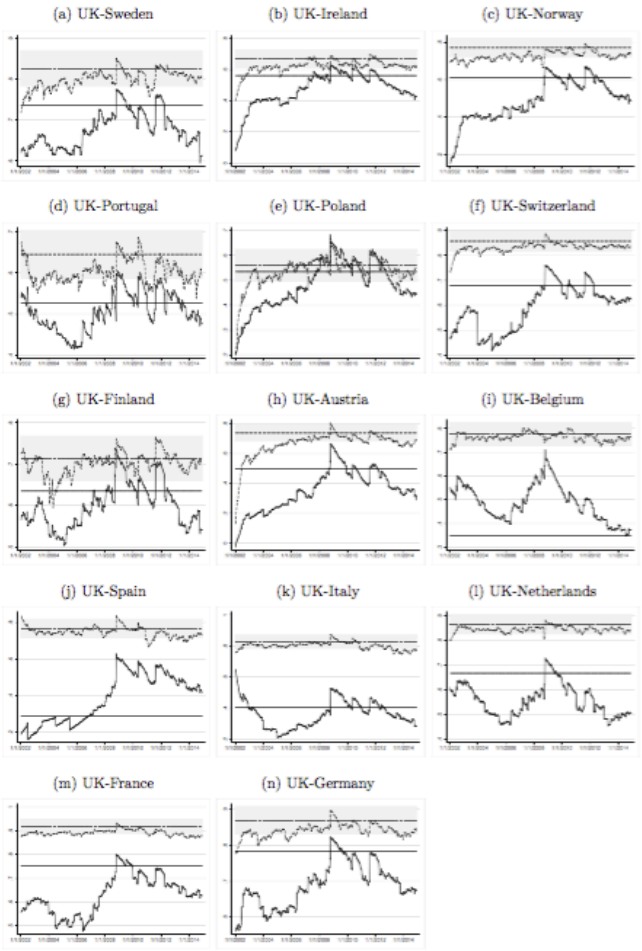


Note: The solid black and gray lines depict the dynamic and the static correlations between the $CAPE^{I}_{7;t}$, $\mathbf{H}^{c,7}_{t}$, respectively; the dash black and gray lines depict the dynamic and the static correlation between the price levels, $\mathbf{H}^{p}_{t}$, respectively. The shaded region depicts the 95% confidence interval for the static correlation of the price levels, which serves as a benchmark.

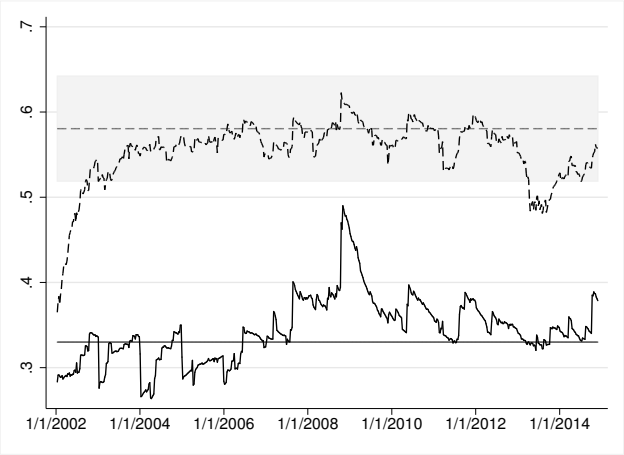
Empirical and Dynamic Conditional Correlations Finland



