Data Analysis

About the Tests

Project (30% of module assessment)

- Use what you learn in this module to extract information from data

1

Advice on Tests 2 & 3

- **Don't be alarmed to see hard questions**
  - Some questions are designed to be hard. They are designed to distinguish between the good and the excellent students.
- **Don't be surprised to see easy questions**
  - Some questions are designed to test your basic understanding of the module. They are designed to distinguish between pass and failure.
- **Read the words carefully**
  - Some answers are only partially correct; they may score some marks but not the full mark.
- **Time management**
  - Given that there are hard questions, Tests 2 & 3 will be time-demanding than Test 1. The more familiar you are with the material, the easier you can manage your time.

2

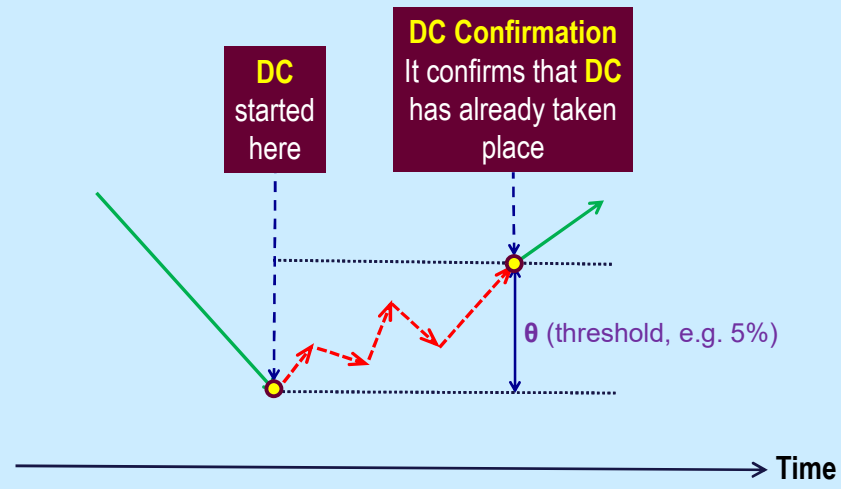
The Story So Far…

To beat your competitors, find opportunities before others

Innovation is the key!

3

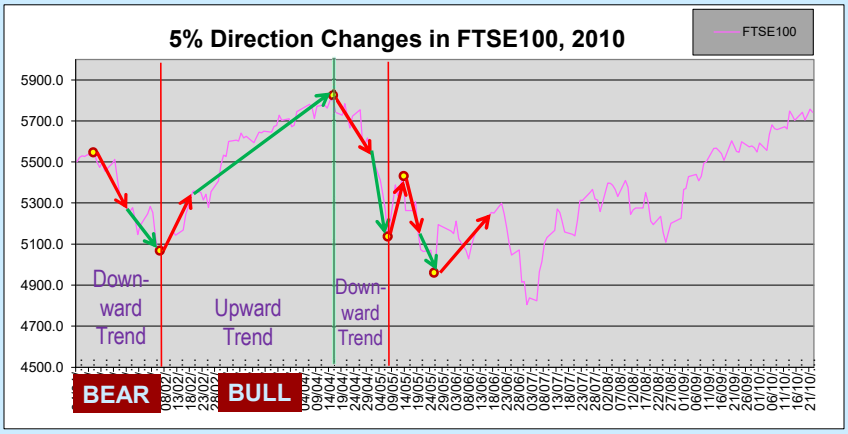
Directional Change (DC)



4

DC-based Summary

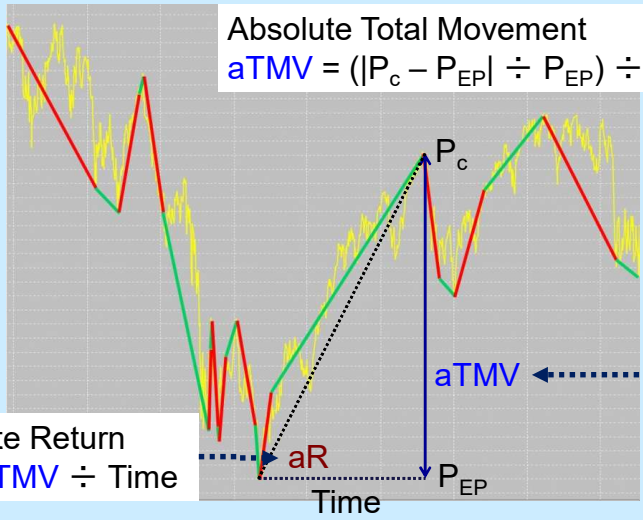
Threshold (%) Directional Changes Overshoots



See video for more information http://www.youtube.com/watch?v=mbSbUKpWOno

5

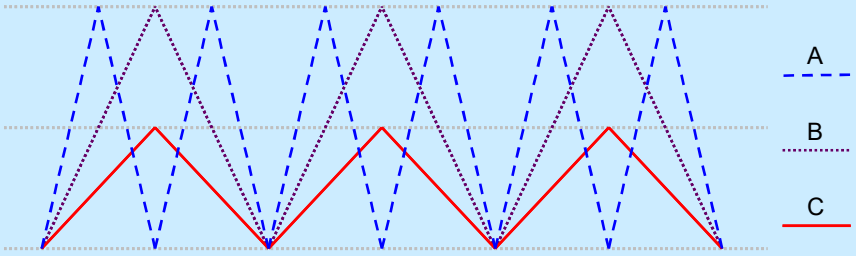
Indicators in DC



6

Measuring Volatility in DC

- How to measure volatility in DC?



Bigger overshoot → higher volatility

Higher frequency in trend changes → higher volatility

What else can we say about a DC summary?

