Multidimensional Directional-Change Intrinsic Time

Scaling Laws and Extension of One-Dimensional Approach

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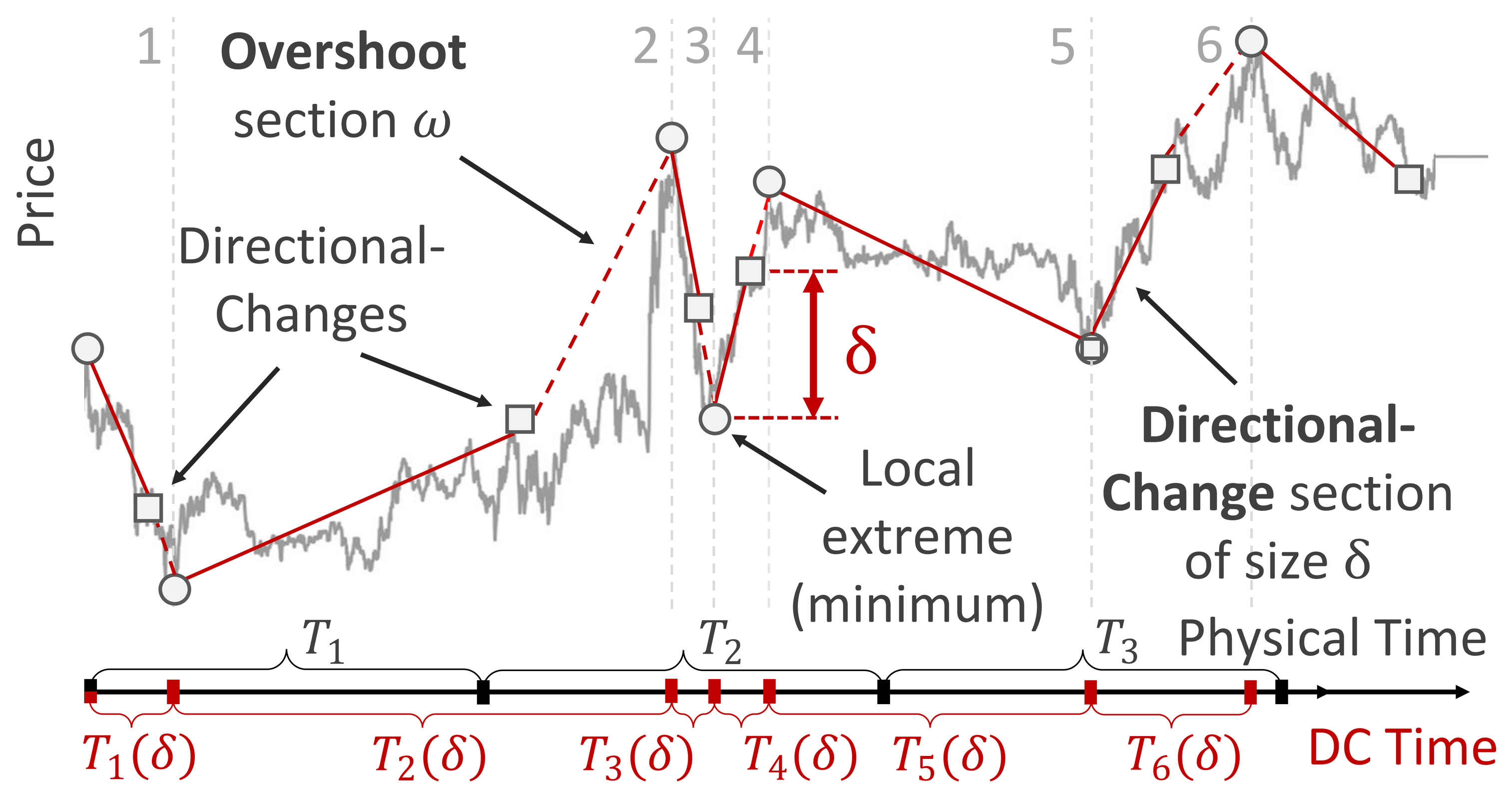
in @pv0011