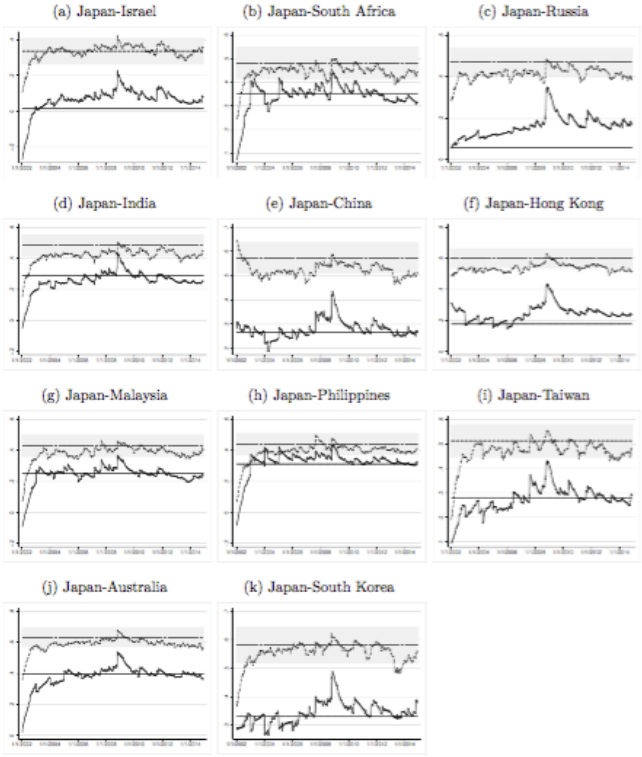
Empirical and Dynamic Conditional Correlations (Europe)



Empirical and Dynamic Conditional Correlations South Korea



Empirical and Dynamic Conditional Correlations (Asia)

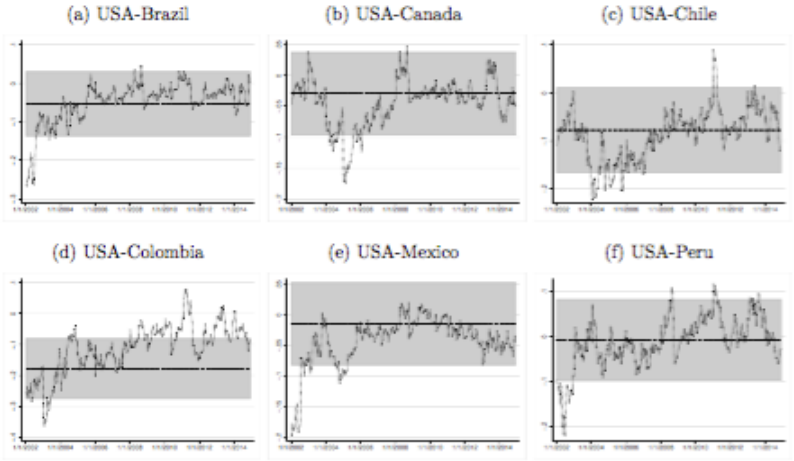


Note: The solid black and gray lines depict the dynamic and the static correlations between the $CAPE^{J}_{7,t}$, $\mathbf{H}^{c,7}_{t}$, respectively; the dash black and gray lines depict the dynamic and the static correlation between the price levels, $\mathbf{H}^{p}_{t}$, respectively. The shaded region depicts the 95% confidence interval for the static correlation of the price levels, which serves as a benchmark.

