RISKS, FAST AND SLOW

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ONE DOES NOT SIMPLY

USEAMENE GENERATOR

imgflip.com

- ► How I will talk about risk.
- > The good old days of quant quakes and liquidity crises.
 - Some bedtime stories
- Classification for (perhaps) actionable purposes.
 - Regimes
 - ► Crises
 - ► Outliers
 - ► WTF
- ► Why bother.





>Let's parse the title of the talk

RISKS, FAST AND SLOW



- Merriam-Webster: possibility of loss or injury
- Elroy Dimson: "Risk means more things can happen than will happen." It is not standard deviation. It is not variability. It is this sense that the future events are highly variable and unknowable that gives us the best sense for risk.
- \triangleright common practice to use σ and call it "risk"
- > I will discuss ways to guess σ conditional on current information
- > Which is clearly not the whole story.
 - Epistemology can be discussed at Jak's tonight with beer ...
- "You don't have to solve everyone's problems but it's good to be able to solve someone's problem."



"Fast" – using real time data

- "Slow" mostly not... (mostly...)
 - We know about things like factor exposures that matter
 - > So I'll focus on **not that**, I'm thinking about "state changes"

FAST AND SLOW



Fear & Greed Index beta

What emotion is driving the market now?





REGIMES/MARKET "STATE" CNN MONEY FEAR & GREED INDEX

Sponsored by

- Ex post it is easy to identify periods that we can classify into two or more regimes or states. For example,
 - ► NBER Recession
 - "Risk on" vs "Risk off"
 - Alpha-seeking vs. liquidity seeking?
- Can we identify anything that leads to meaningful predictions conditioned on our guess of market state?
- Some stats "work"
 - but not a lot of events thus not a lot of power

REGIMES / MARKET "STATE"



lt's a Bunny!



It's a cloud!



- Stuff we can just look up
 - Implied Vol (VIX)
 - Implied correlation (ICJ)
 - Bloomberg FCON <GO>
 - IMF toolkit: systematic risk indicators
 - > OFR suite of macro indicators
 - ECB risk dashboard
 - ► Fun with FRED

REGIMES / MARKET "STATE"





- How do we map from data to policy?
 - WTF does [DATA ITEM] actually mean?
 - Lots of DATA, not so much INFORMATION

REGIMES / MARKET "STATE"



- *30 days in the lab saves 3 hours in the library" Hal White
- Many studies. Hundreds if not thousands...
 - Term spread?
 - Employment?
 - Spending?
- ▶ We have a swiss army knife.
- > Yesterday's talk should help.
 - Let's try some things

REGIMES / MARKET "STATE" RECESSION MODELING

- 10Y3M spread
- ▶ Since 1982,
 - All recessions preceded by negative value
 - All negative values precede a recession
 - > No false positives **nor** negatives!
 - ► But,
 - ▶ it's only 3 for 3
 - Lead time is 1-18 months
- There is some theory
 - However, we can always make up a story ex post, even if we didn't start with any theory...



fred.stlouisfed.org

myf.red/g/dCiS

REGIMES / MARKET "STATE" TERM SPREAD



REGIMES / MARKET "STATE" LATHER, RINSE, REPEAT

- Could just be the shrooms talking wishful thinking, but
- Seems like there is potential for regime timing

- Consider the cost of being wrong
 - False positives -> buy too much insurance / overhedge
 - False negatives -> suffer from left-tail exposure

ECONOMIC CONSEQUENCES

- What can we infer from market data?
- Degrees of freedom / concentration of drivers
 - Entropy measures
 - Kritzman's Absorption Ratio
 - Market model goodness of fit
- Momentum crash
- ► The list goes on

REGIMES / MARKET "STATE" MARKET ACTIVITY



Absorption ratio:

- ▶ % of variance contained in first N principal components
- Compare value over short window to value over long window
 - E.g. 3 weeks vs 1 year
- Q: components of what, exactly?
 - Assets (e.g. <u>SPX 100</u>)
 - Indices (e.g. global equities)
 - Asset classes (e.g. commodities, FX, credit, etc)
 - Factor returns (e.g. momentum, size, liquidity, ...)

REGIMES / MARKET "STATE" ABSORPTION RATIO EXAMPLE



- Entropy measure:
 - Sum(Eigen(cor(X))\$values * log(eigen(cor(X))\$values))
- Model fit:
 - > R^2 from e.g. fit of [your favorite model] over trailing window
 - > High R^2 -> "fragile", Low R^2 -> "robust"
- Prefer to get a daily value using 1-min bars on SP 100

REGIMES / MARKET "STATE" MORE IDEAS, SAME SPIRIT



Momentum crash:

- > I refer you to excellent papers by Kent Daniel for details...
- We might not be able to predict them but
 - > 6 out of 6 in sample lead to "regimes" with specific characteristics
 - > 1 out of 1 out of sample consistent with this story
 - > Momentum crash of March 2016, policy suggests **BUY** market



REGIMES / MARKET "STATE" MOMENTUM CRASH

Co-holdings liquidation risk (Amaranth trigger)

- ▶ 13F of peers.
- > Correlation with **our** long book vs with **our** short book
 - > If we believe they are smart and we are smart, we can make inferences
- > Hard to get cross asset linkages -
 - > E.g. When will a credit issue be reflected in equity trading?
 - > Liquidity, duration, holdings...

