Reproduce: BLITZ ET AL.(2011), Residual Momentum

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1. Data

- 1/1/2000~6/16/2022
- ALL stocks listed on China mainland exchanges
- Monthly
- Four financial indicators: market value, book-to-market ratio, cash investment, operating profit
- close price, CSI300, one-year deposit rate (risk free rate)

2. Grouping

- Get top 10% and bottom 10% stocks every time t in Four financial indicators

e.g. SMB_stocks

2000-01	[[600837.SH, 000014.SZ, 600647.SH, 600137.SH, ...
2000-02	[[600647.SH, 600137.SH, 000014.SZ, 600792.SH, ...
2000-03	[[600837.SH, 600647.SH, 000014.SZ, 600137.SH, ...
2000-04	[[600837.SH, 600647.SH, 000014.SZ, 600137.SH, ...
...	...
2022-03	[[833580.BJ, 834765.BJ, 835508.BJ, 836149.BJ, ...
2022-04	[[835508.BJ, 600091.SH, 833580.BJ, 836149.BJ, ...
2022-05	[[002473.SZ, 600890.SH, 300178.SZ, 600275.SH, ...
2022-06	[[600146.SH, 300312.SZ, 000502.SZ, 002473.SZ, ...

Freq: M, Length: 270, dtype: object

- Average the return of the above stocks
- e.g. SMB is the time sequence of **bottom** 10% market value stocks' average return minus the **top** 10% market value stocks' average return for every time *t*

2000-02	-0.05403614
2000-03	0.090668005
2000-04	-0.05634509
...	...
2022-03	0.007942155
2022-04	-0.14957674
2022-05	-0.00597387

Freq: M, Length: 270, dtype: float64

- e.g. HML is the **top** bm stocks' average return minus the **bottom** bm stocks' average

3. Residual Momentum

- For every stock i
- y is the stock return time sequence (per column)

	000001.SZ	000002.SZ	000004.SZ	...	873169.BJ	873223.BJ
2000-01	NaN	NaN	NaN	...	NaN	NaN
2000-02	-0.01	0.406	0.011	...	NaN	NaN
2000-03	0.003	-0.144	0.184	...	NaN	NaN
2000-04	0.038	-0.017	-0.043	...	NaN	NaN
...	...	...	...	...	...	...
2022-02	-0.005	-0.056	0.034	...	0	0
2022-03	-0.023	-0.003	-0.072	...	0	0
2022-04	-0.004	0.012	-0.371	...	-0.422	0
2022-05	-0.076	-0.081	-0.232	...	0.014	0
2022-06	0.02	0.021	-0.037	...	-0.003	-0.579

270 rows × 4829 columns

- X is the $constant, r\_m, SMB, HML, CMA, RMW$ time matrix

	const	r_m	SMB	HML	CMA	RMW
2002-02	1	0.019	0.042	-0.069	0.041	-0.032
2002-03	1	0.055	0.029	-0.039	0.059	-0.06
2002-04	1	0.03	0.037	-0.044	0.06	-0.024
2002-05	1	-0.085	-0.011	-0.058	0.017	-0.023
...	...	...	...	...	...	...
2021-11	1	-0.016	0.068	-0.129	0.108	-0.098
2021-12	1	0.022	0.015	0.079	0.011	-0.032
2022-01	1	-0.076	0.021	0.055	0.003	0.003
2022-02	1	0.004	-0.024	-0.03	0.018	0.035
2022-03	1	-0.078	0.008	0.026	0.05	-0.02

242 rows × 6 columns

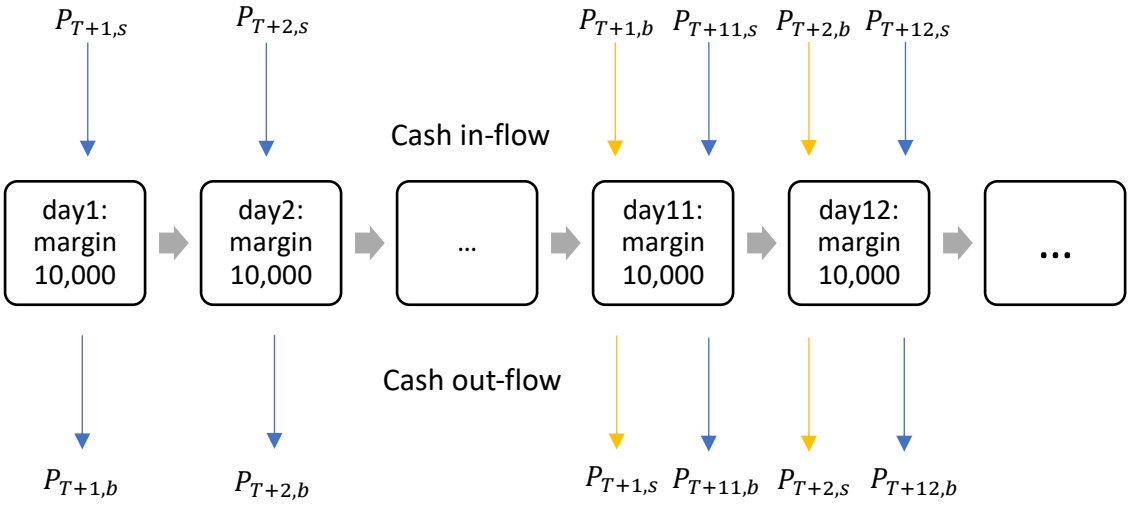
- Run the fit 4829 times
- Record the ε time sequence for every stock i and rolling sum it by 12 month as Residual Momentum

