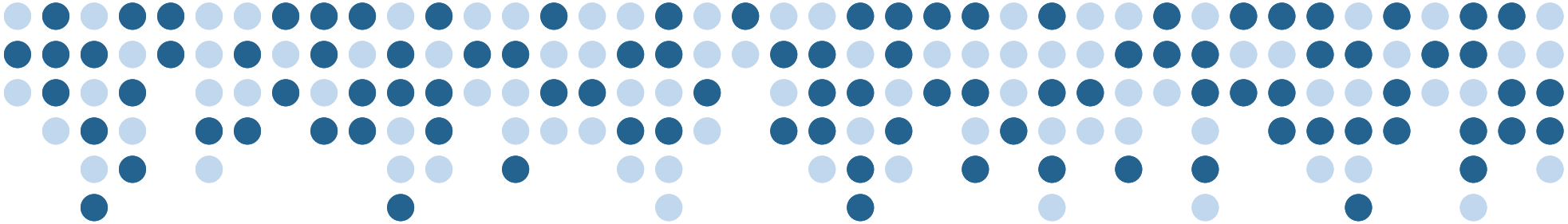
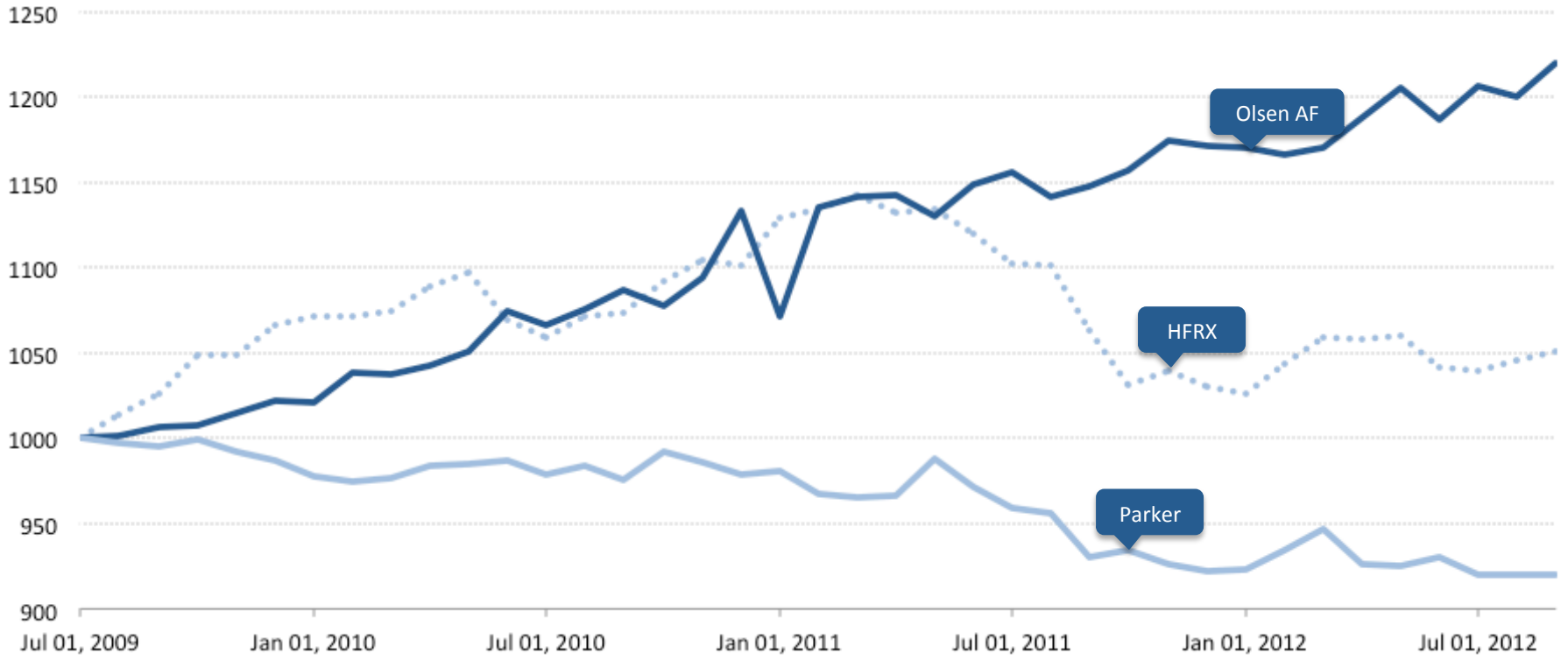


Computational Finance: A Road Map For The Next Ten Years

Richard Olsen

Our Track Record



%	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year	Parker	HFRX
2009							0.18	0.48	0.11	0.74	0.66	-0.07	2.12	-2.18	7.18
2010	1.65	-0.08	0.47	0.84	2.29	-0.80	0.86	1.05	-0.80	1.47	3.62	-5.47	4.93	0.23	5.39
2011	5.99	0.54	0.06	-1.04	1.60	0.64	-1.24	0.47	0.81	1.53	-0.23	-0.10	9.23	-5.82	-9.15
2012	-0.36	0.37	1.48	1.49	-1.52	1.57	-0.50	1.63	0.01				4.20	-0.41	2.42

Performance of product profile AF, gross of fees, including transaction cost, leverage, interest and monthly reinvestment.
Past performance is no guarantee for future results. The value of investments may fall as well as rise. Data sources: see disclaimer.