Value Spread

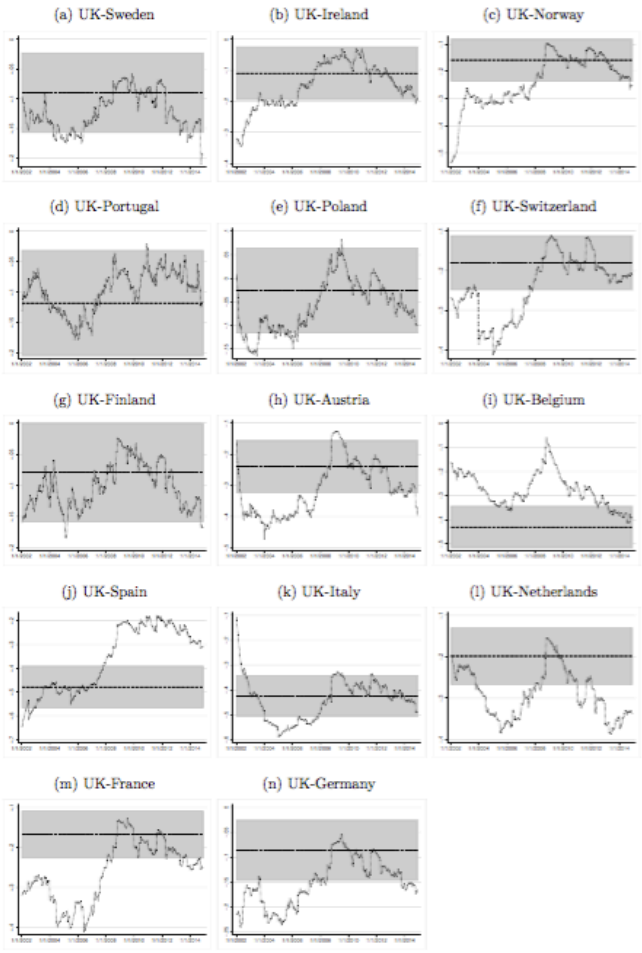
- We define the value spread as the spread between the dynamic correlations of CAPE and Price Returns.
- We further benchmark this spread with the spread obtained from empirical correlations between CAPE and Price Returns.
- We further compute a 95% confidence bound along the empirical correlations.

Value Spread America

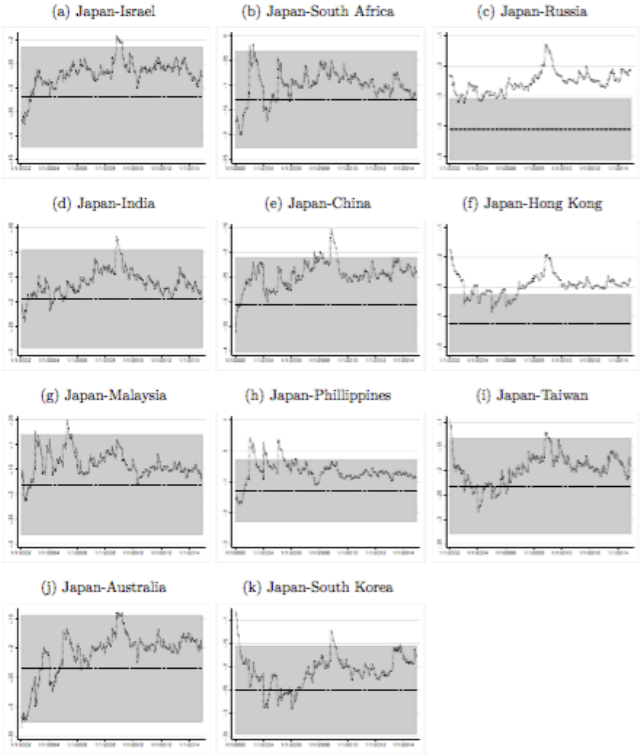


Note: The dash line depicts the value spread between the static correlations of the price-based and $CAPE^{I}_{7,t}$-based valuation measures, the shaded region corresponds to the 95% confidence interval of the static value spreads, and the dotted line corresponds to the dynamic value spreads S_t.

Value Spread Europe



Value Spread Asia



Note: The dash line depicts the value spread between the static correlations of the price-based and $CAPE^{I}_{7,t}$-based valuation measures, the shaded region corresponds to the 95% confidence interval of the static value spreads, and the dotted line corresponds to the dynamic value spreads S_t.

Future Work - Portfolio Optimization

- We use the covariances obtained at time (t-1) from Price Index and CAPE returns at time (t) from the DCC model, for asset allocation.
- We carry out our asset allocation on a weekly rebalancing portfolio across the sample.
- We further extend this work by looking into Market Volume data and Foreign Exchange rates to understand the movement of Hot Money.

Jackson Hole 2007

It does not appear possible to explain the boom in terms of fundamentals such as rents or construction costs. A psychological theory, that represents the boom as taking place of a feedback mechanism or social epidemic that encourages a view of housing as an important investment opportunity, fits the evidence better.

- Dr. Robert Shiller

Thank You

Questions