Directional-Change (DC) Intrinsic Time

Physical time:

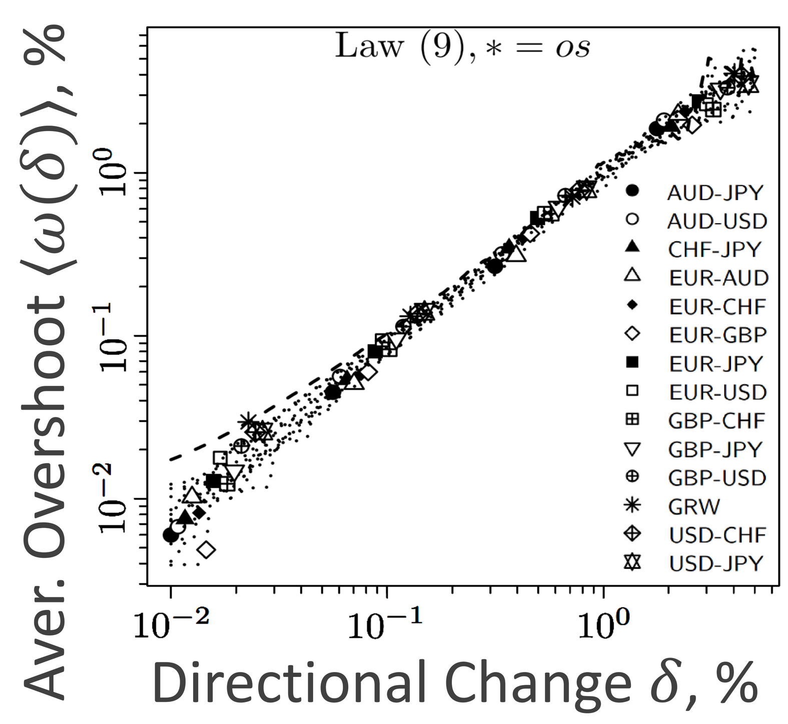
- **Too sparse**, do not capture all the available high-frequency information
- **Too dense** which results in superfluous noisy events in the final time series



Intrinsic time:

- Ticks only when something **significant** happens which affects the price
- Monitors **alternating price moves** of given scale δ measured from local extremes
- Stable **scaling laws**, connection with instantaneous and realized volatility, liquidity

$$\langle \omega(\delta) \rangle = \left(\frac{\delta}{C_\omega} \right)^{E_\omega}$$

