What have we learnt about financial ecology, market speed & auctions?

The Future of Computer Trading in Financial Markets:
has it happened?

London School of Economics
March 2023

Contribution to Foresight (with Doyne Farmer)

Two Driver Reviews

"An ecological perspective on the future of computer trading"

"Are markets too fast?"

Two Policy Option Reviews

"Continuous vs. randomized stop auctions and alternative priority rules"

"Minimum resting times and transaction-to-order ratios"

Main Ideas

1. Ecological perspective especially useful for computer trading

2. *Relative* speed has even larger private value than is appreciated (while absolute speed increases no longer improve markets)

3. Use 'smart call auctions' instead of continuous trading ensure markets reflect information quickly while eliminating private value of *relative* speed

Ecological Perspective

Farmer (2002) introduced financial ecology as distinct to evolution

Ecological perspective is generally useful where there are (1) many agents that are (2) clearly distinct while (3) interacting strongly

These conditions hold for **trading algorithms**:
1. Solve various distinct investment problems
2. Very boundedly rational, therefore highly specialized
3. Strong 'financial food-web' interactions exist

Our proposal for analysis of computer trading ecology

1. Empirical analysis of market ecology and 'financial food-webs'
   - Taxonomy of algorithms-as-species
   - Taxonomy of interactions: competitive, symbiotic, predator-prey
   - Systemic implications of interactions

2. Consider impact of regulations on entire ecology
   e.g. US public works require ecological analysis of environmental impact

3. Large scale simulations to model many empirically observed features of ecology (1) *simultaneously*

Financial Ecology research in last 10 years

'Financial Ecology' terminology is slowly attracting attention:

- e.g. Andrew Lo's "Adaptive Markets" book
- Farmer is doing new related work in this direction
- Related research citing our paper (63)

Still in early stage of first goal (empirical taxonomies & interactions)

Some hope:

'Clientele' literature in finance uses different terminology but same focus!

clientele analysis as ecological analysis

- **Empirical proxies for activity of certain species**: retail, institutions, HFT, mutual funds, hedge funds, liquidity providers, contrarians, trend-followers.

- **Theory emphasizes certain species**: liquidity providers, market makers, rebalancing contrarians, under/over-reactors, noise/rationality

  Less sharp heterogeneity in terms of: information, investment horizons, financial constraints, etc

- Note strong presence @LSE: Lou, Polk, Vayanos, Woolley, (me) etc

# clientele analysis as ecological analysis
simple illustration

From Lou, Polk and Skouras (2019 JFE and 2023)