Short-term Volatility Is Bigger Than We Think

Financial Markets As Energy Source

Over one day:

0.5% plus/minus price move

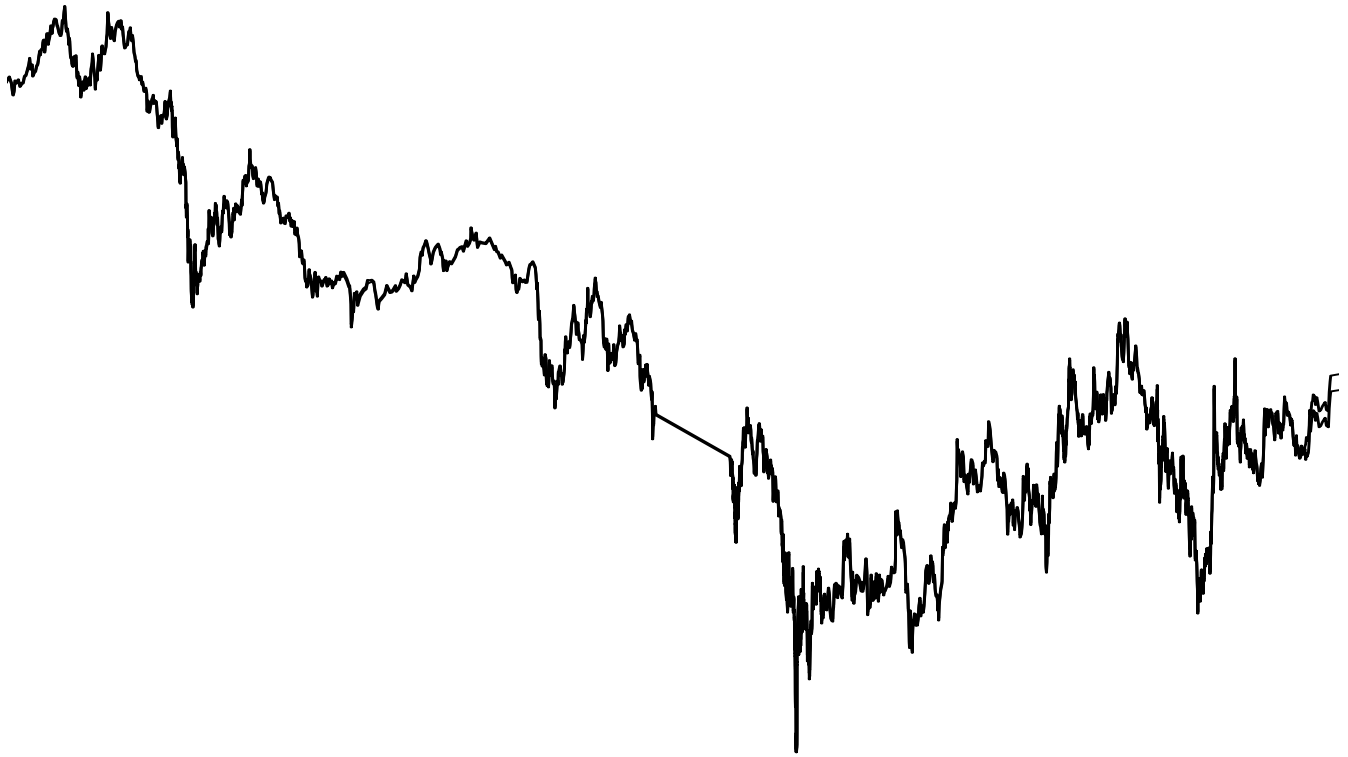
6% coastline (at threshold of 0.05% after deducting transaction costs)

Over one year:

30% plus/minus price move

1600% coastline

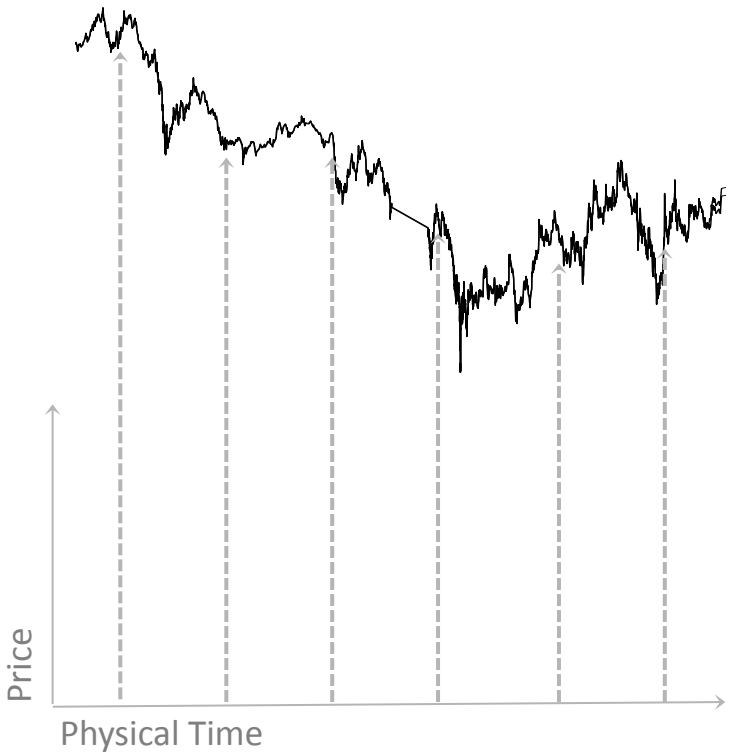
How to approach problem?



Fundamental analysis
Neural networks
Technical analysis
Time series analysis
……

?