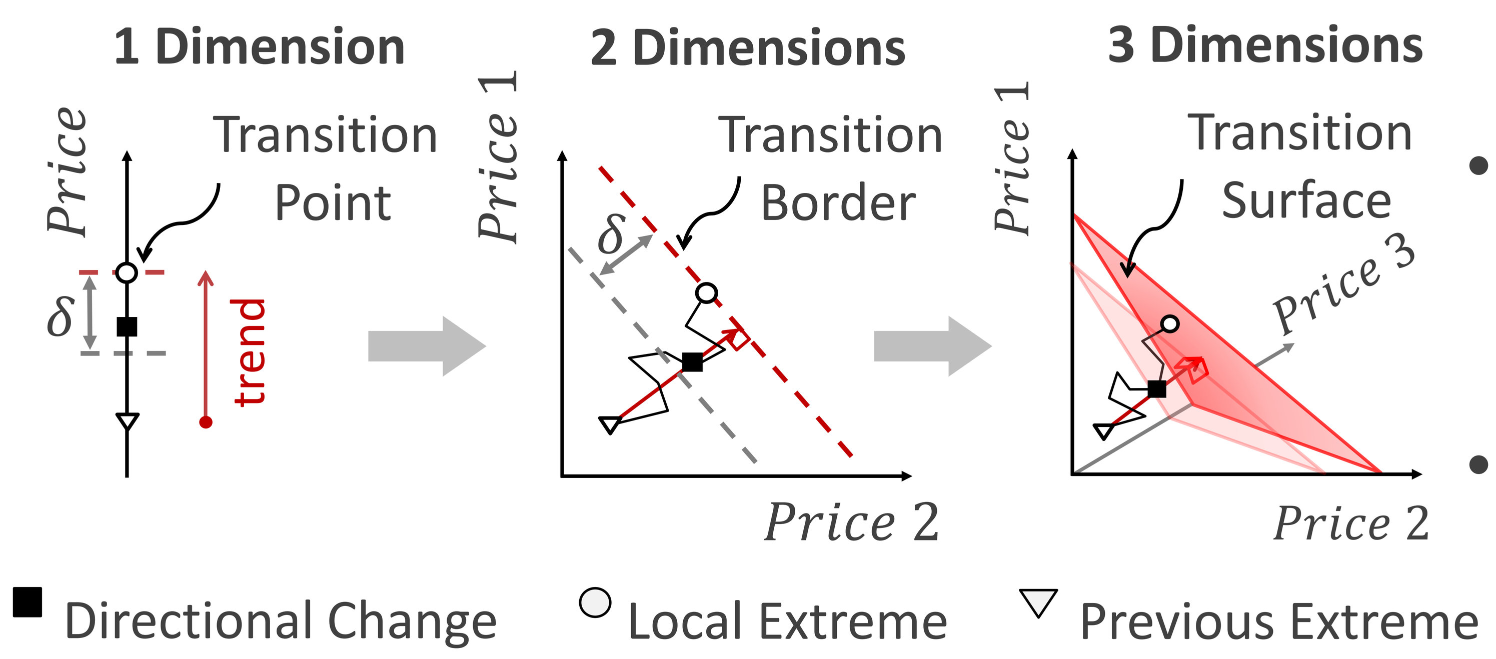


Glattfelder, J. B., A. Dupuis, and R. B. Olsen. "Patterns in high-frequency FX data: discovery of 12 empirical scaling laws." Quantitative Finance 11.4 (2011): 599-614.

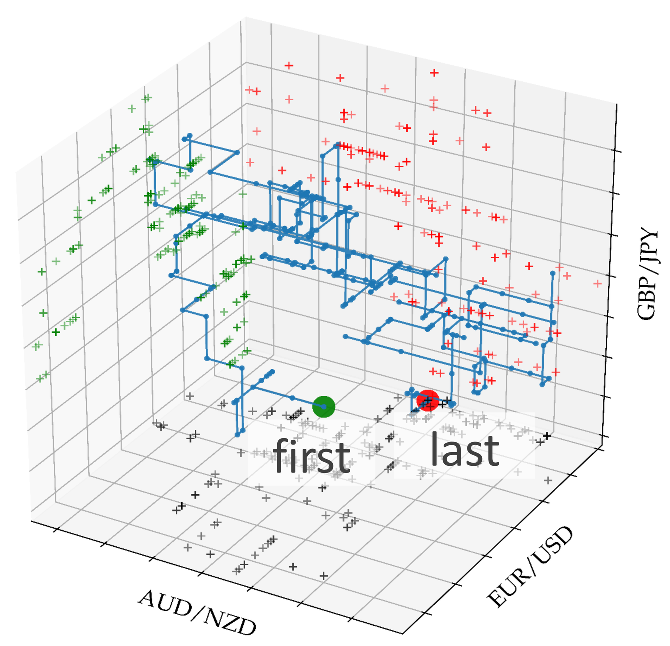
Multidimensional Approach

Higher dimensions:

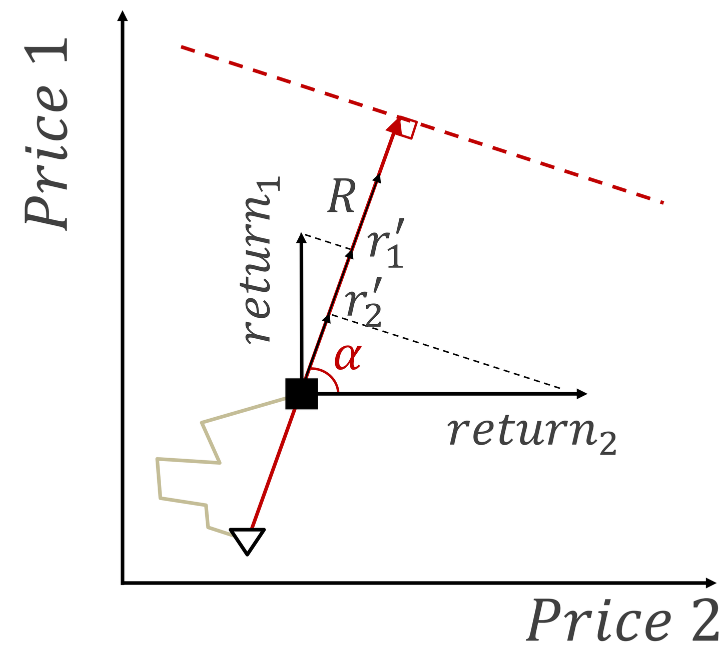
- Dimensions are formed by several different orthogonally placed exchange rates
- Logical extrapolation to higher dimensions: definition of local extremes from point to line, from line to surface etc.



Price trajectory in **3D**



From **2D** back to **1D**



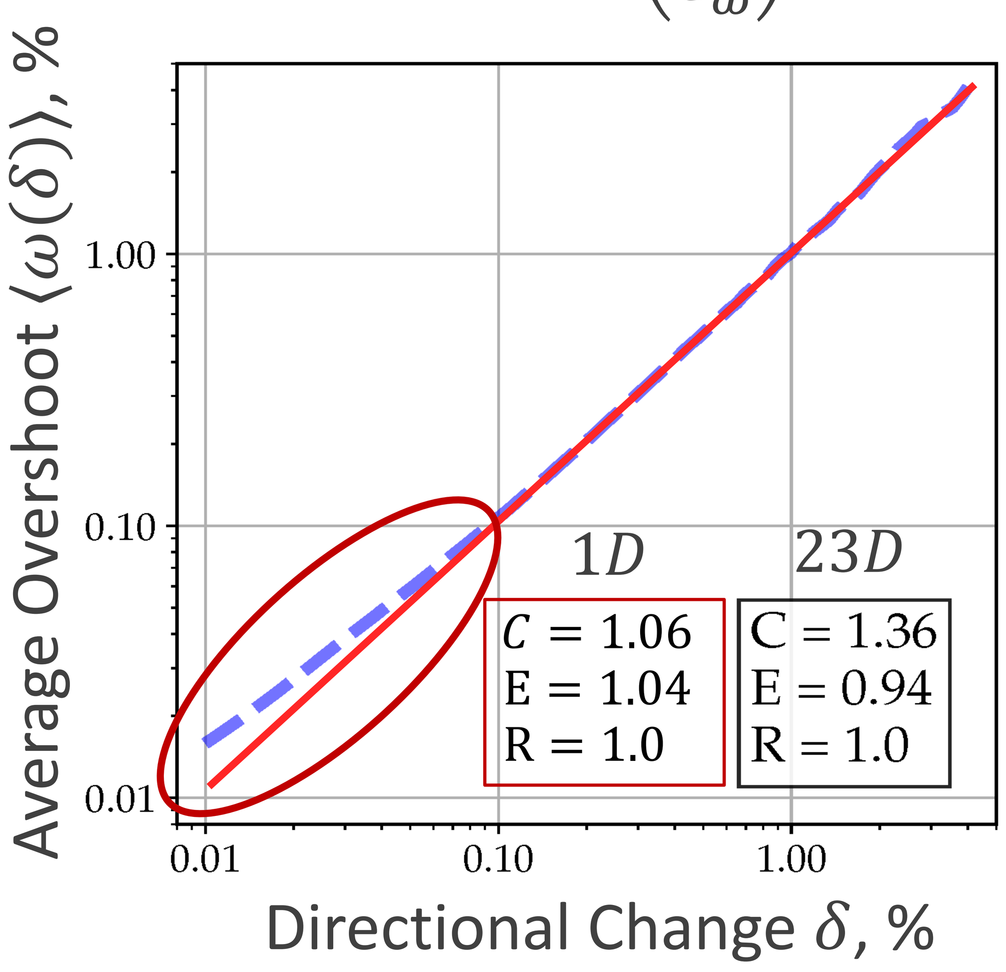
- As more information can be captured the **higher performance** of methods based on intrinsic time is expected
- Transition from higher to lower dimensions allows the use of techniques developed for the one-dimensional DC intrinsic time concept

