Market Convexity and the Failure of Risk Control:
What Happened to China's Quant Hedge Funds

观澜 · 事前风控的失效：中性化真能中性化吗

The Failure of Ex Ante Risk Control:
Can Neutralisation Really Neutralised Risk Exposure?

PENG Langye 彭琅烨
3036154613
Incoming Quant Researcher
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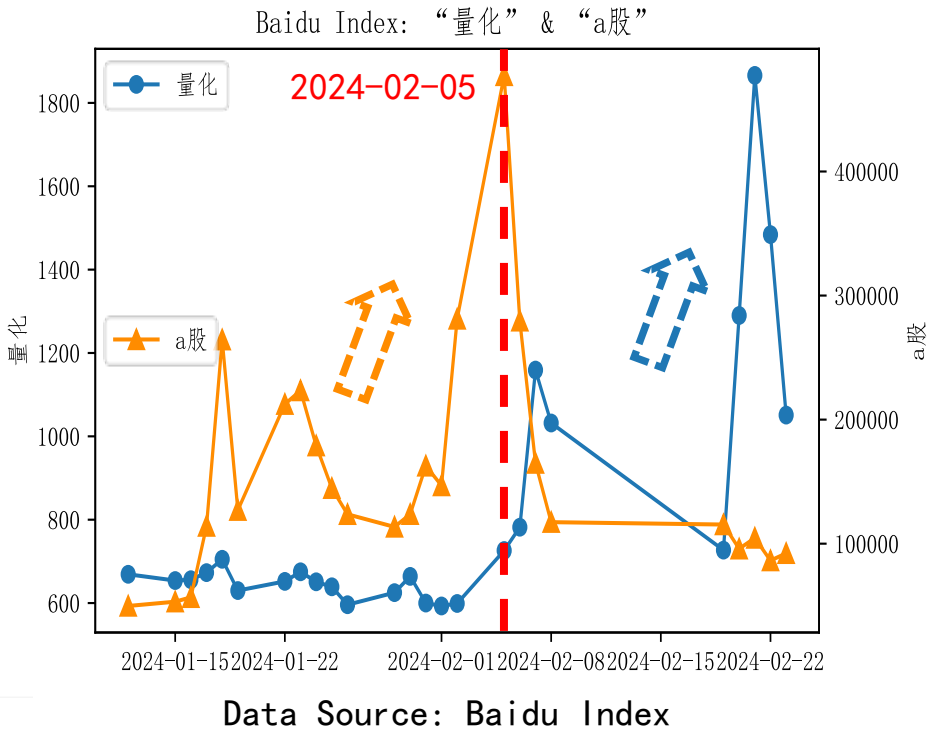
What Happened to China's Quant Hedge Funds

- Rumours flying and searches skyrocketing
- Misaligned search trend of "Quantitative" (量化) with the "A Share" (a股)

Crashes?