Physical time introduces bias

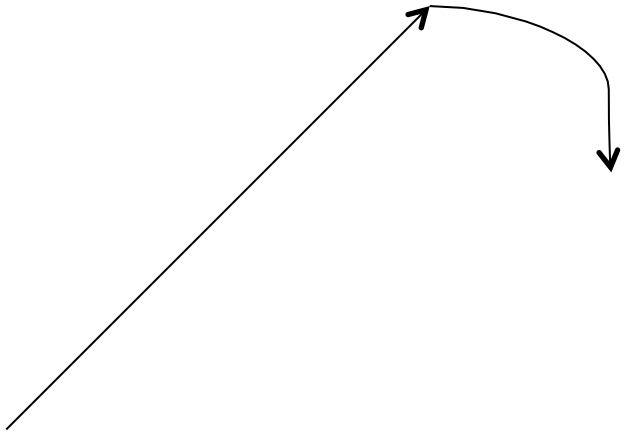


What is problem?

Observer

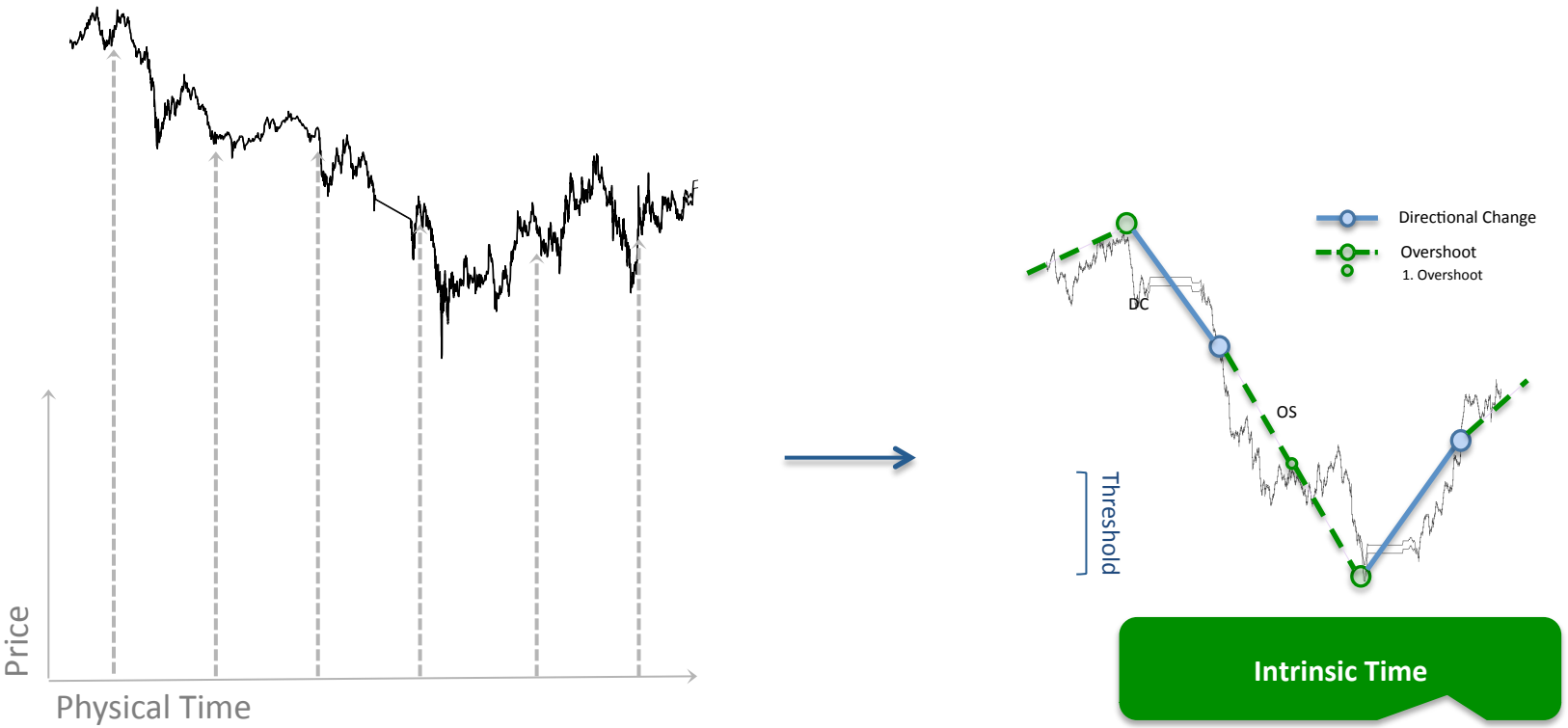
Observer influences object by choosing time scale.

What is time?