REGIMES / MARKET "STATE" WHAT ARE THE PLAYERS DOING?





- Is current market state typical?
- Is market "fragile"?
- Are we changing regimes?
- Entering or exiting recession?

SUMMARY: REGIMES / MARKET "STATE" WHAT'S THE POINT?



Coming up on the 10 year anniversary of Quant Quake

- Still afflicted with PTSD and obsess about market disruptions
- "Dash to cash" vs. "Dash to trash"

REAL TIME DETECTION OF (SOMETHING INTERESTING)



Trading records show

- "regimes" (maybe)
- Flash crashes
- Flight to liquidity
- Flight to quality
 - can occur over long periods
 - > E.g. May-Sept, 1998

REAL TIME DETECTION OF (SOMETHING INTERESTING)

- Track stats on instruments along dimensions of
 - Some kind of Beta
 - E.g. Dow < SPX < NDQ < RUT</p>
 - Inverted return to beta
 - **Duration**
 - E.g. Bonds, BUT can calculate effective duration for many things
 - Term curve inversion
 - Quality
 - E.g. Sovereign > AAA > JNK
 - "Dash to trash" or "Flight to Quality"
 - Liquidity
 - E.g. "Typical" market depth, turnover, \$ volume / \$ float, etc.
 - Sell what you can, not necessarily what you want to.

REAL TIME DETECTION OF (SOMETHING INTERESTING)

- VPIN on hedging instruments like ES, US, Gold...
 - Is current activity significantly different from "typical"
 - Most of the time nothing interesting
 - > BUT when crisis occurs (occurred?) we see extreme value
- HFT Activity
 - Can we identify presence of more aggressive HFT algos?
 - Can we game them by understanding their patterns of accumulation and distribution?

REAL TIME DETECTION OF TOXIC TRADING

- <u>"Turbulence"</u> compare current vector of returns to "typical"
- > Degrees of freedom / number of independent drivers
- > Statistical process control ideas (CUSUM, runs tests)
- > Can we predict longer horizon vol with high frequency data?
 - > (Yes)

REAL TIME DETECTION CROSS SECTIONAL TICK DATA

Turbulence



► I will tell a story

(since I didn't want to take the time to reproduce old results...)

REAL TIME DETECTION CROSS SECTIONAL TICK DATA



IS BELONG TO US

Insurance is expensive

- **Even more so when we need it**
- > When it might no longer be available

WHY BOTHER?



MANY packages calculate things of interest.

E.g. see CRAN Task Views on

- Econometrics, Time Series, Finance, Optimization
- ExtremeValue
- I might like to see a dashboard,
- Maybe in a Shiny app...
- Most of these ideas are easy to code
- As usual, challenge is **data** management...

RISK PACKAGES?





"the appendix is small and has no known function" – Oxford Dictionary



http://www.womenshealthmag.com/health/facts-you-need-to-know-about-your-appendix

APPENDIX

Regime / market state

- ▶ If "benign" swim naked. Better yet, sell vol.
- ► If not, buy some insurance
 - Not gonna mention counterparty risks here...
- If you can react & trade fast without "too much" market impact

CONTINUED

- Track critical things in real time
- For example:
 - > VPIN on instruments used for hedging; SPY, US, Gold?
 - > Degrees of freedom on suite of indices
 - > E.g. Factors (value, momentum, any other likely smart beta things...)

LAST RECAP: WHY BOTHER? MAYBE GET POLICY IDEAS...

In 16th century London, a statement that describes impossibility was referred to as a "black swan" because all historical records of swans up to that time had reported that swans only had white feathers. The Greek philosopher Aristotle first used the term "white swan" as an example of necessary relations and the term "black swan" as the expression of the incomprehensible. Further developed by Pyrrhon.

A Black Swan is NOT just some outlier

It's an event that we did not believe was possible either because

- we were "sure" about it or
- we did not even think about it

WHAT ABOUT BLACK SWANS



Twitter or other real time social media?

- ► Fake news?
- I don't deal with this but probably worth thinking about
 - I read claims about successes but have yet to see evidence

WHAT ABOUT SENTIMENT?

Model	Authors
CoVar	Adrian and Brunnermeier
Co-Risk	Chan-Lau, Espinosa, Giesecke, and Solé
Network Models and Financial Stability	Nier, Yang, Yorulmazer, and Alentorn
Agent-Based Model of the Leverage Cycle	Thurner
Systemic Expected Shortfall	Acharya, Pedersen, Philippon, and Richardson
Distress Insurance Premium	Huang, Zhou, and Zhu
PCA and Granger-Causality	Billio, Getmansky, Lo and Pelizzon
Distress Dependency	Segoviano and Goodhart
Systemic CCA	Gray and Jobst

(Swiped from one of the reports on next page)

MORE SYSTEMATIC RISK IDEAS

https://www.financialresearch.gov/annual-reports/

- https://www.mitre.org/sites/default/files/pdf/12_1870.pdf
- https://www.imf.org/external/pubs/ft/wp/2011/wp11235.pdf
- https://sdw.ecb.europa.eu/reports.do?node=1000003268

A FEW REFERENCES

WILLGLADY PAY YOU TUESDAY

FOR REDUCINGRISK TODAY