7

Project

- Given: Stock indices around the world
- Your task: Assess their returns and risks
- How do you measure risks?
- How do indices compare with each other?
- What alternative measures are available?
- How do difference measures compare?
- Which markets would you recommend to trade in?

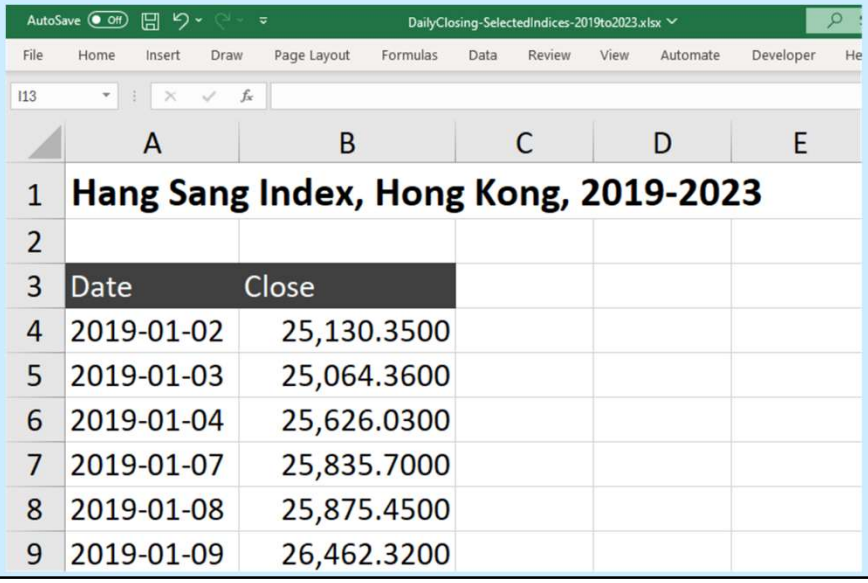
8

Selected Indices

Index	Markets
AEX23	The Netherlands
ASX200	Australia
BSE30	Indian SENSEX
CAC40	France
CHINAA50	China
DAX30	Germany
DJI	US Dow Jones
EuroStoxx	Euro Zone
FTSE100	UK
HIS	HK Hang Seng
IBEX35	Spain
JP225	Japan
NASDAQ100	US Nasdaq
S&P500	US S&P 500
SMI20	Swiss
STI	Singapore

9

Daily Closing Prices,16 Indices



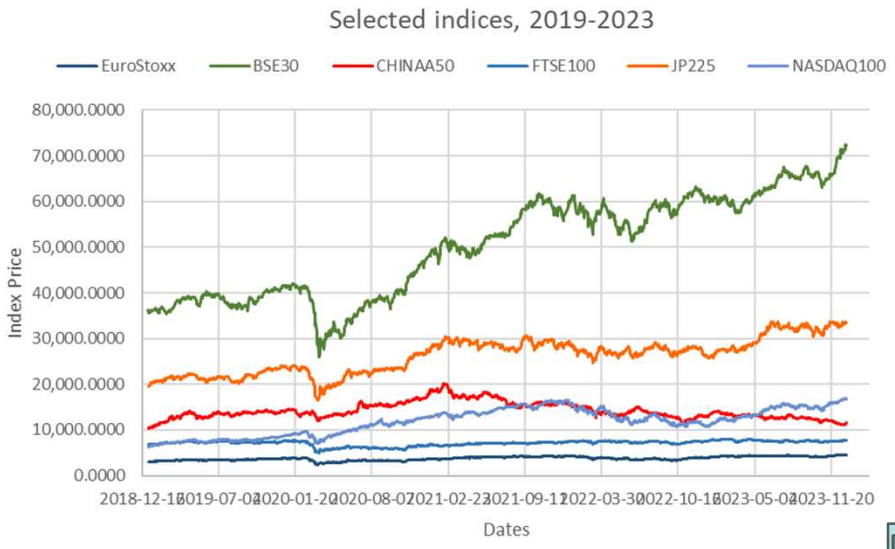
10

What to do

- Descriptive statistics may reveal useful information
- Deeper research → more useful information
- What can you find?
- Can you convince your boss to give you a team to conduct your research?

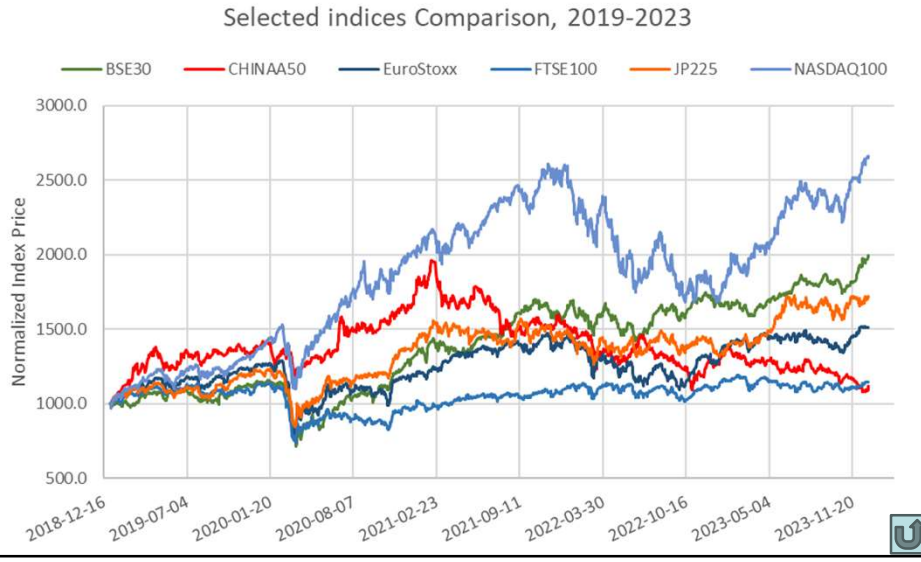
11

Selected Indices 2019-23



12

Indices Normalized 2019-2023



13

Measuring Volatility in Time Series

14

Return and Risk in Time Series

- Given time series (p_{t-n+1}, …, p_{t-2}, p_{t-1}, p_t)
- Return of the period:

$$\mathbf{R} = (p_t - p_{t-n+1}) \div p_{t-n+1}$$

- Return is calculated for each interval

$$r_t = (p_t - p_{t-1}) \div p_{t-1}$$

$$(r_{t-n+2}, \ldots, r_{t-2}, r_{t-1}, r_t)$$

- Risk: standard deviation of returns

$$\sigma = \text{stdev.p}(r_{t-n+2}, \ldots, r_{t-2}, r_{t-1}, r_t)$$

15

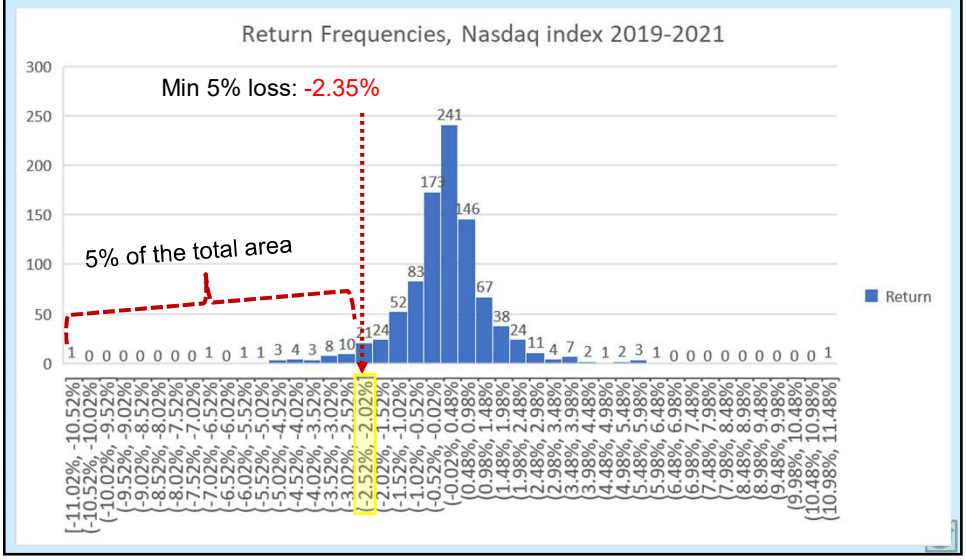
TS σ vs Return, 2019-21

2023

CVaR

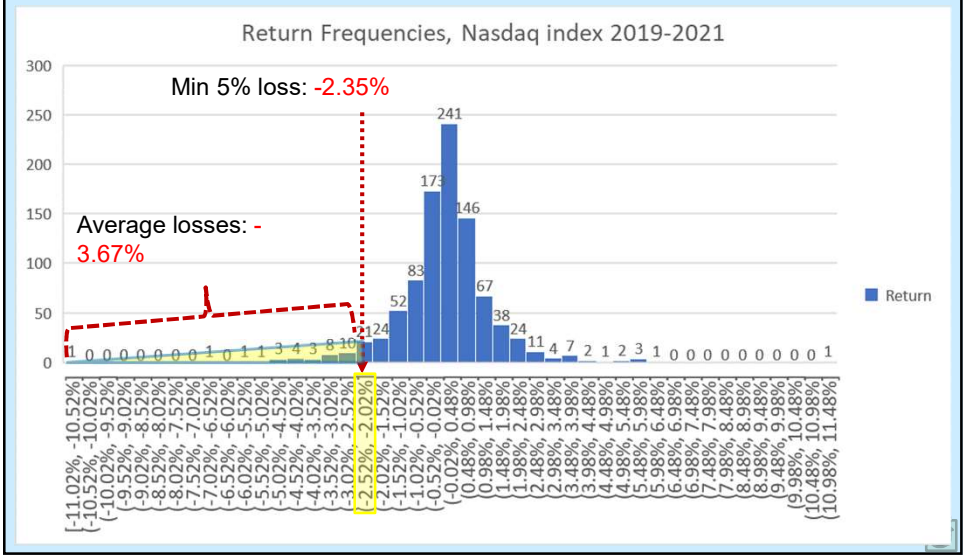
17

Historical Value at Risk (VaR)