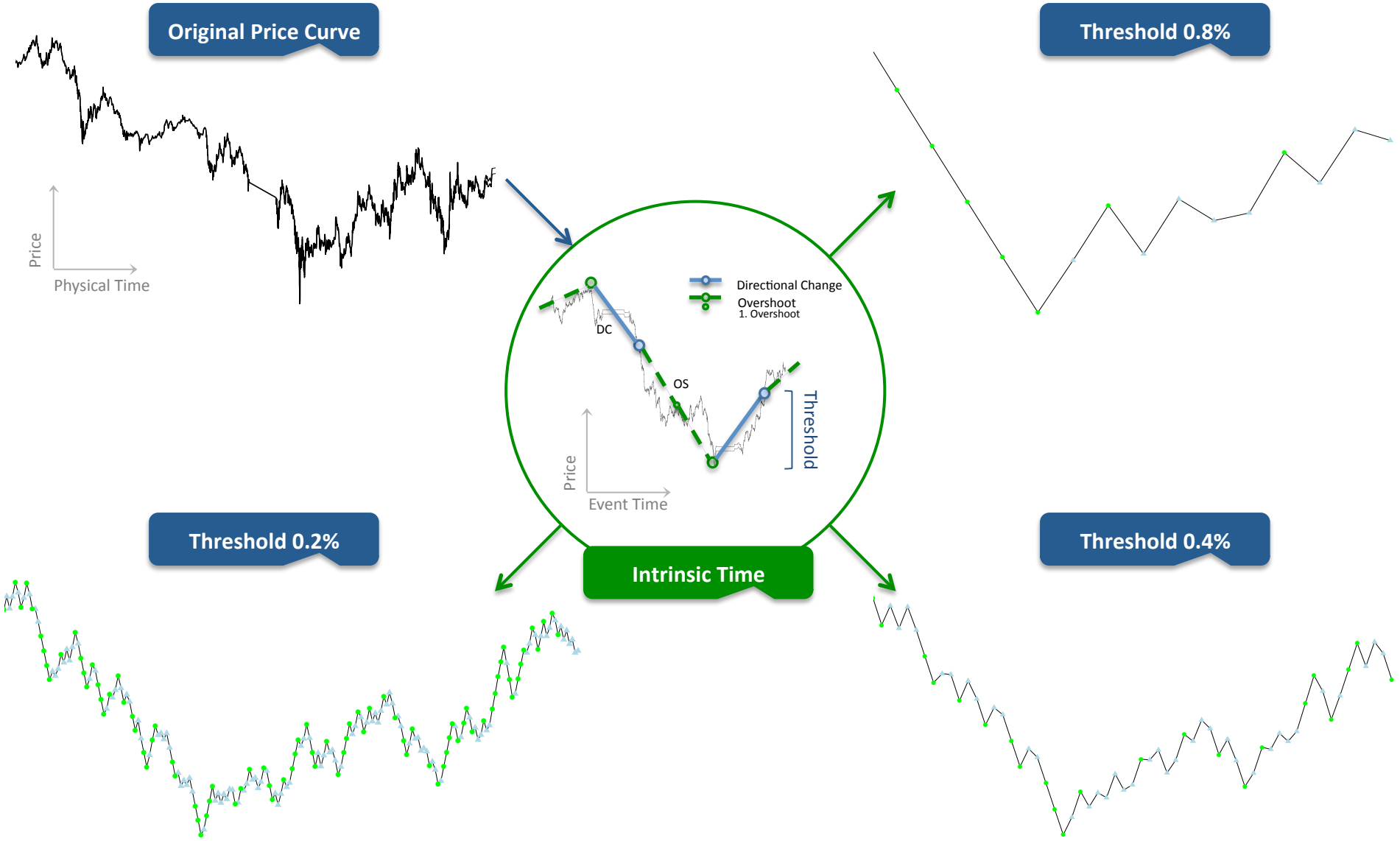
Events are turning points.

Event Based Intrinsic Time



Endogenous time scale: more radical than Mandelbrot's transaction clock

Intrinsic Time: Threshold + Overshoot



How Big Is Price Overshoot On Average?

Price Overshoot is approx. = Threshold

Scaling Laws: Mathematical Description

$$y = \left(\frac{x}{C}\right)^E$$