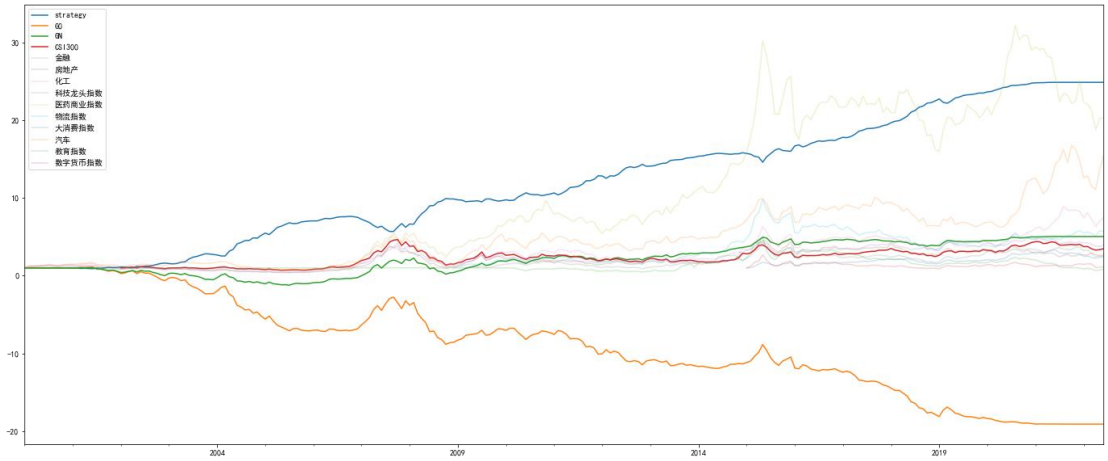
	000001.SZ	000002.SZ	000004.SZ	...	873169.BJ	873223.BJ
2003-01	0.152	-0.211	-0.385	...	NaN	NaN
2003-02	0.156	-0.207	-0.344	...	NaN	NaN
2003-03	0.143	-0.062	-0.166	...	NaN	NaN
2003-04	0.118	-0.002	0.09	...	NaN	NaN
...	...	...	...	...	...	...
2021-11	0.036	-0.434	-0.278	...	NaN	NaN
2021-12	0.01	-0.26	-0.068	...	NaN	NaN
2022-01	-0.127	-0.123	0.04	...	NaN	NaN
2022-02	-0.064	-0.386	0.184	...	NaN	NaN
2022-03	-0.098	-0.289	0.252	...	NaN	NaN

231 rows × 4829 columns

4. Back Test

- Trading fraction: 2‰
- ε matrix as factor matrix
- 10 groups
- Risk-free rate assumed as p.a. 2%
- Short sell G_0, buy and hold G_N
- Redeem G_0 after 10 days, sell G_N after 10days
- No leverage
- Initial endowment: 100,000





daily sharpe ratio	daily treynor ratio	β	daily α	25 window MDD	win rate	calmar ratio	5% VaR	5% ES	compounded yearly return	daily std	CSI300 earning multiple	CSI300 daily volatility multiple
0.33	-0.048	-0.264	0.016	-34.36%	82.59%	0.918	3462.605	4913.411	19.804	7.726	9.63	7.565

5. Deficiencies and Prospects

Deficiencies:

- This work is a duplicate of *BLITZ ET AL.(2011): Residual Momentum*, I implemented methods in this paper with Fama French 5 Factor Model and China mainland data. 11 years later, it's classical but old.

The profit in this arbitrage strategy is mainly from short-selling, but short-selling in China mainland is restricted.

I did not perform ablation study for better arbitrage strategy parameters.

Prospects:

BLITZ ET AL.(2011): Residual Momentum inspired the idea of residual momentum. But that's not the point, residual is an inspiration, we should try every possible momentum factors.

Take an example, *CHAVES (2012): Eureka! A Momentum Strategy that Also Works in Japan*, author(s) used idiosyncratic volatility to construct momentum FOR THE FIRST TIME, and succeeded in a market (Japan) where most momentum strategy researches failed before.

Innovation and trials are the real useful things.

6. Acknowledgements

Thanks for Mr. CHEN, Rui's guidance.

I am a quant (Intern). I have a good coding skills and good network, but I ran out of ideas recently (June). I find that ideas, mathematics and data availability are limiting my career.

Literature index gave me great inspiration. After the study of asset pricing class this semester, I find that reading literature with a SORTED index and following up it really enrich my investment ideas.

In addition to reproducing the Residual Momentum in this project (individually), the team I led reproduced *GU, KELLY, AND XIU(2020) Empirical Asset Pricing via Machine Learning* in machine learning class (another course this semester, in charge of Mr. ZHANG, Ning). The literature index really helped me.

The 5 pages of momentum factor literature' PDF are attached in the "Papers" folder or you can access it on my website http://dacian.cc:8/files/Asset%20Pricing%20Papers/

I also started to use EndNote for reading literature. This is a good software, but the "reference list" can only be shared to some specific e-mails, no way to make it public. If Mr. CHEN or class assistant requires, I am more than happy to share this reference list.

Thanks for Mr. CHEN's guidance again.

7. Notes

I skipped NA processing nor data aligning procedures in this document, you can check codes to know how I handle these situations.

The Back Test codes are developed by me during my quant intern (03/2022) this semester, other codes are developed now and here.