1. New proxy to empirically identify clienteles/species

2. Measure clienteles/species variation over time

3. Measure 'systemic' implications of specific financial food webs:

    • Greater and more explainable predictability of stock market

    • CAPE predicts market bcz retail flow moves prices away from fundamentals

    • Bubbles and crashes can be distinguished based on species causing them
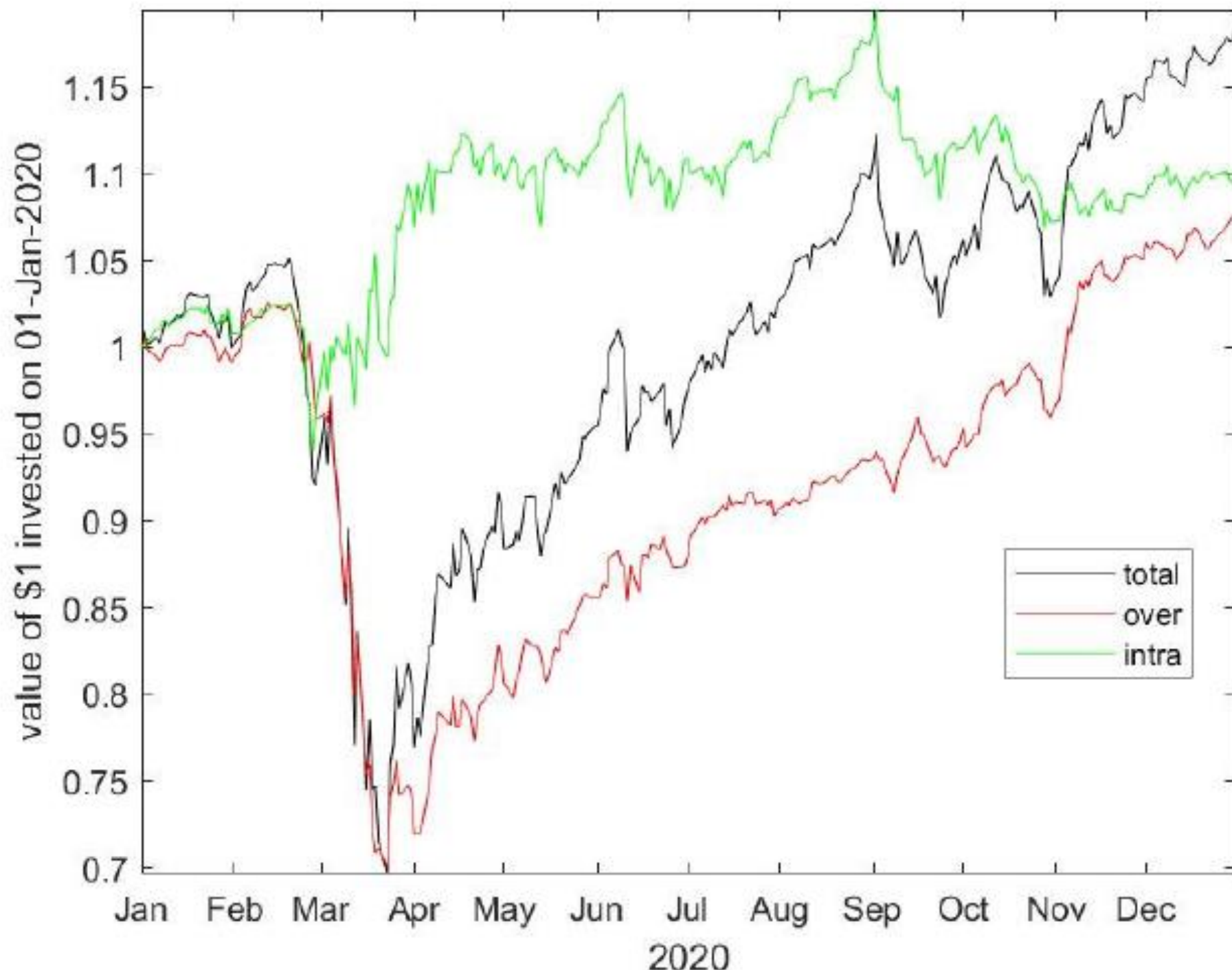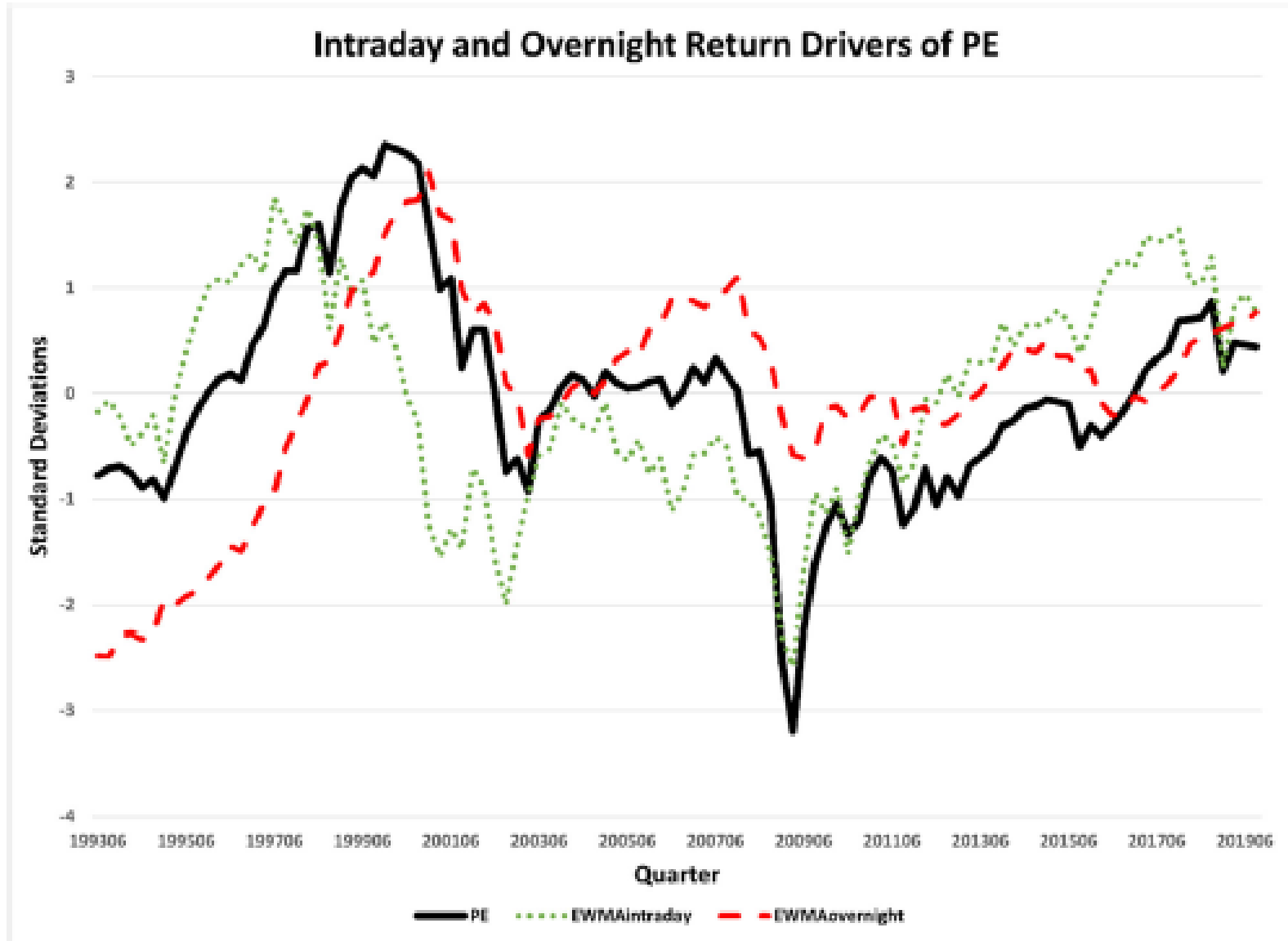
COVID CRASH
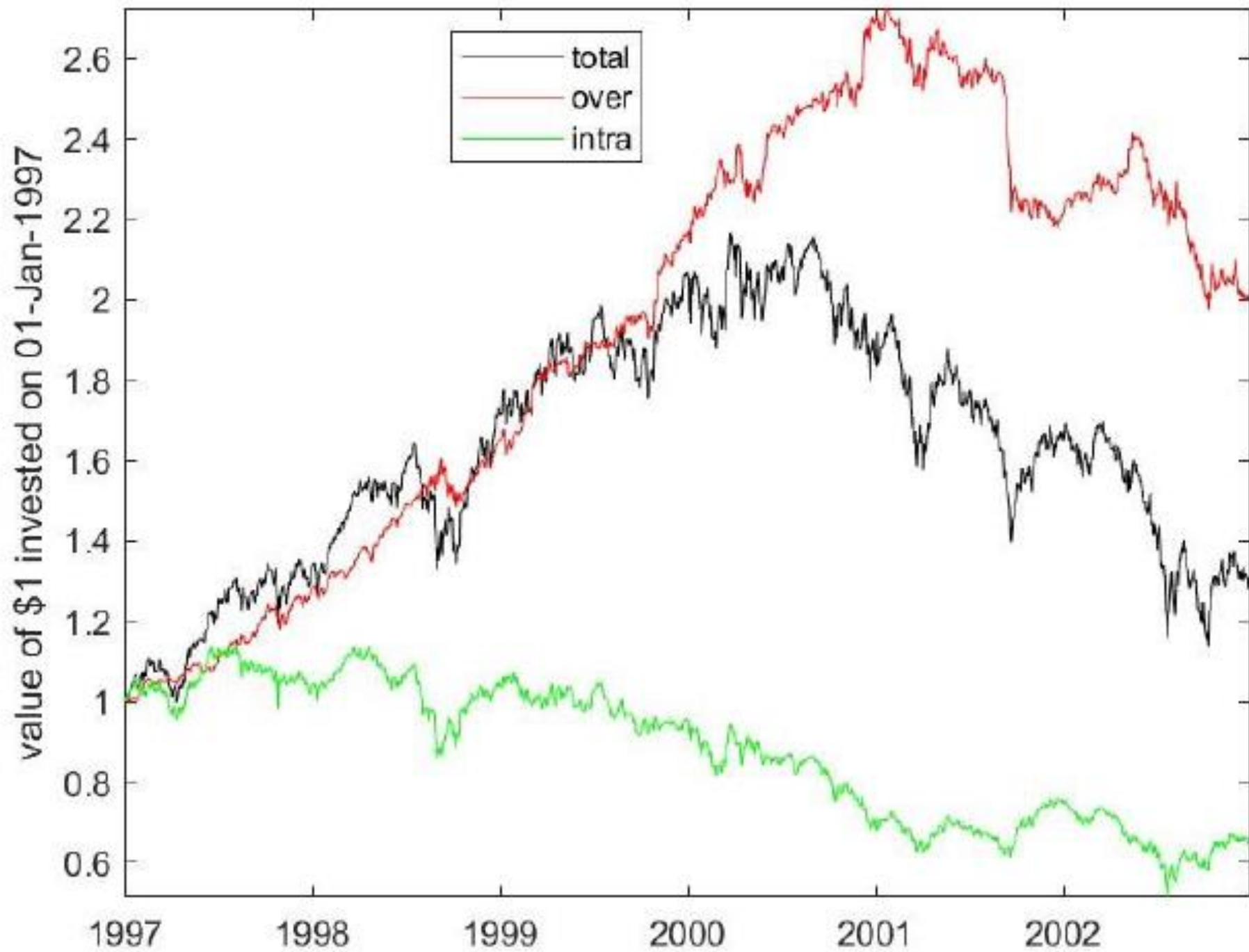
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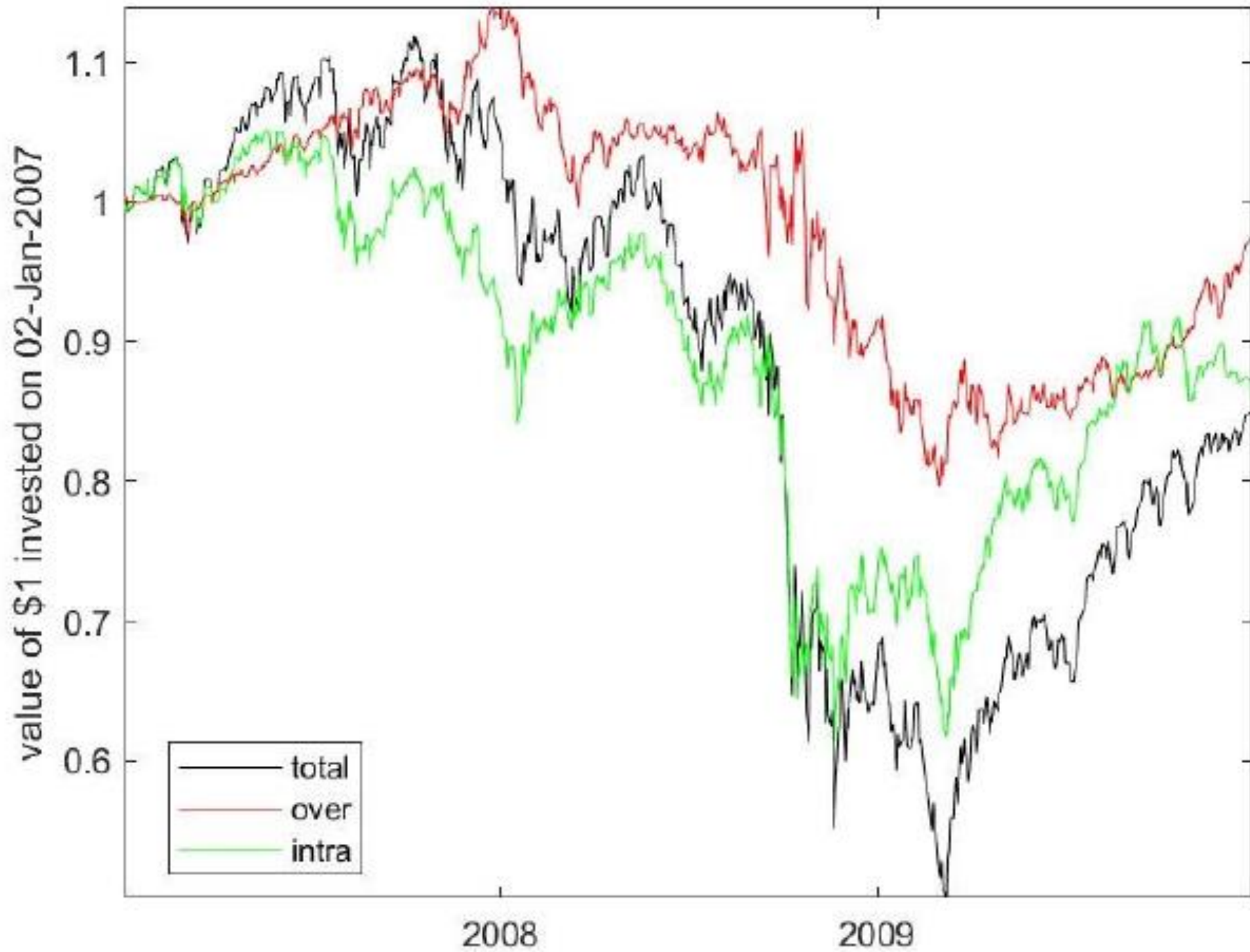
GFC