Invariance of scales

$$\begin{aligned} y_0 &= \left(\frac{x_0}{C}\right)^E \\ x_1 = \alpha x_0 \quad &\rightarrow \quad y_1 = \left(\frac{\alpha x_0}{C}\right)^E = \alpha^E y_0 \end{aligned}$$

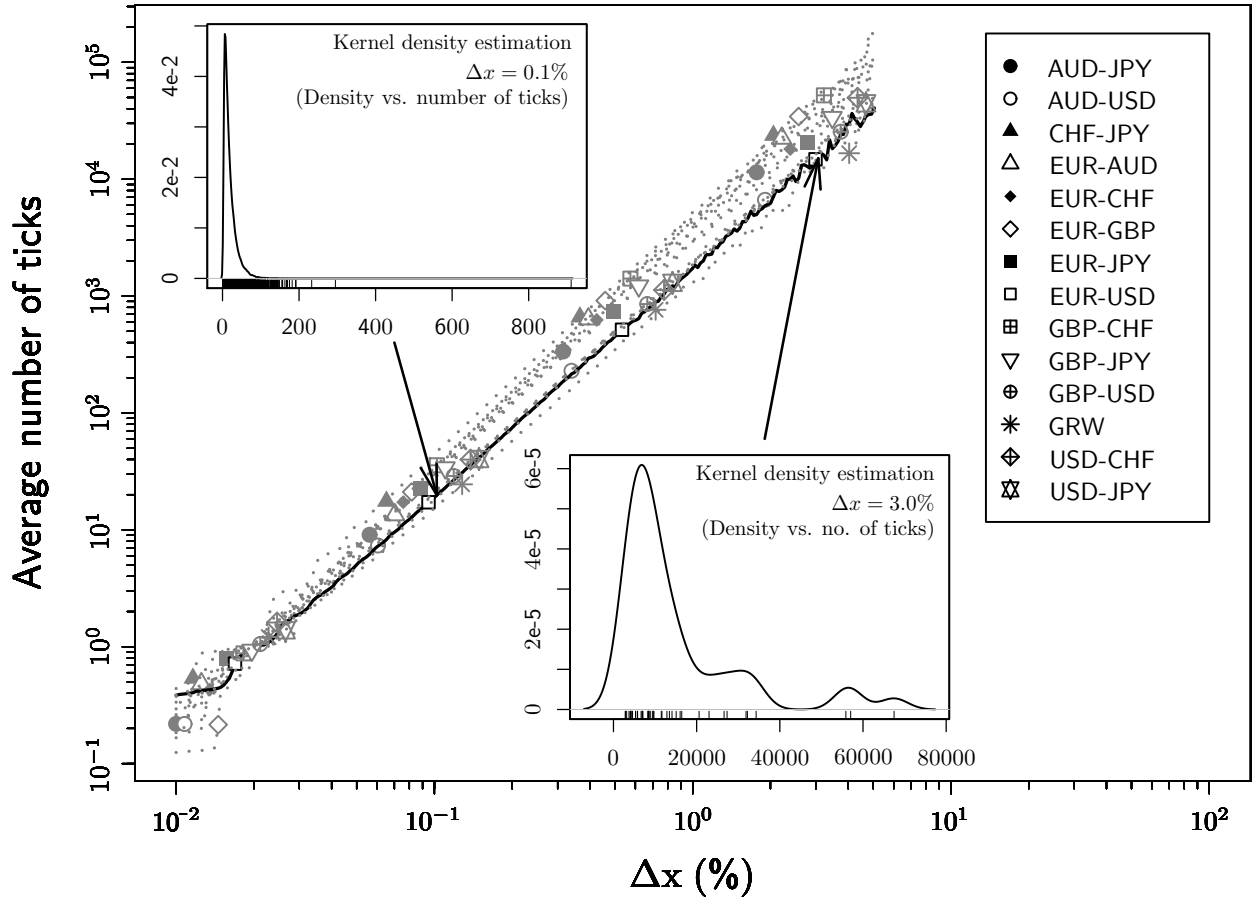
$$\begin{aligned} \ln y &= \ln\left(\frac{x}{C}\right)^E = E \ln x - E \ln C \\ \tilde{y} &= E\tilde{x} + \tilde{C} \end{aligned}$$