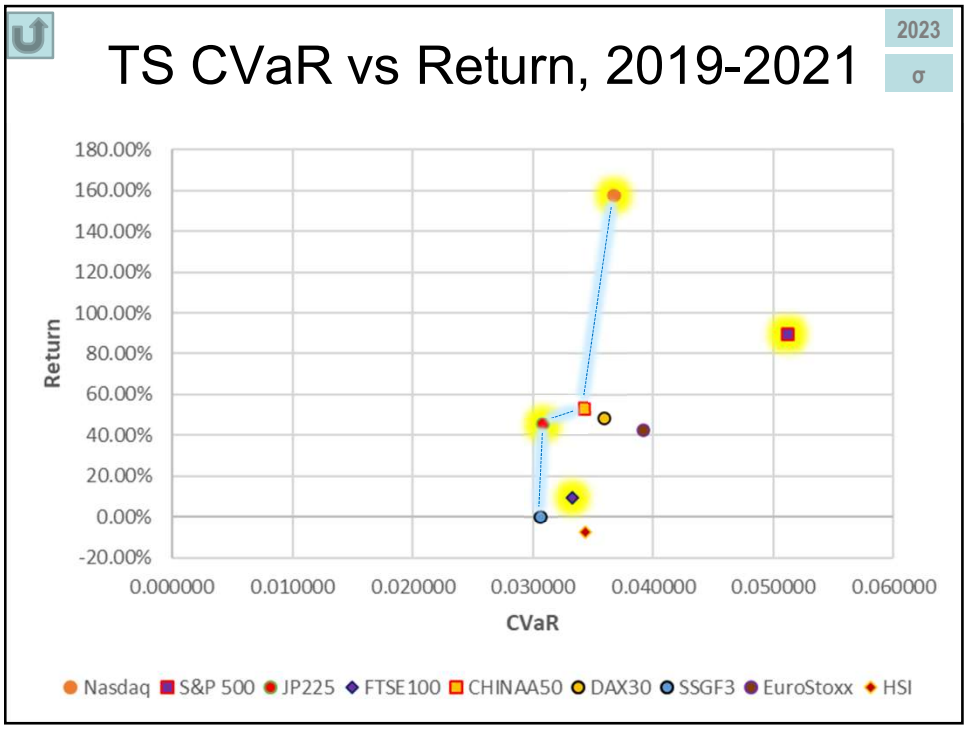


18

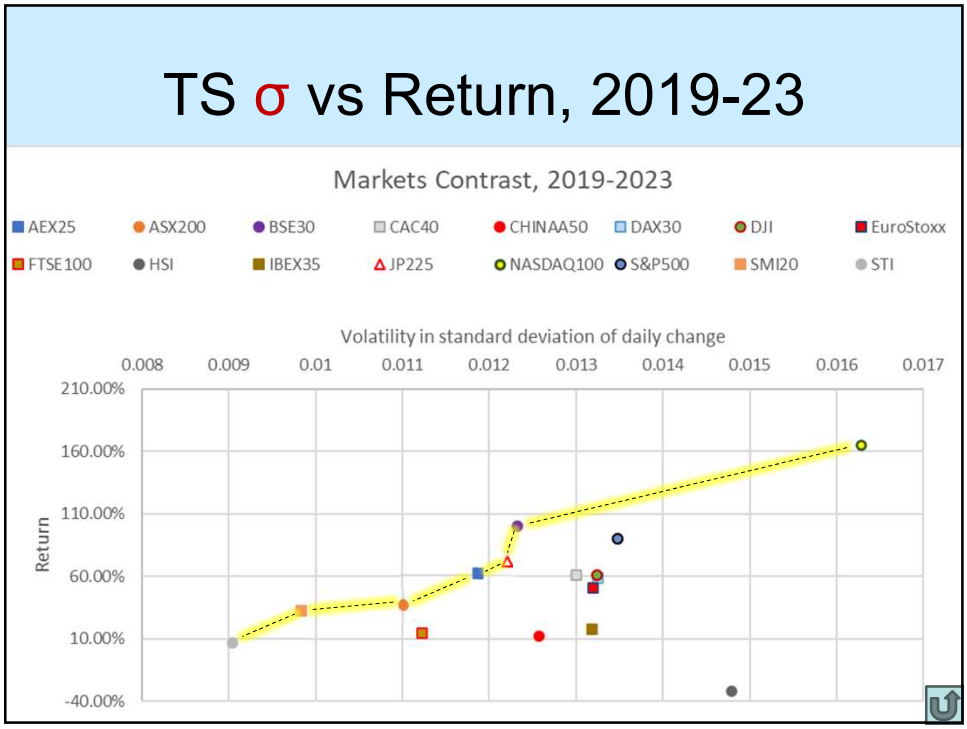
Conditional VaR (Expected Shortfall)



19

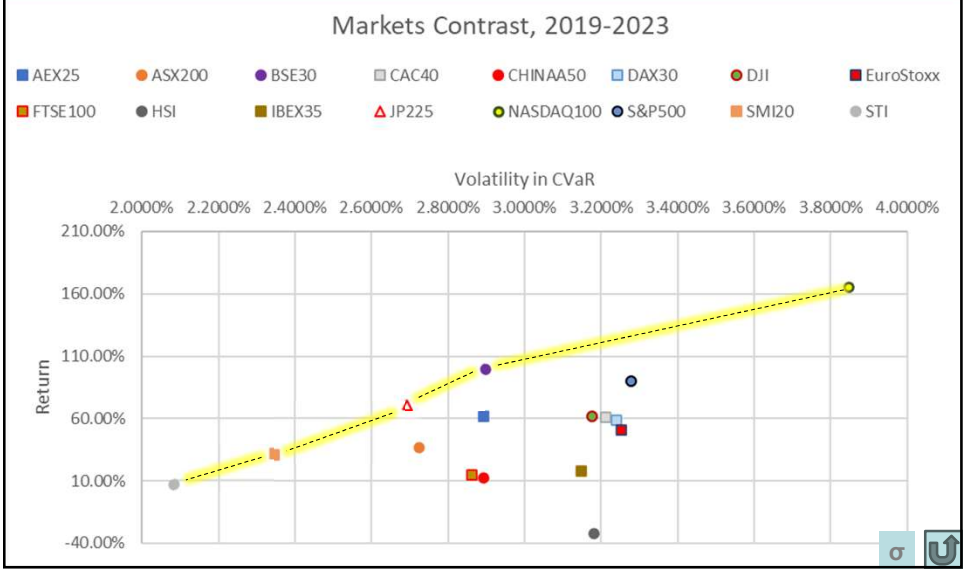

TS CVaR vs Return, 2019-2021
2023
σ
180.00%
160.00%
140.00%
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
-20.00%
Return
0.000000
0.010000
0.020000
0.030000
0.040000
0.050000
0.060000
CVaR
Nasdaq
S&P 500
JP225
FTSE100
CHINAA50
DAX30
SSGF3
EuroStoxx
HSI