Figure 1. This figure shows the PE ratio and smoothed (exponential-weighted average) overnight/intraday returns for the period 1993-2019.

	[1]	[2]	[3]	[4]	[5]
	Panel A: Forecasting Excess Market Returns				

|	[1]	[2]	[3]	[4]	[5]
PE	-0.017*				
	[-1.77]				
$EWMA_{overnight}$		-0.032***	-0.030***	-0.031***	-0.029***
		[-5.53]	[-5.10]	[-5.33]	[-3.83]
$EWMA_{intraday}$		0.006	0.003	0.007	0.010
		[0.74]	[0.50]	[0.54]	[1.11]
$EWMA_{earn}$				-0.002	
				[-0.18]	
CAY					-0.004
					[-0.36]
VS					-0.007
					[-0.64]
RVOL					0.007
					[0.43]
Adj-R²	3.0%	14.1%	11.7%	13.1%	11.6%

clientele analysis as ecological analysis
another illustration

Skouras (2023)

Dependence on lagged returns is outcome of clienteles with: (i) different risk exposures, (ii) reaction speeds and (iii) offsetting flows

1. Very rich new patterns in cross-sectional predictability
2. Patterns all shift together
3. Market conditions modify patterns:
   - Can favour specific clienteles (e.g. value risk)
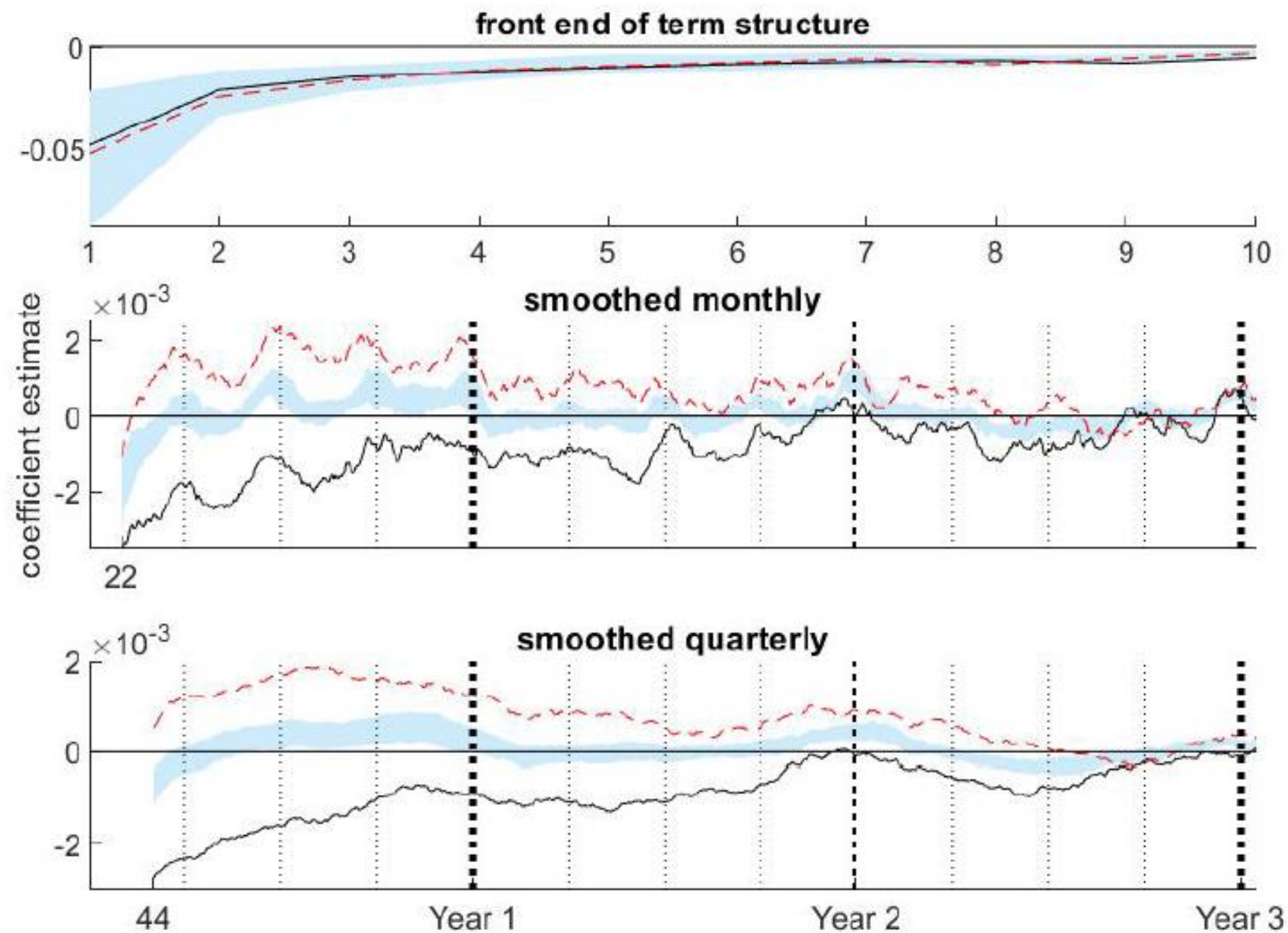   - modulate importance of all clientele interactions (e.g dispersion)
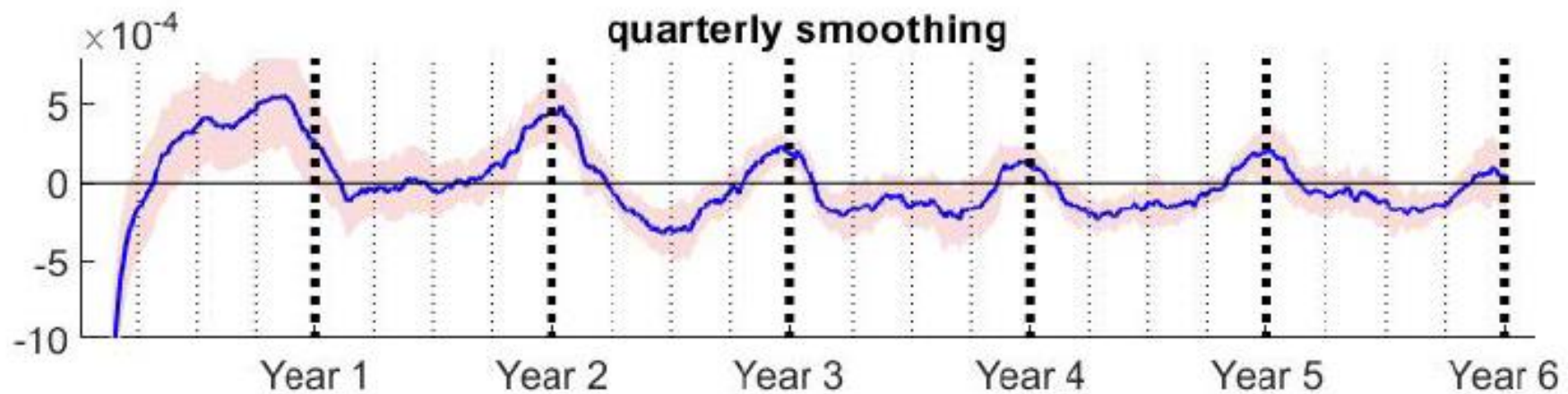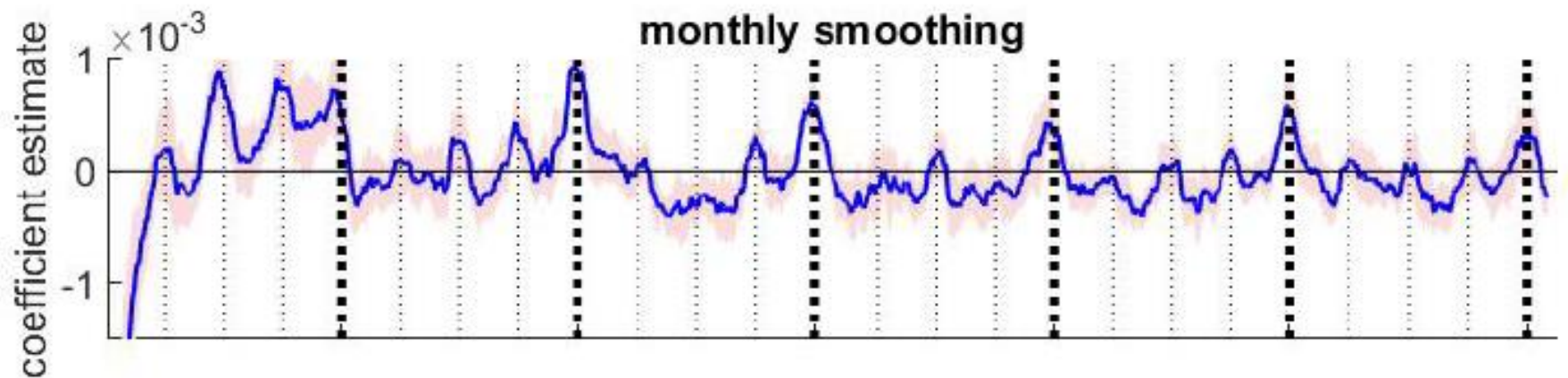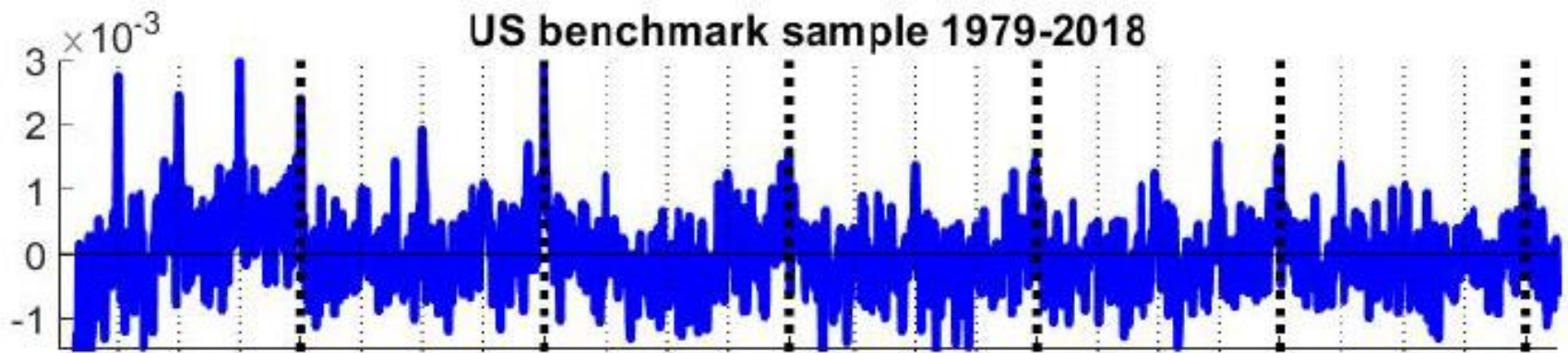
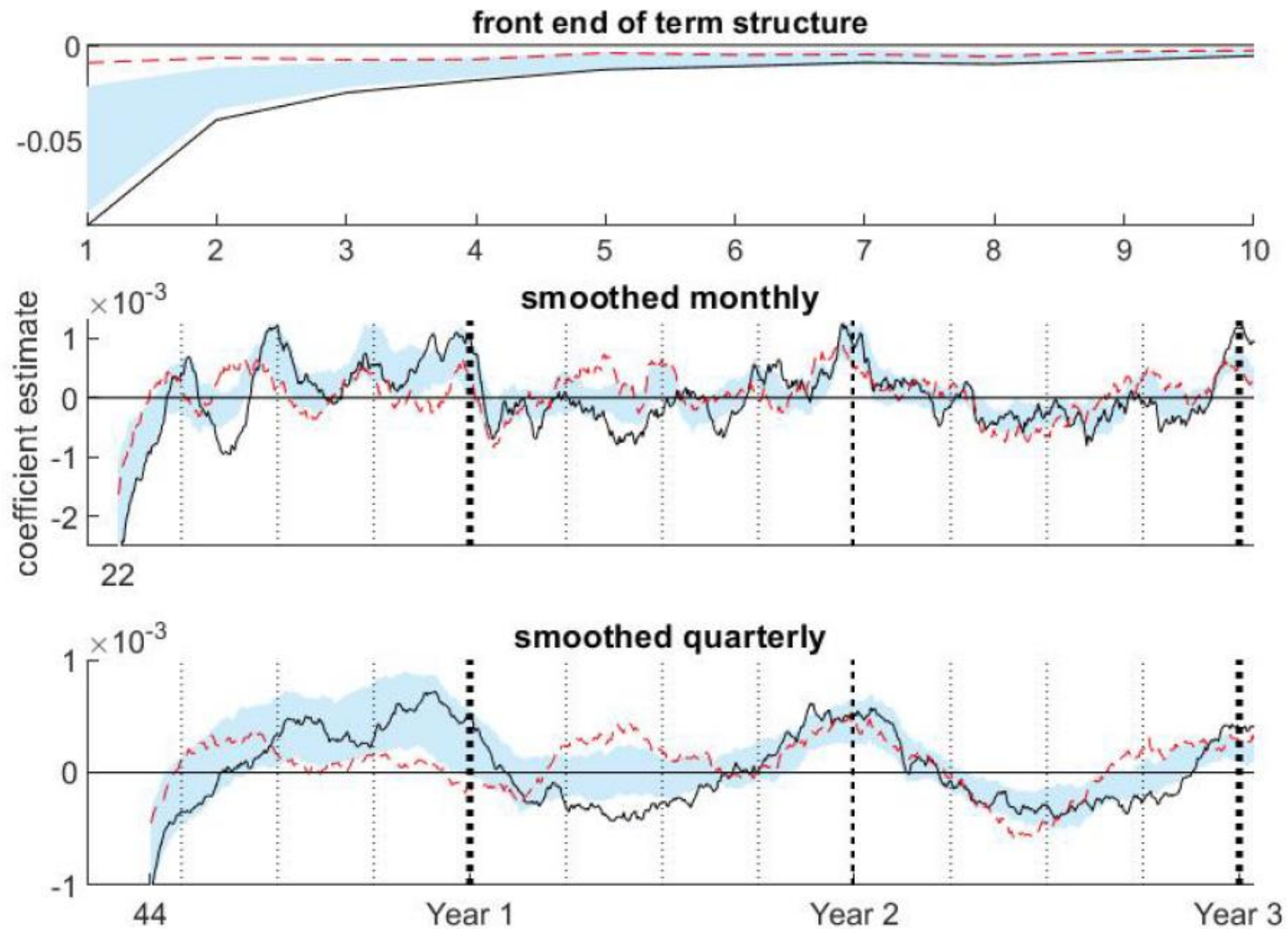Figure 5: Term structure across market conditions: high vs low value return days