Elegant: a couple of constants summarizes the relation

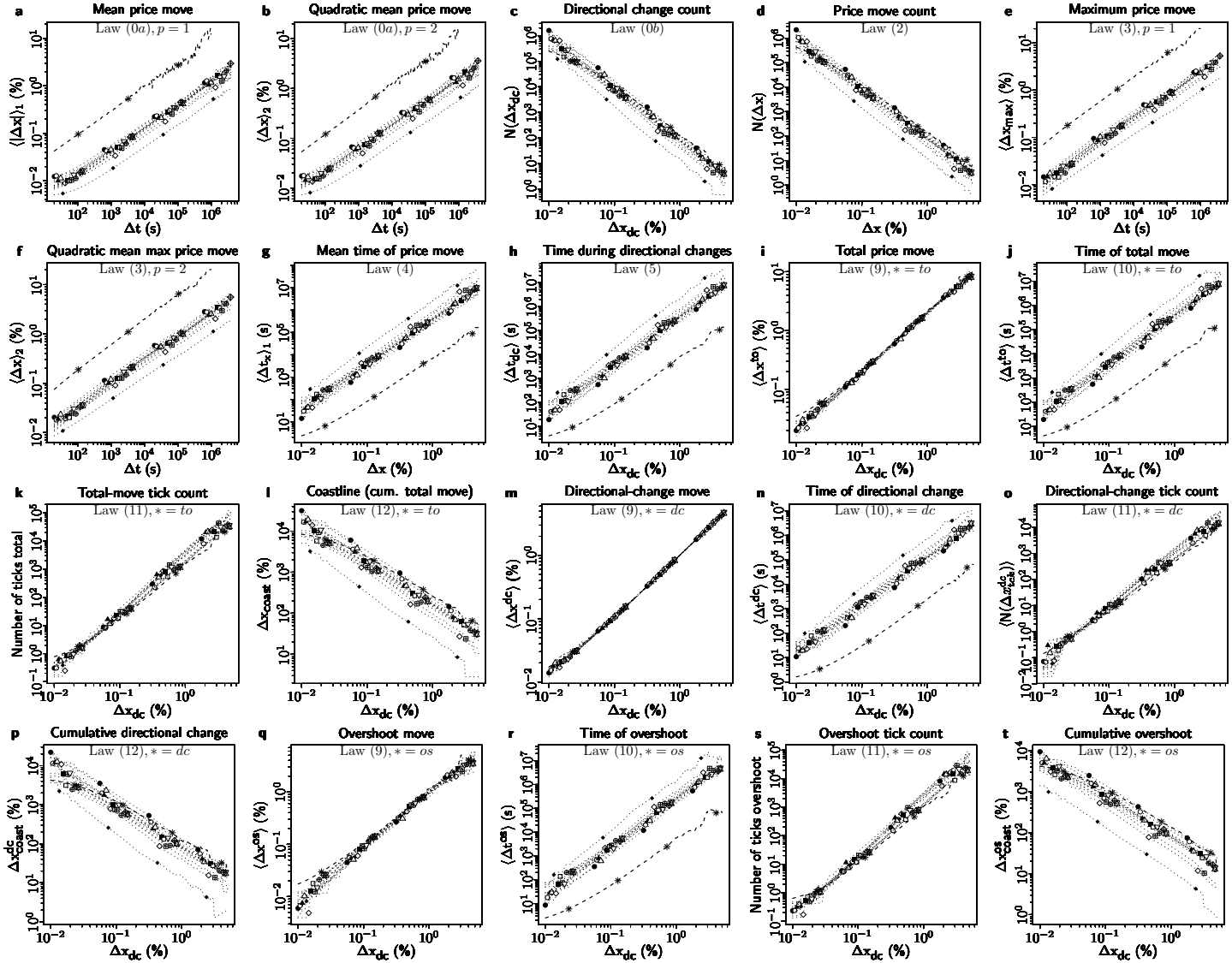
No point of reference

Tick Scaling Law

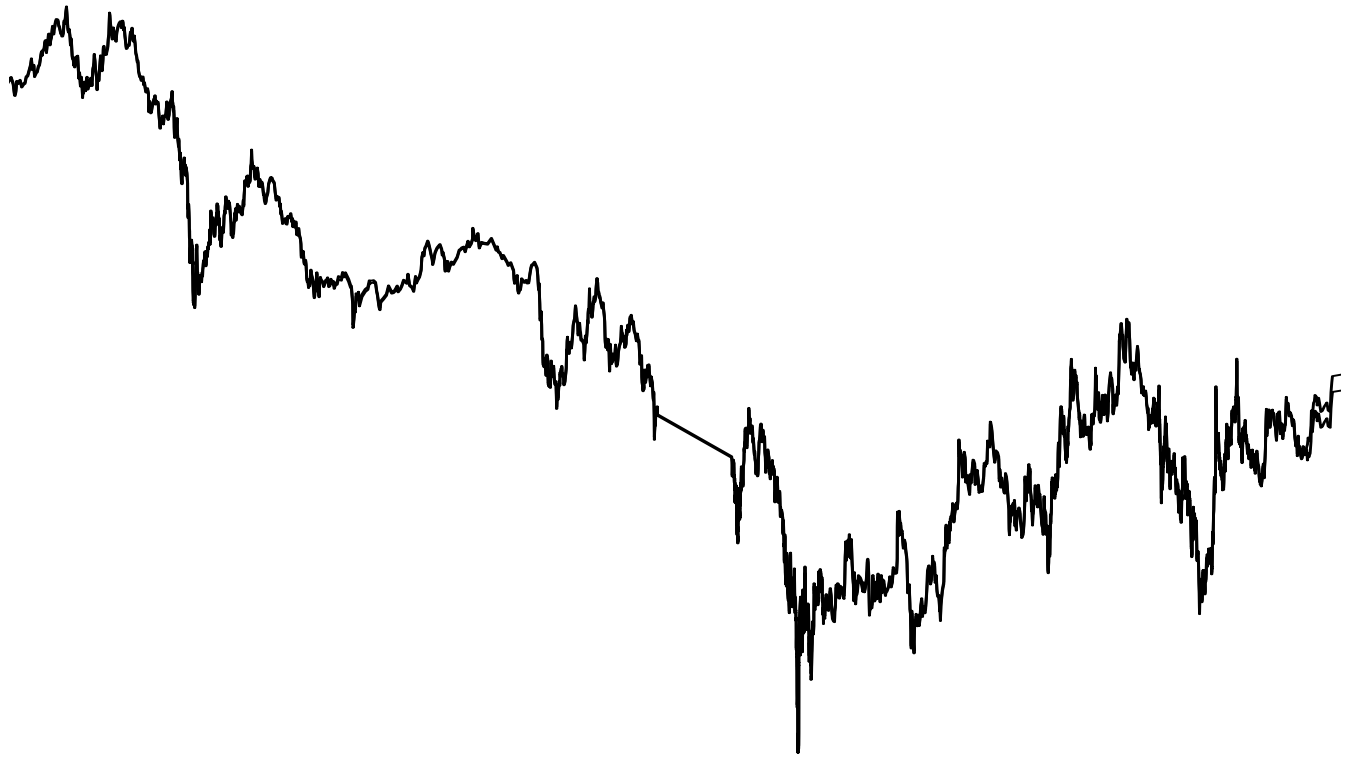
$$\langle \mathsf{N}(\Delta x_{tck}) \rangle = \left(\frac{\Delta x}{C_{\mathsf{N},tck}} \right)^{E_{\mathsf{N},tck}} \qquad \text{where } \Delta x_{tck} = 0.02\%$$