20


TS σ vs Return, 2019-23
Markets Contrast, 2019-2023
AEX25
ASX200
BSE30
CAC40
CHINAA50
DAX30
DJI
EuroStoxx
FTSE100
HSI
IBEX35
JP225
NASDAQ100
S&P500
SMI20
STI
Volatility in standard deviation of daily change
0.008
0.009
0.01
0.011
0.012
0.013
0.014
0.015
0.016
0.017
210.00%
160.00%
110.00%
60.00%
10.00%
-40.00%
Return

22

TS CVaR vs Return, 2019-23

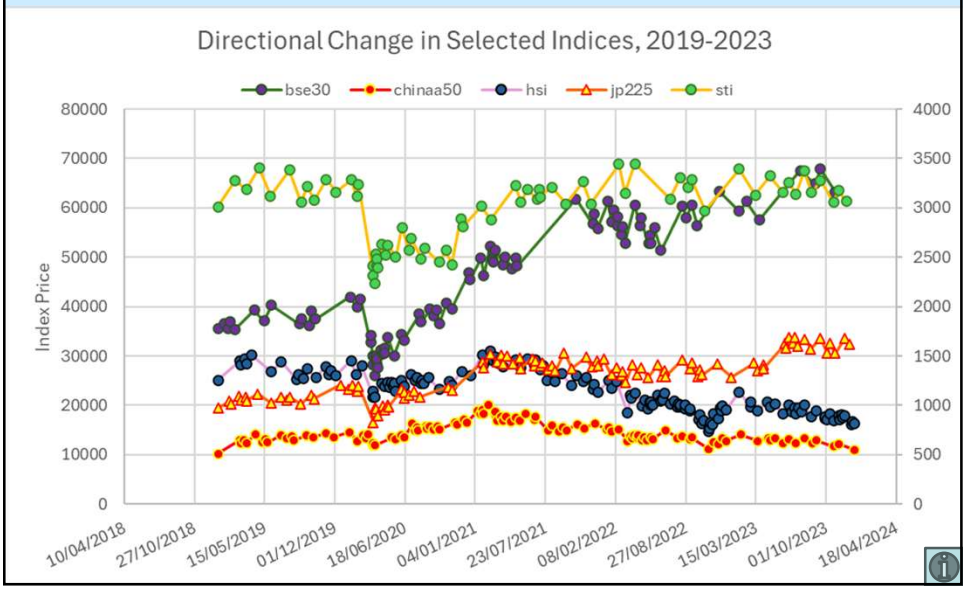


23

Directional Change Summaries

24

DC for selected indices



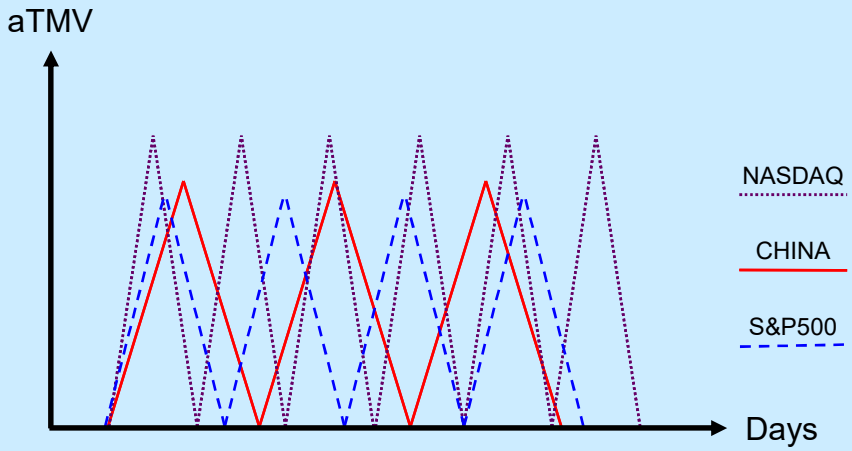
25

Key DC indicators, 2019-23

	NDC	μ Trend Duration	Median aTMV	Coastline
BSE30	86	20.4	2.17	248.1
Chinaa50	106	17.1	2.05	283.6
HSI	144	12.6	2.27	379.2
JP225	100	18.0	2.24	272.6
STI	68	27.1	2.07	176.6
EuroStoxx	114	15.4	2.04	289.4
FTSE100	96	18.3	2.01	225.3
Nasdaq	135	13.0	2.41	395.9