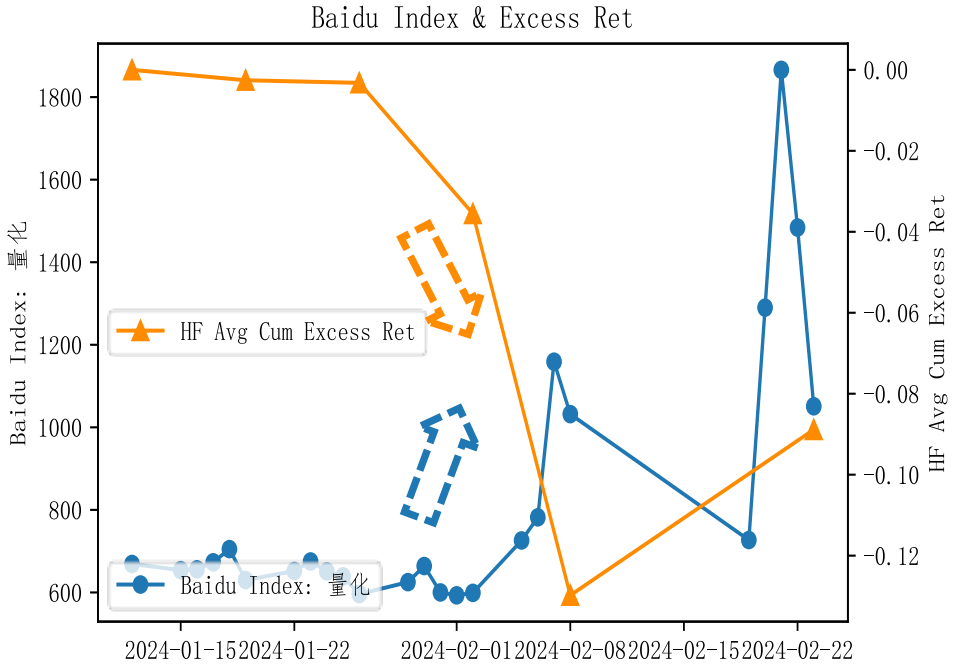


Data Source: Baidu Index

What Happened to China's Quant Hedge Funds

Some representative hedge funds and their excess returns

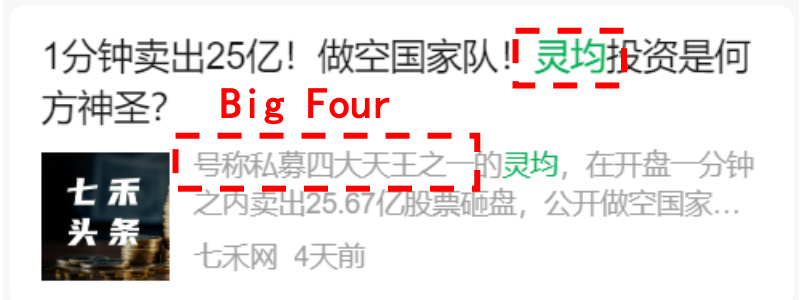
- Selection based on AUM and reputations
- Average cumulative excess return of CSI 500 Enhanced Fund
- CSI 500 Enhanced Fund is the most popular product among hedge funds



Data Sources: Baidu Index & PRIVATE ARRANGEMENT NET (私募排排网)

Representative Hedge Funds

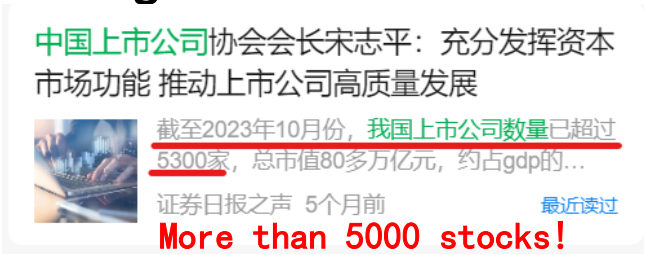
代表性量化私募综合规模和关注度等因素选择，详细清单（拼音顺序）为：白鹭、诚奇、黑翼、幻方、九坤、聚宽、量锐、灵均、茂源、明汰、鸣石、念空、启林、前沿、锐天、思勰、天演、稳博、信弘、衍复、因诺和卓识。仅考虑这些代表性样本私募的中证500指数增强产品。