Figure 6: Term structure across market conditions: high vs low return dispersion days

Our contribution to measuring value of speed

- We estimated value of obtaining *queue priority* in LOB

- Found it was the **dominant** reason to pursue relative speed

Past of future of value of speed estimation

- Many studies have produced estimates of value of speed

- But emphasis has been on aggressive trading and arbitrage

 NB: A promising new approach to value of speed:

  On smart contract blockchains, priority is *for sale* & its value is calculable ('extractable value')

- Our suggestion that **value of queue priority is huge remains neglected**

Our proposal for 'Smart call auctions'

- 1Hz Frequency (or higher), i.e. 1/second (on average)
  Reduces private infrastructure cost including datafeeds etc. to apx $40,000/year (2-3 orders of magnitude reduction)

- Pro-rata not time-priority execution
  Limits private value of relative speed for trading any kind of info
  An alternative could be continuous price increments or fees for priority

- Randomized offset
  Further limits private value of relative speed for trading any kind of info

- Synchronize trades across all exchanges globally
  Limits private value of relative speed for trading cross-exchange

- G20 agreement that this would be unique trading mechanism
  There is likely symbiotic relationship between HFT and exchanges

More calls for call auctions in past of future

- Budish et al (2015): **10-100 milliseconds**
- Cochrane (2013) suggests **1/sec to 1/min**
- Jagannathan (2022): **1/sec** eliminates crashes w/o impact on trades & prices
- Twu & Wang (2018): **0.5/sec** for Taiwan
- Fricke and Gerig (2017): **1/'few seconds'** for S&P500 stocks

Indriawan, Pascal & Shkilko confirm that Taiwan's switch to continuous:

- Increased costs due to adverse selection
- But, increased exchange profits (due to increased trading volume)

Reality in past of future

CBOE & London Stock Exchange have since adopted frequent auctions

- Since 2015 and 2017 respectively
- Roughly 1/100 millisec
- Account for a few % of European stock trading
- … but in parallel to continuous trading (**defeating the purpose!**)

The future of the future – final thoughts

- A 'financial ecology' revolution may be close – it will consider many interactions simultaneously

- Value of speed will also increase in defi markets and for non-financial transactions on an increasing range of products arbitragable electronically

- Were we right about value of queue priority?

- Regulations imposing financial market design (e.g. call auctions) may be unrealistic => markets as a global public good?