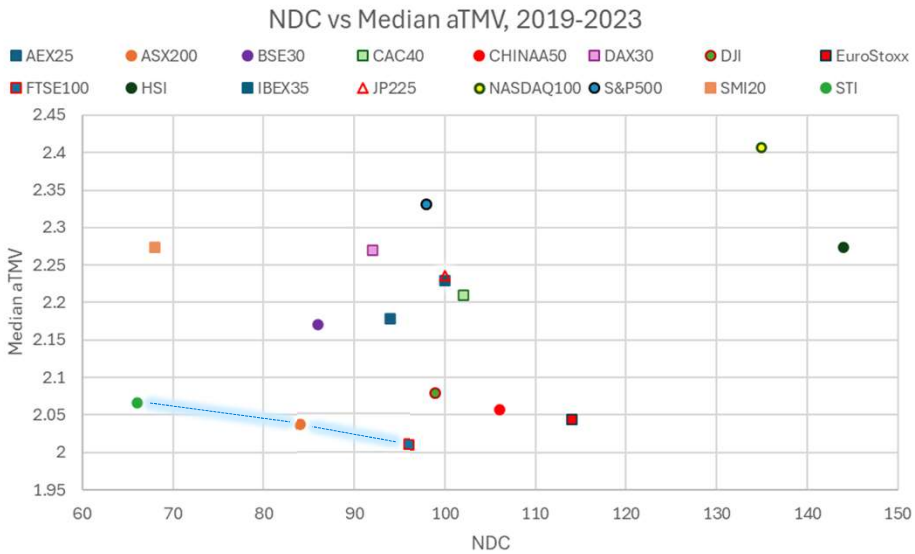
26

Markets by Median Days/Trend and aTMV, 2019-2023



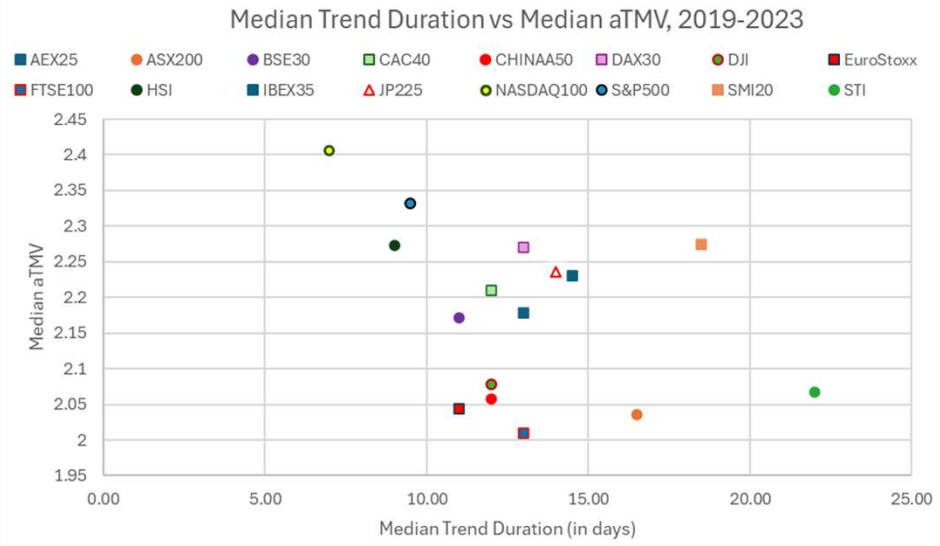
27

NDC vs aTMV, 2019-23



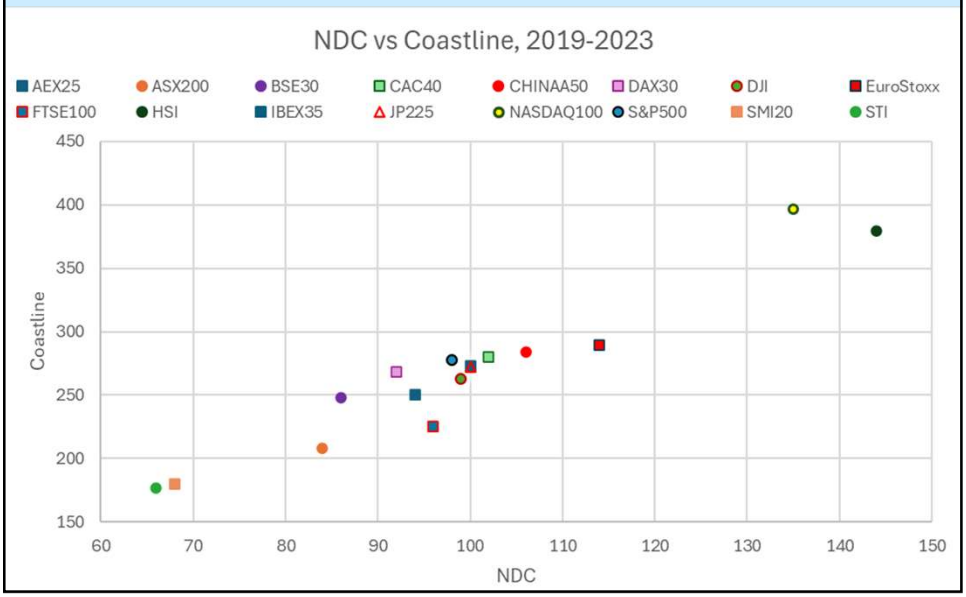
28

Median Trend Duration vs aTMV, 2019-23



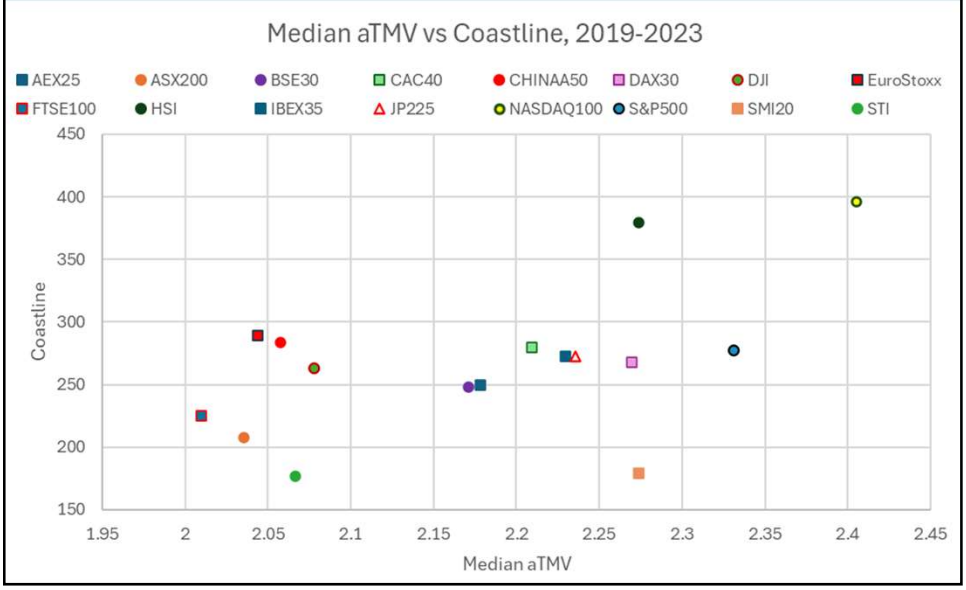
29

NCP vs Coastline, 2019-23



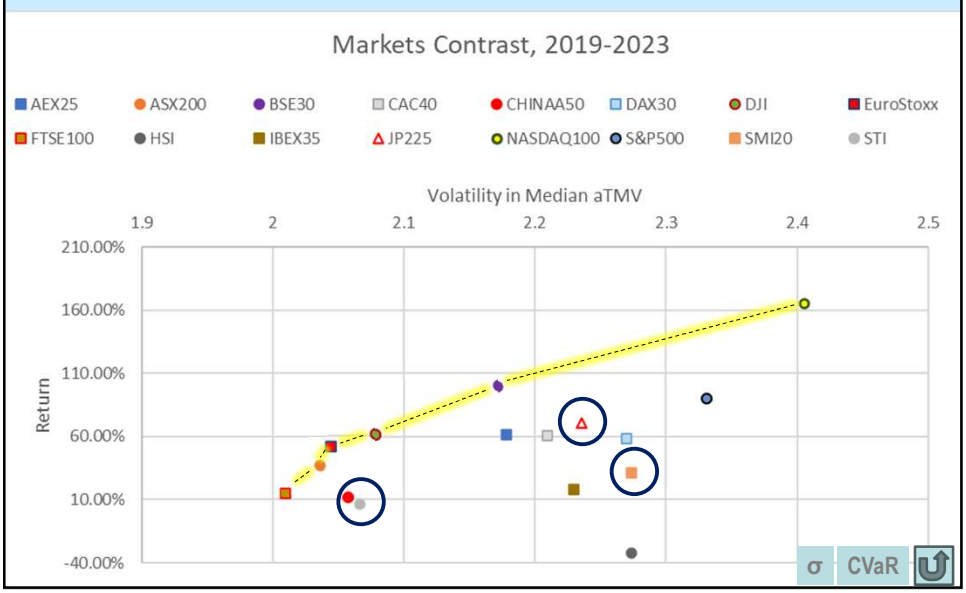
30

aTMV vs Coastline, 2019-23



31

Median aTMV vs Return, 2019-23

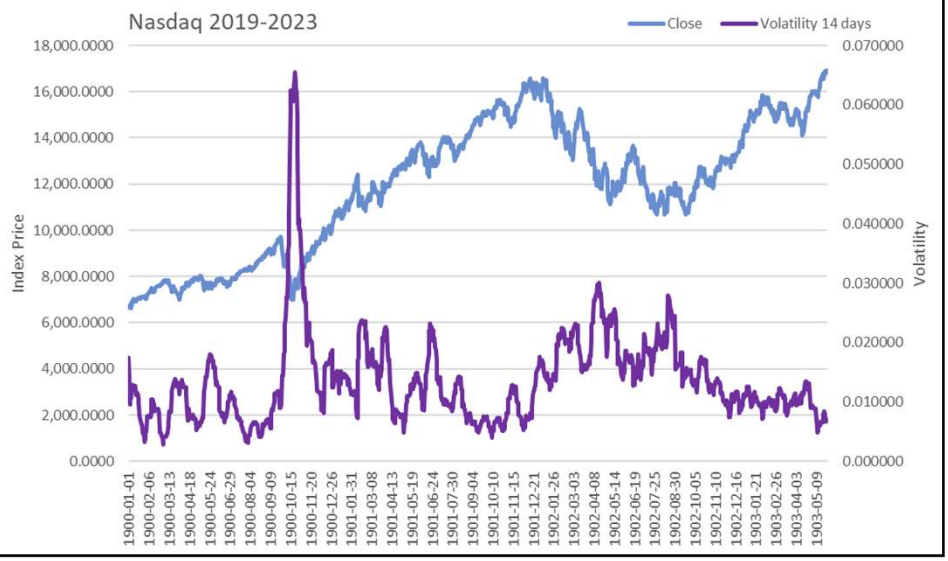


32

Change over time

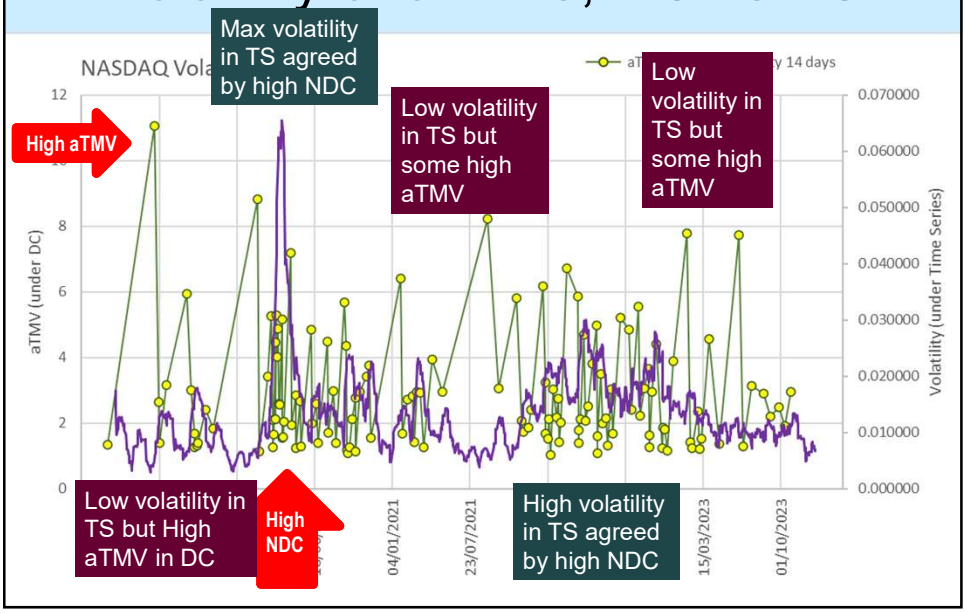
33

Volatility Over Time