What's Happening in the Market

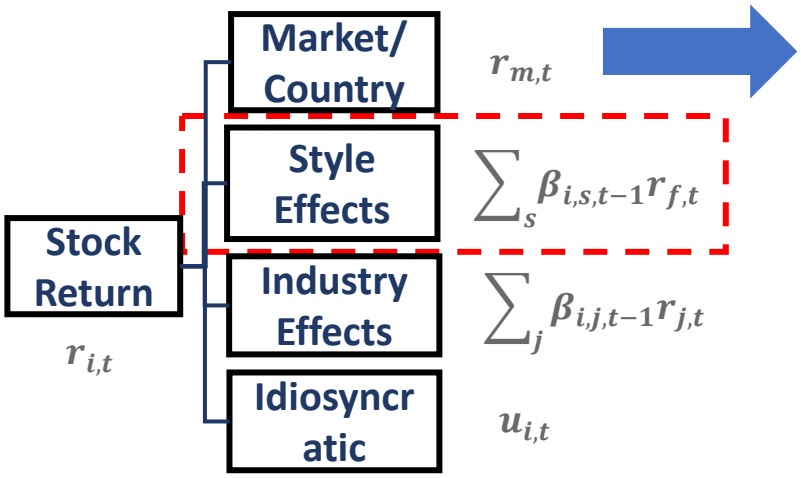
A Factor Return Perspective

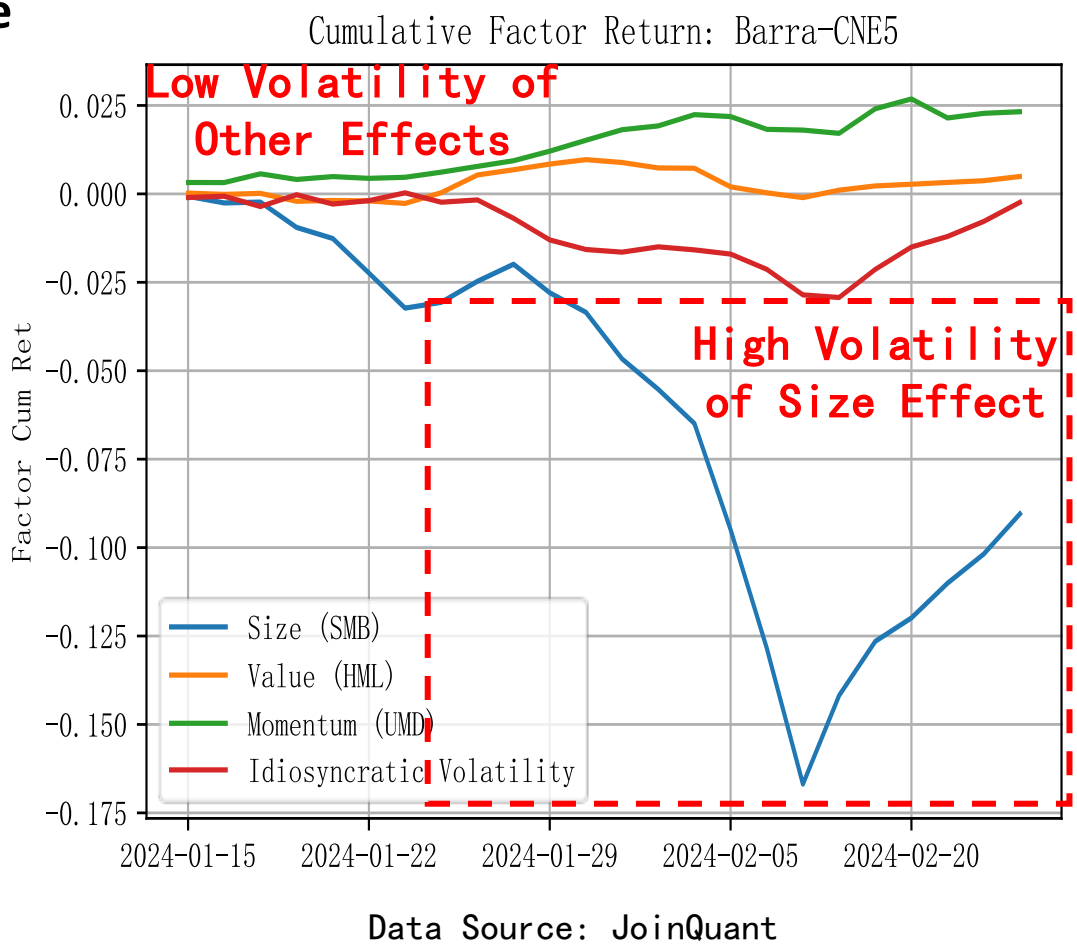
