Normal Distribution of Returns of 65 Stock Exchange Indexes

Krzysztof Borowski

Discussant: Anmar Al Wakil,
University Paris-Dauphine, PSL Research University

IInd Econometric Research in Finance Conference (ERFIN)
Warsaw, September 15, 2017

Outline

Remarks

- **Straight-to-the-point and effective paper**
  I enjoyed reading this paper.
- **Topic of interest**: Questions the well-known returns normality assumption in the litterature.
  Investigates in particular time frequency.
- **Many empirical results**: 65 equity indexes, 5 time intervals (daily, weekly, monthly, quarterly, yearly), 4 settings (CC, OO, OC, OV), 4 statistical tests (Jarque-Bera, Shapiro-Wilk, D'Agostino-Pearson).
  Performed 5,200 statistical tests.

Outline

Motivation

Empirical Facts

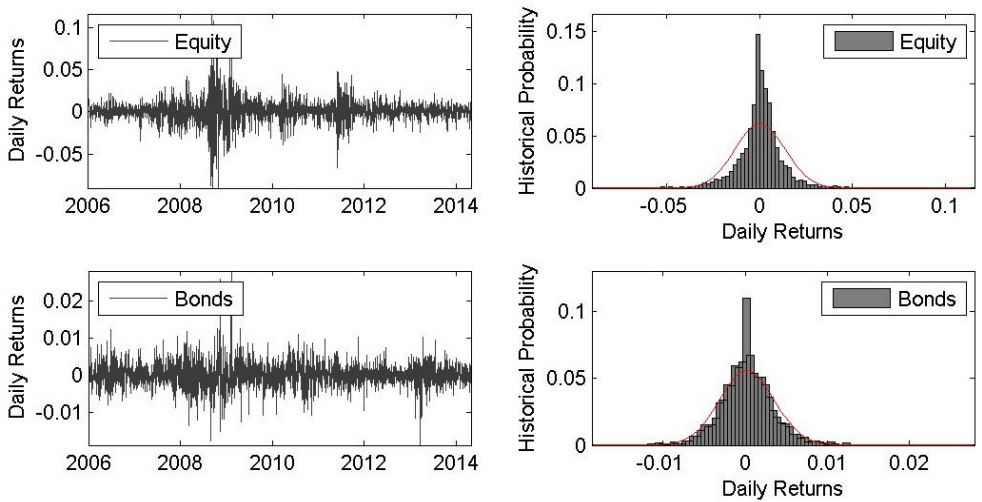

Figure 1: Returns (left panels) and returns distribution (right panels) respectively associated to the S&P 500 total return index and the Barclays Global Government Bond Index over the time period 2006-2014. The histograms compare the empirical returns distribution to the Gaussian distribution (in orange). Empirical distributions depart from the normal one, exhibiting **fat tails**, **peakedness**, and **asymetry**.

Motivation

Empirical Facts

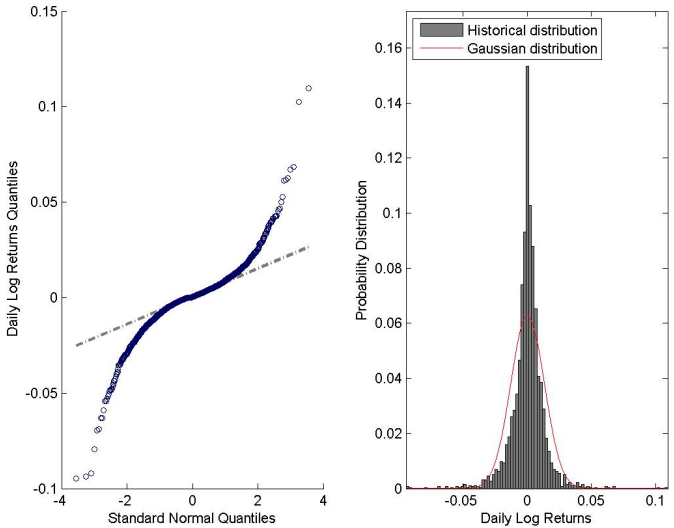

Figure 2: Returns (right panel) and returns Q-Q plot (left panel) associated to the S&P 500 total return index over the time period 2006-2014. The Q-Q plot compares empirical quantiles to standard normal quantiles, where straight line validates the normal assumption. Q-Q plot validates **non-normality**.

Motivation

Empirical Puzzle

This paper adresses a major empirical puzzle:

- **Returns non-normality is widely assumed:** Empirical returns distribution show **fat tails**, **peakedness**, and **asymetry**.
- **But high-frequency econometrics** comes up with a very different finding: this literature is recent and there are still many **grey areas** to explore.

This paper provides additional and complementary empirical results documenting this empirical puzzle.

Contributions

- **Kendall (1953), Fama (1976), Barunik et al. (2010):** Clearly evidenced equity index daily returns are non-normally distributed.
- **Ghahfarokhi et al. (2009), Barunik et al. (2010), Piasecki et al. (2013):** Showed however that over specific time intervals / periods, normal distribution can be statistically assumed.

Borowski (2017) provides **new and broad evidence** over a wide range of **time intervals** (from daily to yearly), **time settings** (CC, OO, CO, OV), and **statistical tests** (JB, SW, AP). I particularly appreciated the smart **stock index ranking** procedure.

Outline

Questions

Robustness Checks

(...) with a ***strong increase in volatility*** *on 19.08.2015, the value of p dropped below the trigger value of 0.05. Explaining the decrease in the value of parameter p below 0.05 for $K = 126$ and $K = 252$ sessions becomes more complex issue and requires further investigation.*

Economic interpretation behind: Extreme Events

You could control for **tail events** in your stock index ranking procedure. Intuitively, non-normality assumption should be widely rejected over extreme events, including Lehman Brothers bankruptcy, US sovereign debt crisis, EU Sovereign debt crisis, Flash Crash, Fed Tantrum, among others.

Questions

Complementary Studies

Existing literature about normality assumption is vast and have recourse to multiple complementary studies:

- Among others: Mandelbrot (1963), Danielsson et al. (2000), Thode (2002)

Additional studies:

You could provide: *i/* **summary statistics**, e.g. higher-order moments, parametric and historical VaR and CVaR; *ii/* **graphical exploratory analysis**, e.g. histograms, Quantile-Quantile (Q-Q) plots, mean excess plots and kernel density estimation (KDE) plots.

Questions

Implications

What could be the **implications**?

- For risk management: tail-related measures, non-normal risk measures at stake (e.g. VaR, CVaR, Sharpe ratio);
- For asset pricing theory: e.g. CAPM, Markowitz;

Additional studies:

You could derive an **application** to risk management or asset pricing from your stock index ranking procedure.

Thank you