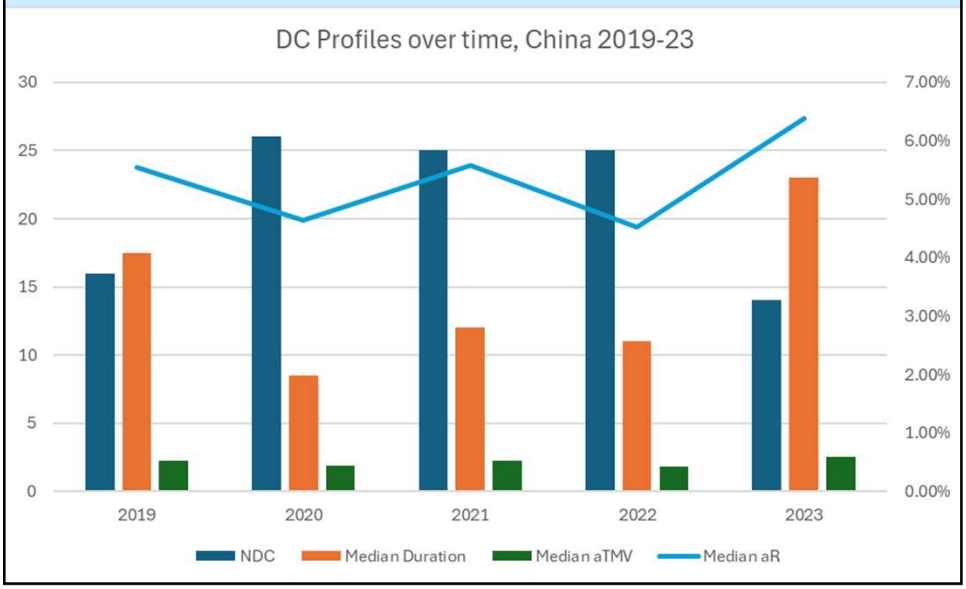
34

Volatility over time, DC vs TS



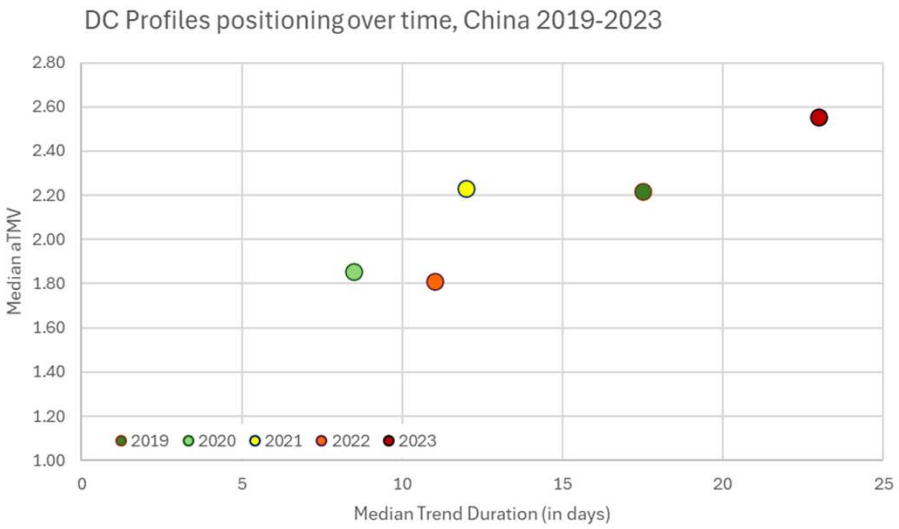
35

DC Profiles Over Time, 2019-23



36

DC Positions Over Time, 2019-23



37

Summary

Don't let the above examples limit your imagination!

Innovate!

38

What You Might Look For

- Trading Opportunities?
  - Any obvious patterns useful for trading?
  - Any trading strategies that might work?
- Risk analysis?
  - For individual markets over time?
  - For markets comparison?
- Any market follows any other market?
- Any two markets moving together?

39

More questions to ask

- Do different views agree with each other?
  - If so, what do they agree upon?
  - If not, where do they disagree?
  - Any insights from their differences?
- What is the 'true picture'?
- Which markets to trade in?
- Which markets form a good portfolio?
- …..

40

Lessons for Project

- The classic risk-return view partial
  - Different angles → different views
  - The 'true picture' is complex
- Try to find something that are
  - Original
  - Useful (for trading or risk analysis)
- Project open-ended

41