Too Large Cross-Section to Analyze



MSCI

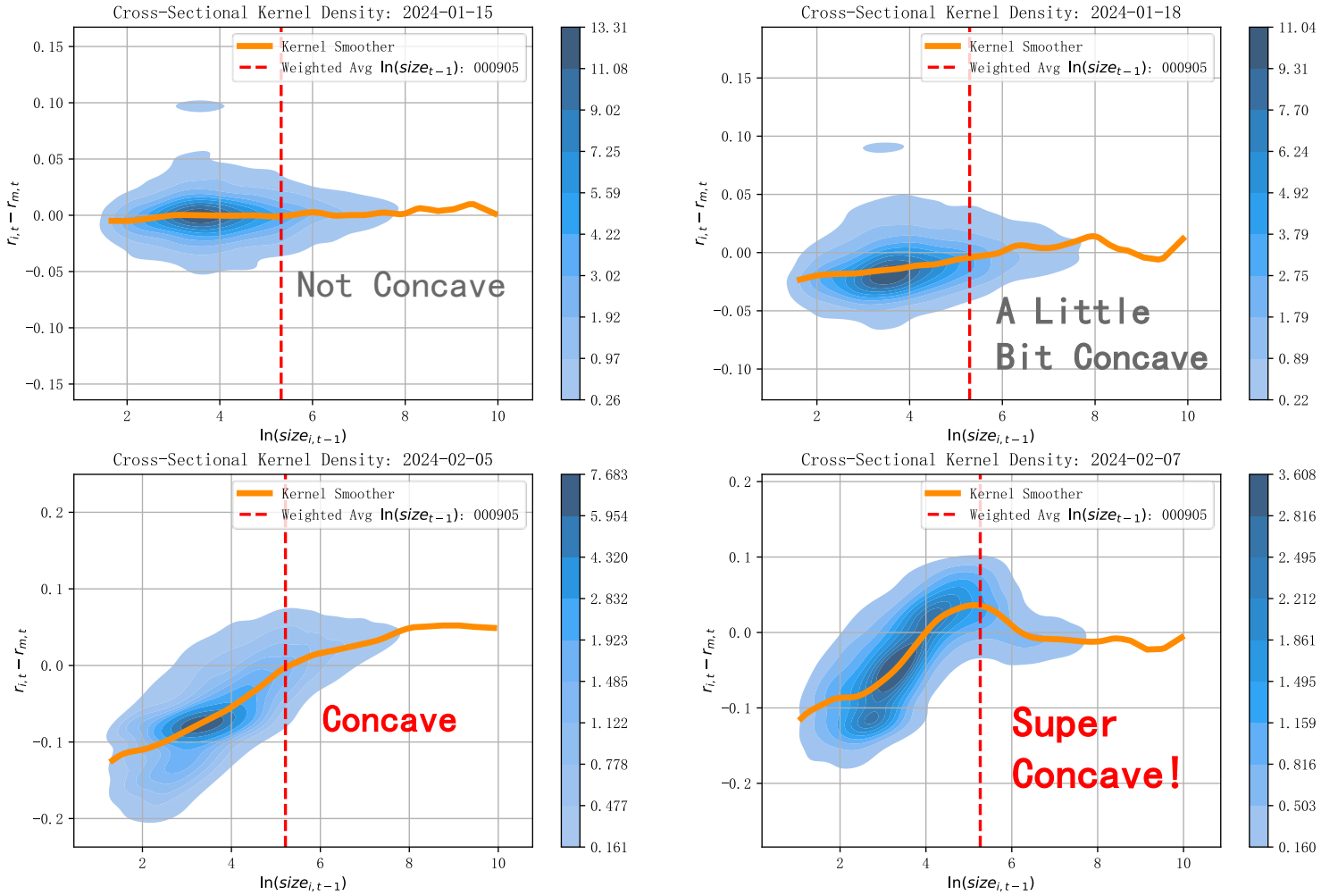
Barra CNE5 Factor Model





What's Happening in the Market

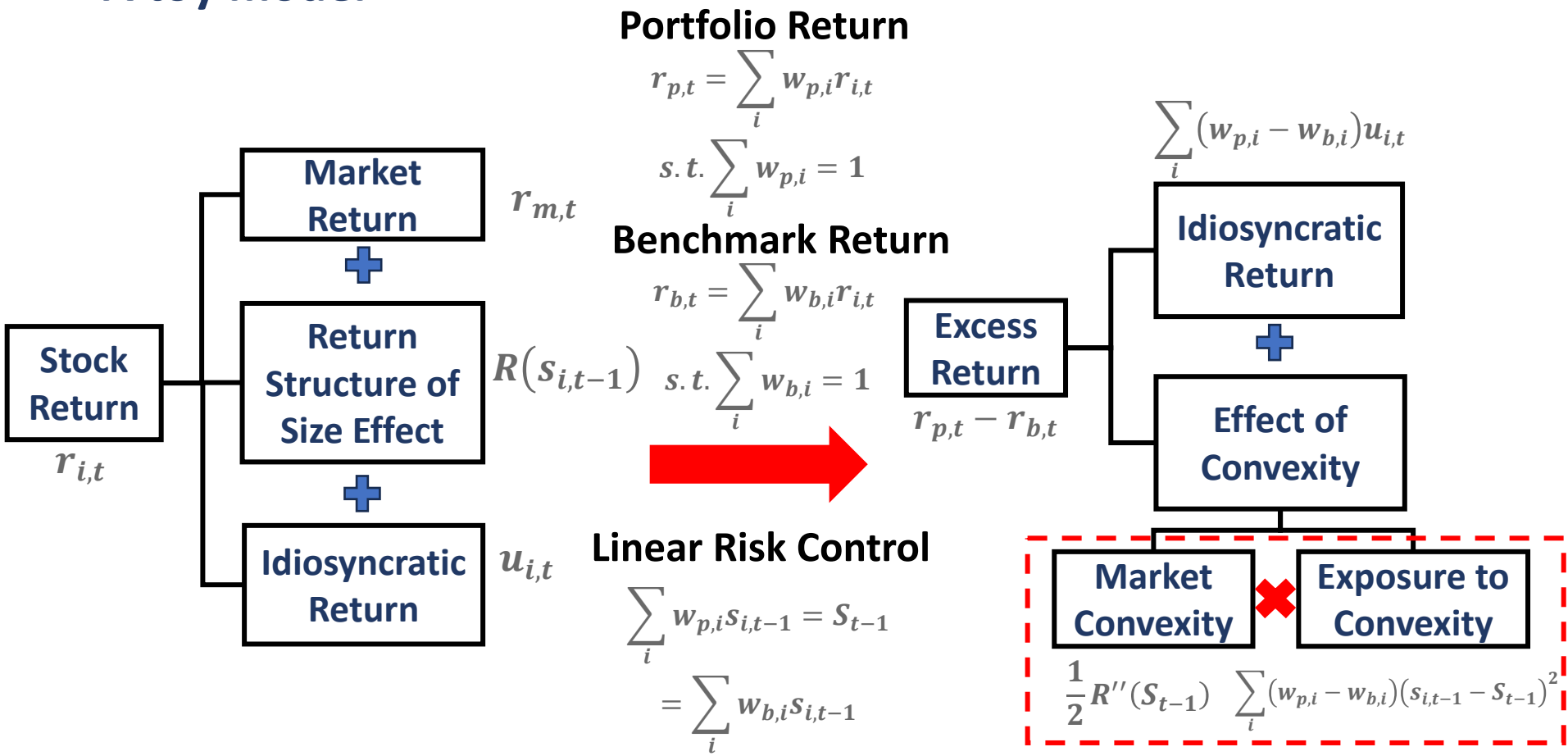