A Set of Scaling Laws

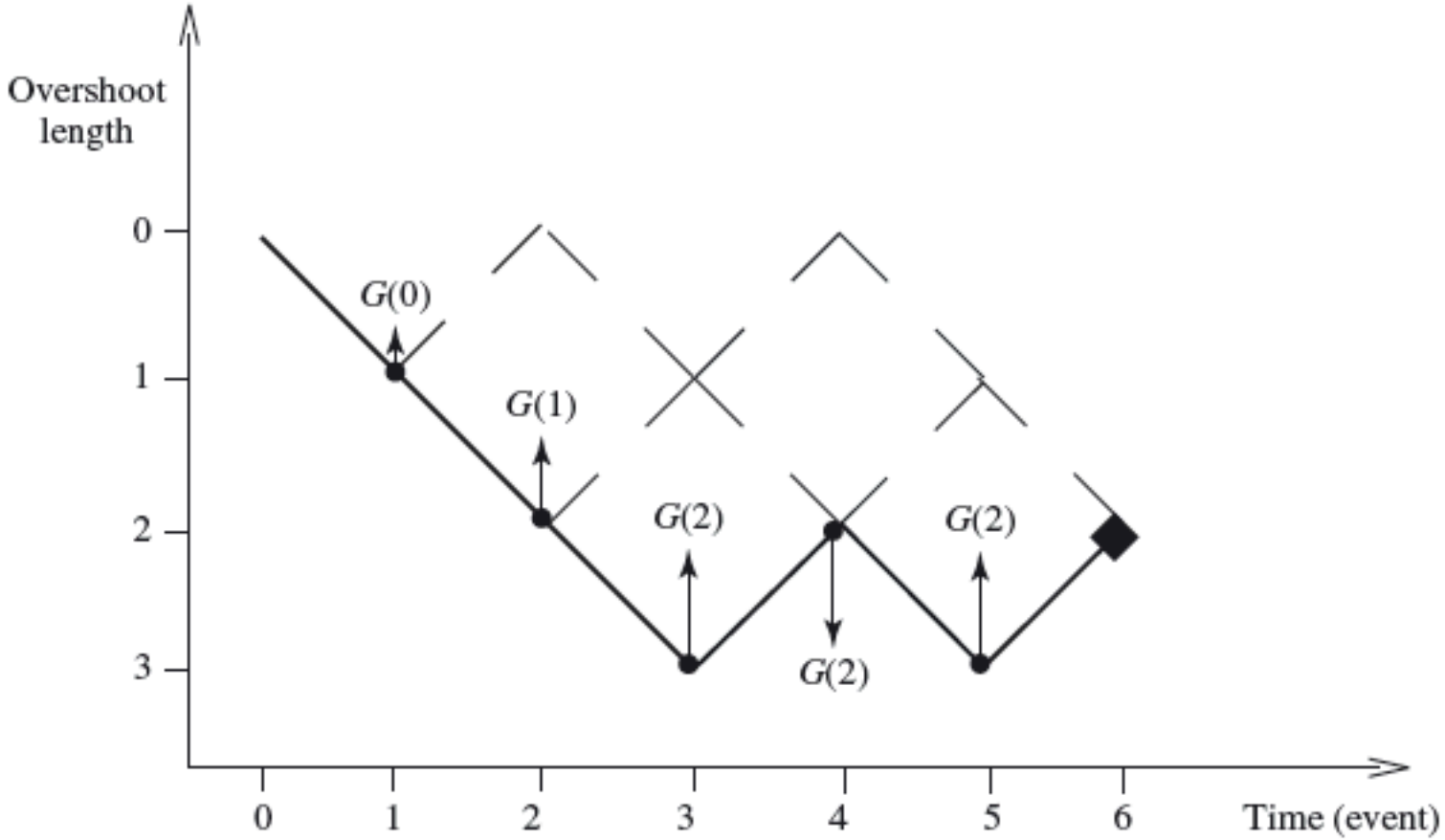


Imbalances Of Supply And Demand Cause Price Overshoots

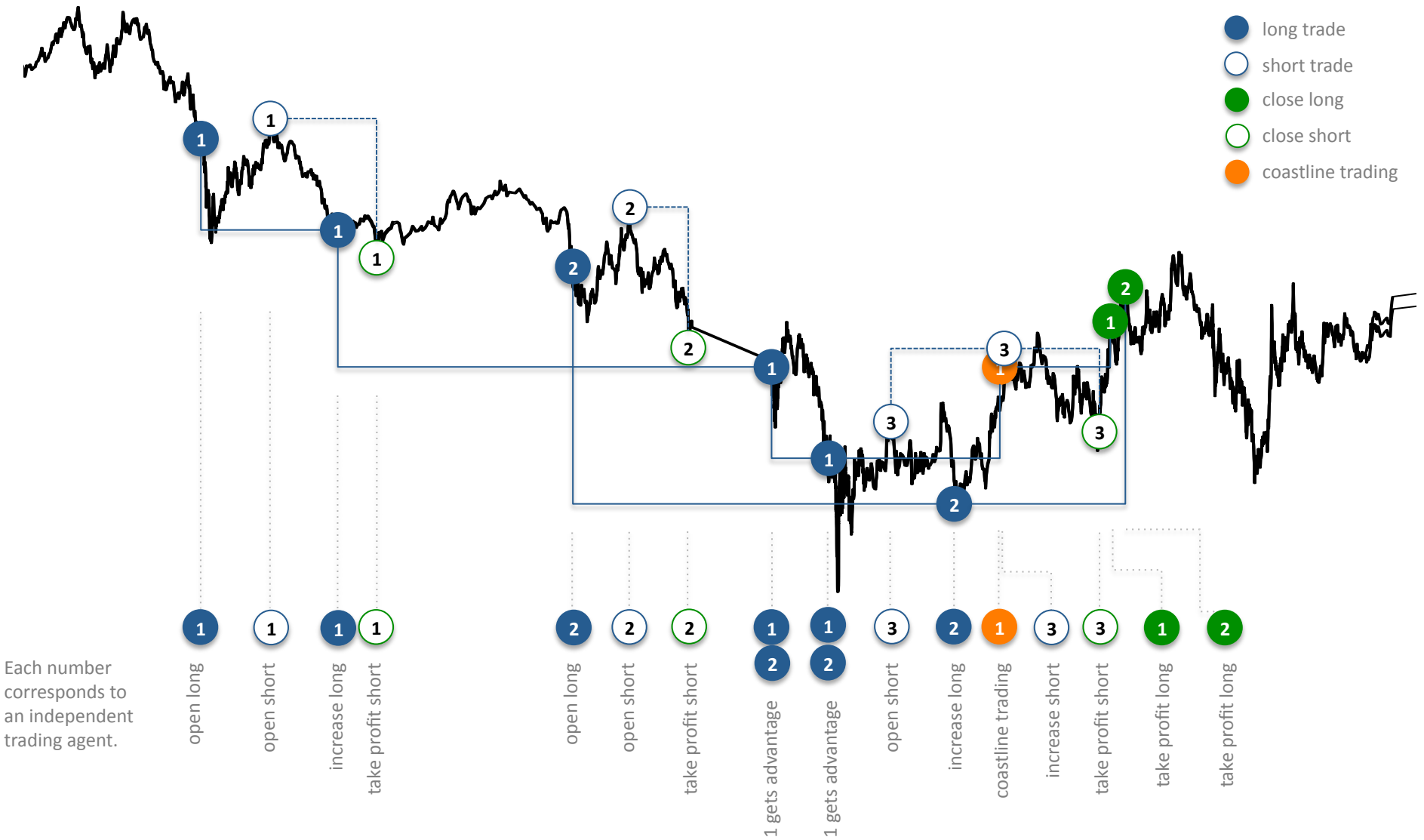


Agent based modeling: we configure agents as virtual traders with simple trading rules.