Intrinsic Time Properties of 23D FX Market

- Scaling laws revealed in one-dimensional case are **still observed** when the number of dimensions is increased
- Scaling law dependencies **substantially deviate** from the expected linear dependence in the range of **small thresholds**
- The approach works with tick-by-tick data so no pre-processing of data is needed

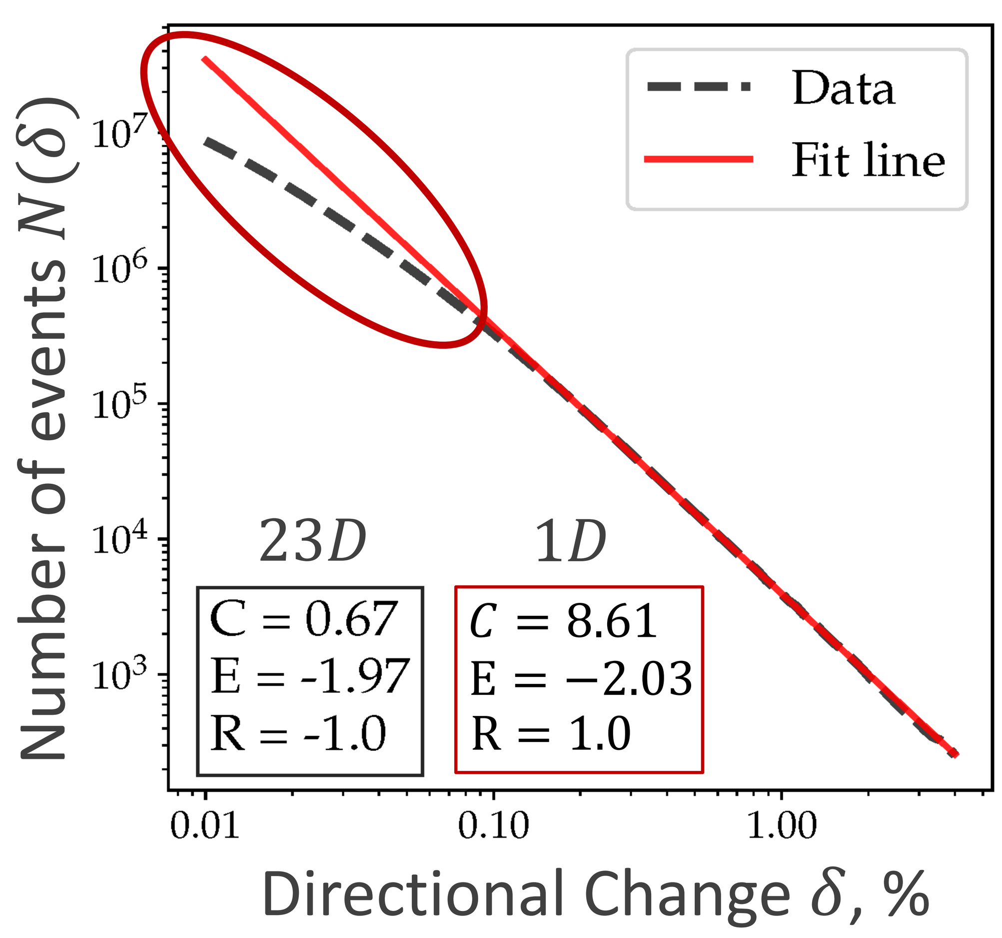
Overshoot scaling law

$$\langle \omega(\delta) \rangle = \left(\frac{\delta}{C_\omega} \right)^{E_\omega}$$



DC count scaling law

$$N(\delta) = \left(\frac{\delta}{C_N} \right)^{E_N}$$



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