Evolutions in market convexity



Data Source: JoinQuant

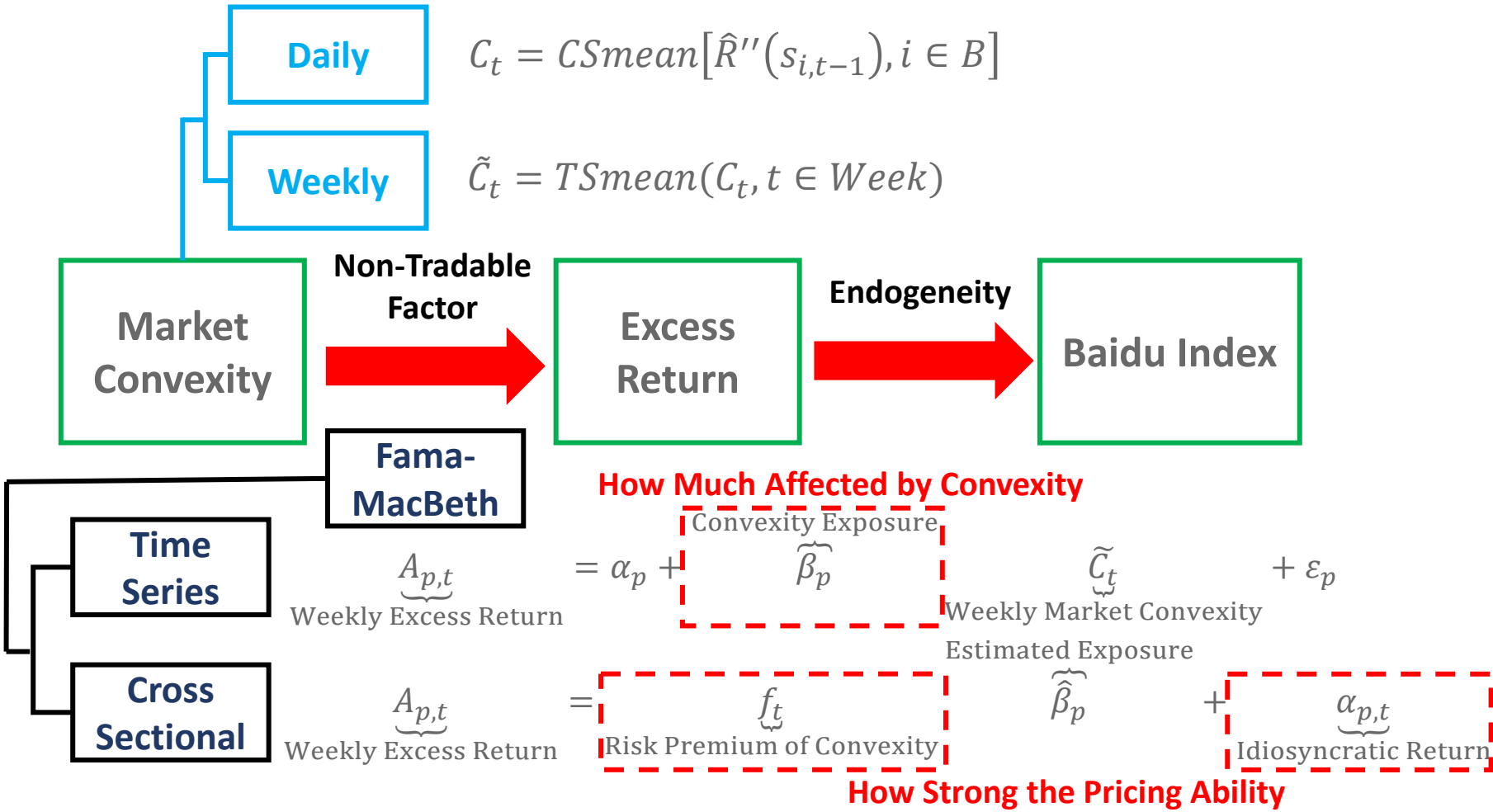
Effect of Market Convexity on Hedge Funds: Model

