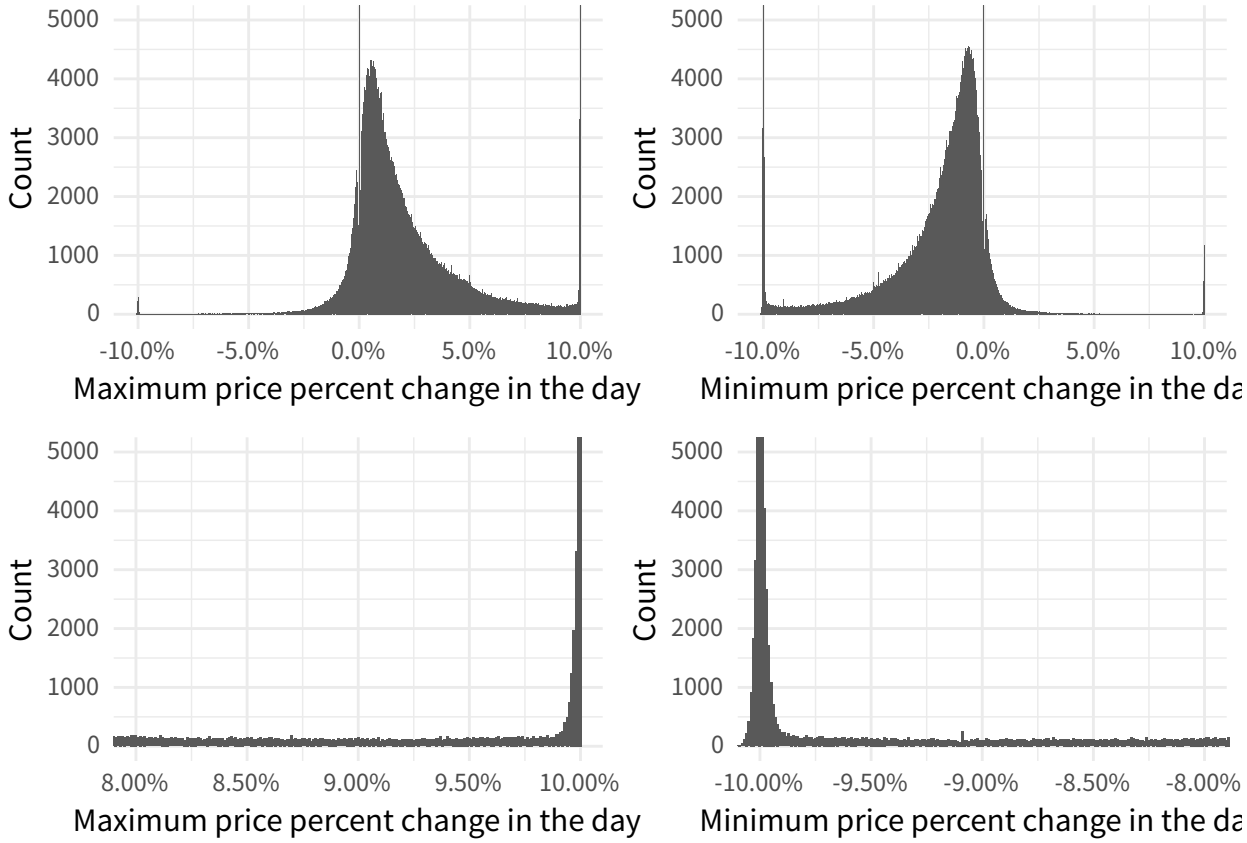
Contrived scale line as a collapsaro: evidence from China stock market's price limit rules

Background

In am ideal frictinoles stock market, stock price walks randomly. Actually, howerver, does any price really makes the same sense in terms of probability? For instance, a round number may impress people more than a none-round number, thus $100 other than $94.56 may makes a difference psychologically to a investor. The question comes that will this difference affect the price trend practically? In China's stock market, the two exchanges, Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE), restrict the daily absolute movement of a stock price to 10% of the previous trading day's closing price for most of their listed stocks, thus the upper and lower price limit equivalent to 10% and -10%[1] may make special to investors.

Distribution of maximum and minimum daily price percent change



Type	Obs. All	Obs. Reach 9%	Obs. Reach Limit	Prob. Reach 9%	Prob. Reach Limit	Con. Prob. Reach Limit
All	1,205,361	85,683	60,575	7.1%	5.0%	70.7%
Upper	1,205,361	42,722	29,678	3.5%	2.5%	69.5%
Lower	1,205,361	44,842	31,817	3.7%	2.6%	71.0%

[1] Actully because the minimum tick size for stocks is RMB one cent. Therefore, in cases where a 10% price change is not an integral number of cents, the daily price limit is rounded to the nearest cent.

Data and methodology

methodology

Stock price movement is commonly presumed to follow a geometric Brownian motion (GBM). Let S be the stock price at time t, it's disrete time form is

$$\frac{\Delta S}{S} = \mu \Delta t + \sigma \epsilon \sqrt{\Delta t}$$

or

$$\Delta S = \mu S \Delta t + \sigma S \epsilon \sqrt{\Delta t}$$

Variable ΔS is the stock price change after a short time period Δt. ϵ follows a starndart normal distribution, whose expectaion is 0 and variance is 1. Parameter μ is the expected return of the stock in unit time while parameter σ is the volatility rate of the stock, both of which are assumed to be constants. The equation indicates that $\Delta S/S$ follows a normal distribution whose expection is $\mu \Delta t$ and standard deviation is $\sigma\sqrt{\Delta t}$. That is

$$\frac{\Delta S}{S} \sim \phi(\mu \Delta t, \sigma^2 \Delta t)$$

When $t \to 0$, we get the continuous time form

$$\frac{dS}{S} = \mu dt + \sigma dz$$

or

$$dS = \mu S dt + \sigma S dz$$

where z is Brownian motion.

A MCMC approach

The Monte Carlo simulatin of a stochastic process is a precedure to cast repititive random sampling of the process. The simulation process involves two parameters μ and σ. We estimate the parameters with historical stock price data. We use a 120 day rolling window for estimating the parameters of the day. Then we cast MCMC simulation.

Diagram

Baseline results

REACH_LIMIT_mean	PROB_REACH_LIMIT_mean	diff	p.value
69.2%	66.8%	2.4%	0
69.7%	63.8%	5.9%	0

Robustness: daily v.s. intraday estimate

Hard-to-Value Firms

Investor Sentiment