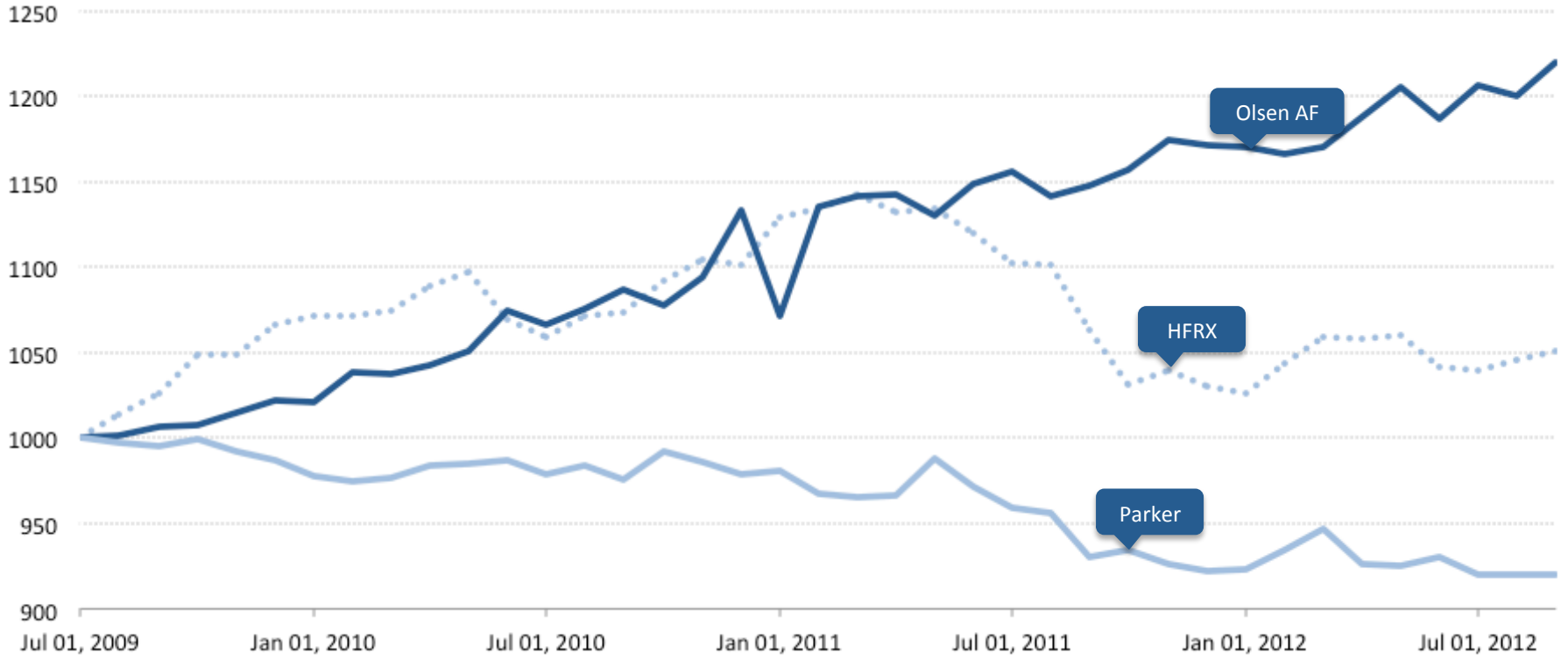
Trading the Coastline



Interacting Agents Trade The Coastline Long And Short



Return Is Reward for Providing Liquidity And Stabilizing Prices.



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Context

45 trillion USD: World Global Product
60 trillion USD: Market Capitalization of equity markets
160 trillion USD: Global Debt

- Crash of 1987
- Crash of 2008
- Flash Crash
- Interest Rate Bubble

Errors and omissions in computational finance translate into losses of 10+ trillion of USD.

Financial Markets Are A Mirror For Real Economy

Outdated middle and back office of financial industry with
based processing and daily interest rate payments

Revamping of financial market infrastructure:
electronic certificates for financial assets and Internet exchange

Global information system with real time forecasts, risk measures
as a Wikipedia-like project.

Price stabilizing investment strategies

Research And Development Agenda

- Collecting big data and making data accessible
- Online Wikipedia for global information system
- Dynamic model of emerging systems
- Theory of scaling laws
- Modeling of market processes
- Emergent social structures
- Financial engines: alpha generating trading models
- Weather maps of financial markets
- Risk modeling
- iPhone like financial products

FuturICT pitches for a 10 year 1 billion EUR program:

….integrating adaptive information and communication technologies, Complexity Science and Social Sciences will create a paradigm shift….

Prof. Dirk Helbing, ETH Zurich

More powerful than all the armies of the world, is an idea whose time has come.

.....Victor Hugo