A toy model



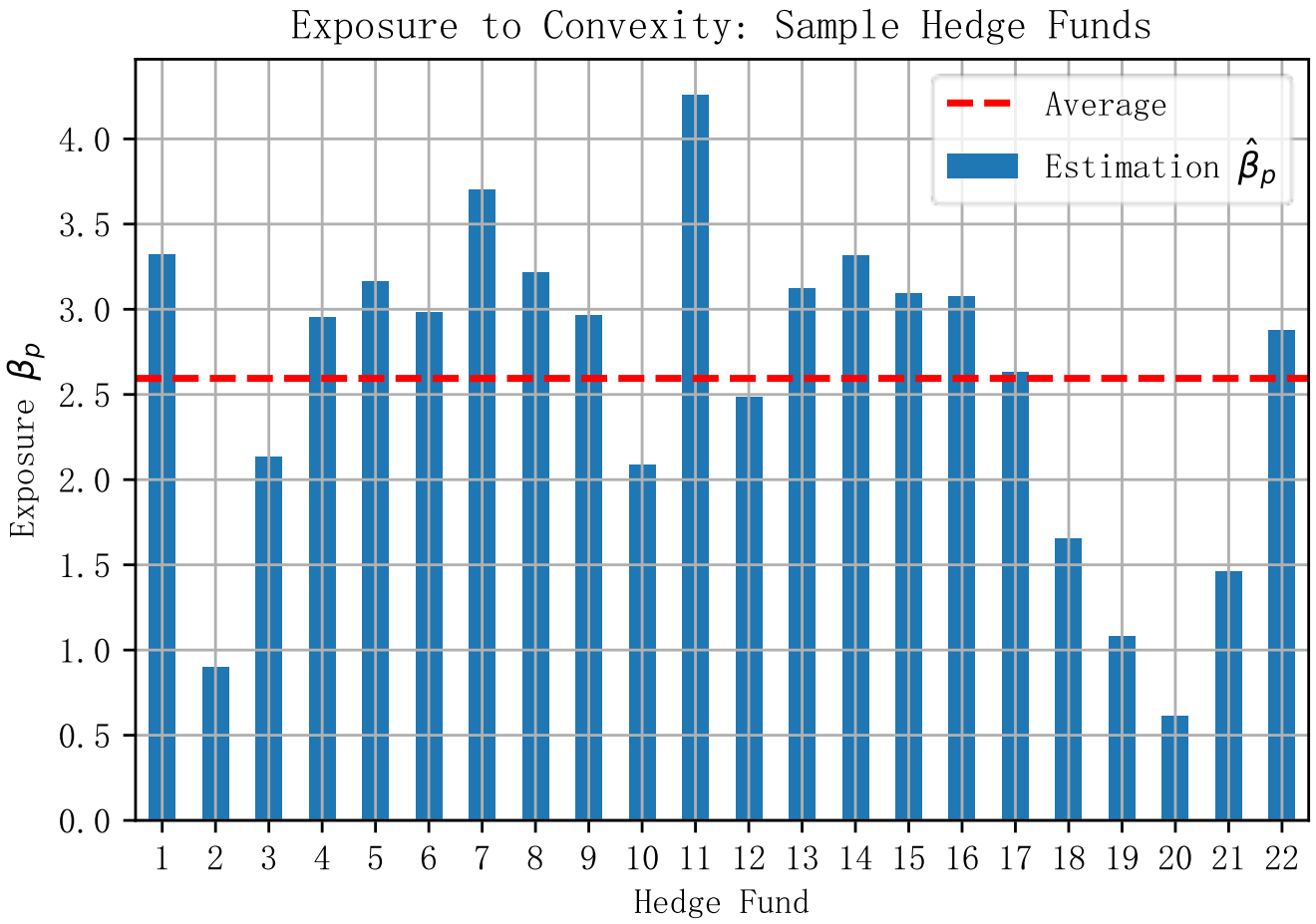
Effect of Market Convexity on Hedge Funds: Identification

Identification framework



Effect of Market Convexity on Hedge Funds: Results

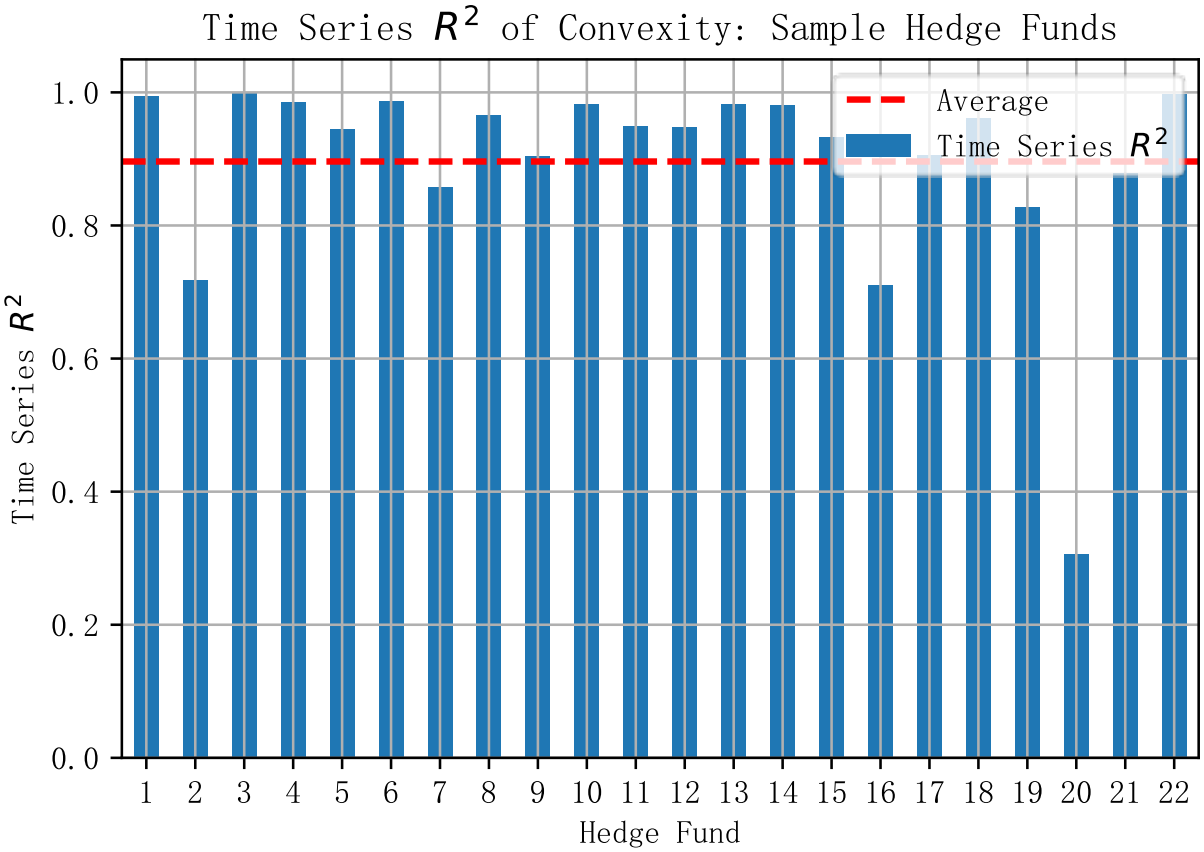
- **Almost all of these hedge funds have large exposure to convexity**



Effect of Market Convexity on Hedge Funds: Results

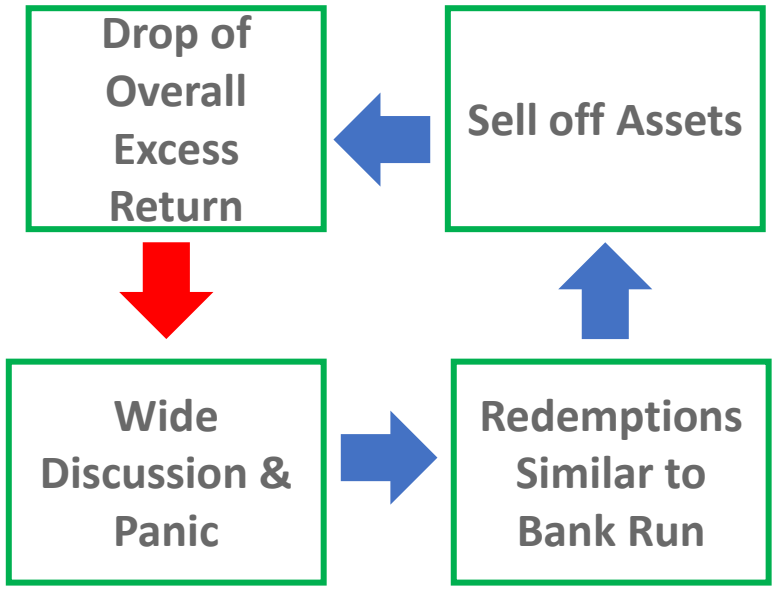
Explaining the time-series variance very well

- Use results of the second step to calculate time-series $R_p^2 = 1 - \frac{\mathbb{E}_t \hat{\alpha}_{p,t}^2}{Var_t(A_{p,t})}$

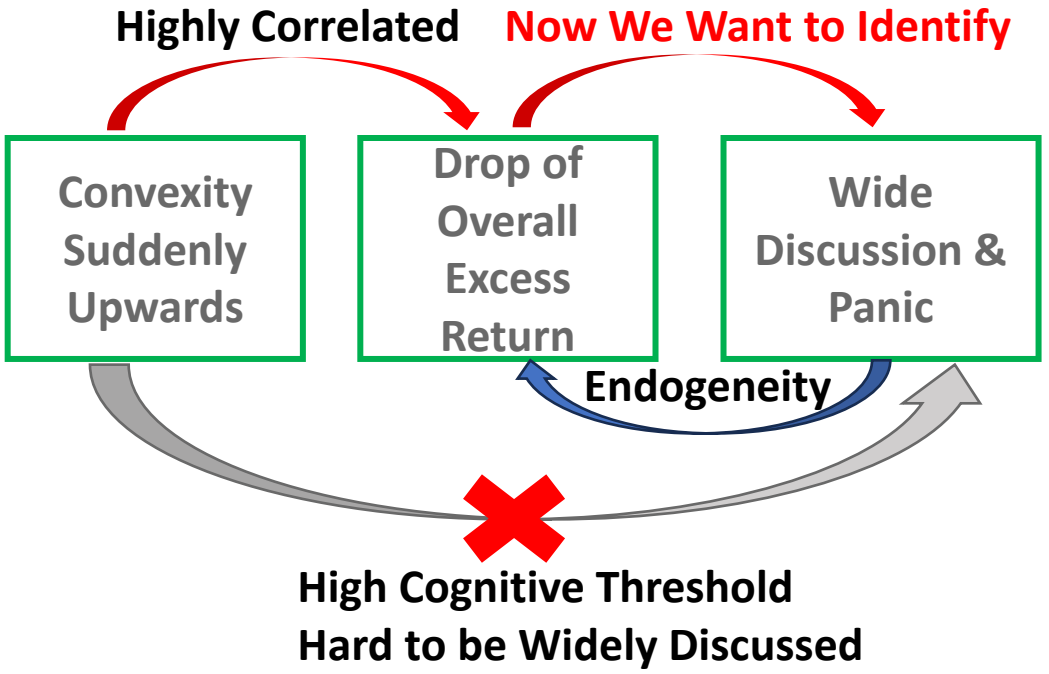


Effect of Convexity from a Perspective of Communication

- **How much does excess return brought by convexity affect the Baidu Index**
  - How to identify? Directly regress?
- **Endogeneity**



Convexity as an instrument variable

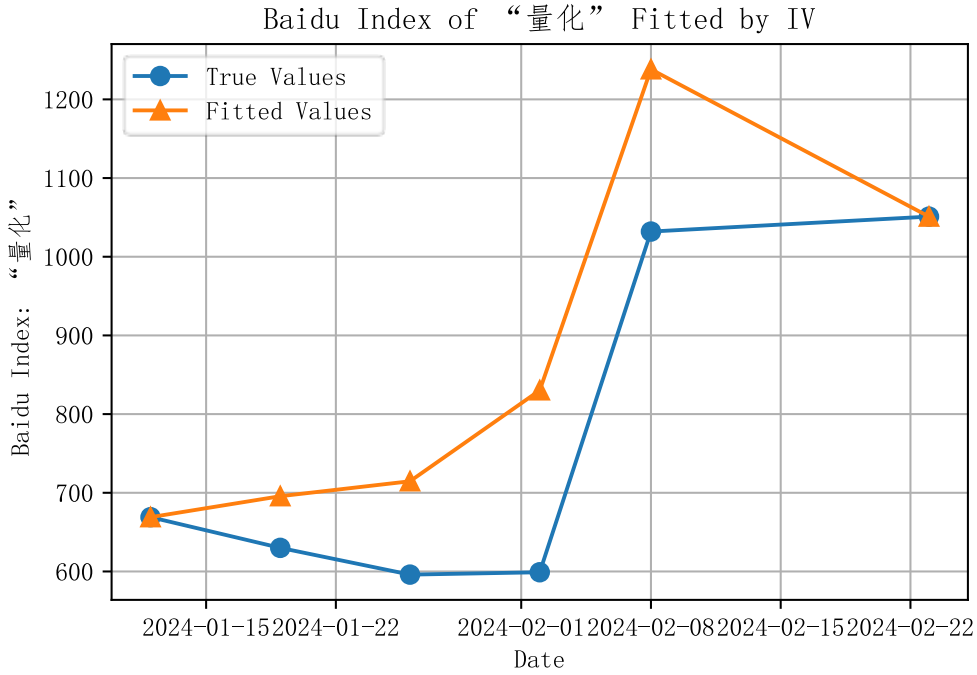


Effect of Convexity from a Perspective of Communication

Time-Series Regression

$$\underbrace{\Delta \ln I_t}_{\text{Weekly Log Changes}} = \alpha + \beta \underbrace{\hat{\bar{A}}_t}_{\text{Weekly Overall Excess Return}} + \varepsilon_t$$

- $\hat{\bar{A}}_t$ is cross-sectional mean of $\hat{A}_{p,t}$ in the cross-sectional regression
- Transform $\widehat{\Delta \ln I_t}$ to $\hat{I}_t$ by using I_t of 2024-01-12



Reference

- Orr, D. J., I. Mashtaler, and A. Nagy (2012). The Barra China Equity Model (CNE5) Empirical Notes. MSCI. https://www.msci.com/www/research-report/the-barra-china-equity-model/014459336
- The Failure of Ex Ante Risk Control: Can Neutralisation Really Neutralised Risk Exposure? https://mp.weixin.qq.com/s/wCoS_PsybBNcKBbGPn-GaA

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Appendix

Calculation of Convexity

- Sort CSI 500 Index Constituents List B by MV $s_{i,t-1}$ in ascending order
- Calculate the first-order derivative $D_{i,t}$, where $\hat{R}$ is the Return Structure of MV estimated by the kernel function smoothing

$$D_{i,t} = \frac{\hat{R}\left(s_{i+1,t-1}\right) - \hat{R}\left(s_{i-1,t-1}\right)}{s_{i+1,t-1} - s_{i-1,t-1}}$$

- Calculate the second-order derivative $C_{i,t}$

$$C_{i,t} = \frac{D\left(s_{i+1,t-1}\right) - D\left(s_{i-1,t-1}\right)}{s_{i+1,t-1} - s_{i-1,t-1}}$$

- The equal-weighted mean of $R''\left(s_{i,t-1}\right)$ in a certain region is regarded as the convexity of the return structure in this region

$$C_t = \frac{1}{|B| - 4}\sum_{i \in B} C_{i,t}$$