Bus 701:
Advanced Statistics

Harald Schmidbauer

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Harald Schmidbauer	**harald** at **hs-stat** dot **com**
Angi Rösch	**angi** at **angi-stat** dot **com**

- The slides were produced using LaTeX and R (the R project; website: www.R-project.org) on a GNU/Linux system.

- R files used for this course are available upon request.

Some Projects

From Our Recent Research

Recent (and ongoing) research projects.

The following slides give an outline of four projects.

- Project 1: Green segmentation: a cross-national study
  (with Barış Yılmazsoy & Angi Rösch)
- Project 2: OPEC Announcements and Oil Price Volatility
  (with Angi Rösch)
- Project 3: Algorithmic Trading
  (with Angi Rösch, Vehbi Sinan Tunalıoğlu, Tolga Sezer)
- Project 4: Shock dynamics in networks of asset markets
  (with Angi Rösch, Erhan Uluceviz, Narod Erkol)
- Project 5: Applied wavelets
  (with Angi Rösch)

Project 1:
Green Segmentation: A Cross-National Study

Some aspects.

- world facing environmental challenges
- business consequences
- shift in consumer attitude and preferences
- understanding the "green" consumer is important
- key concepts: attitudes, behavioural intentions
- theory of Reasoned Action:
  attitudes $\Rightarrow$ behavioural intentions $\Rightarrow$ actual behaviour
- relationship between green attitudes and green behaviour:
  no agreement in literature

Project 1:
Green Segmentation: A Cross-National Study

The questionnaire: Attitude items.

strongly agree / agree / indifferent / don't agree / don't agree at all

- Tenor, basic attitudes: A1, A4, A9

  too much trouble; not too late to save the environment; natural resources are scarce

- Emotional concern: A2, A5, A8

  responsible for global warming; frustrated with industies polluting; frightened with chemicals in food

- Scepticism: A3, A6, A7

  job loss; green trend is marketing gimmick; benefits of consumer products more important

Project 1:
Green Segmentation: A Cross-National Study

The questionnaire: Behaviour items.

always / mostly / sometimes / rarely / never

- Daily behaviour: B1, B3, B8, B9

  using public transport; re-usable bags; energy-saving light bulbs; recycling

- Consumption: B5, B6

  products with less packaging; buying more expensive "greener alternative"

- Environmental activism: B2, B4, B7

  advising others; participation in meetings; reading about environmental issues

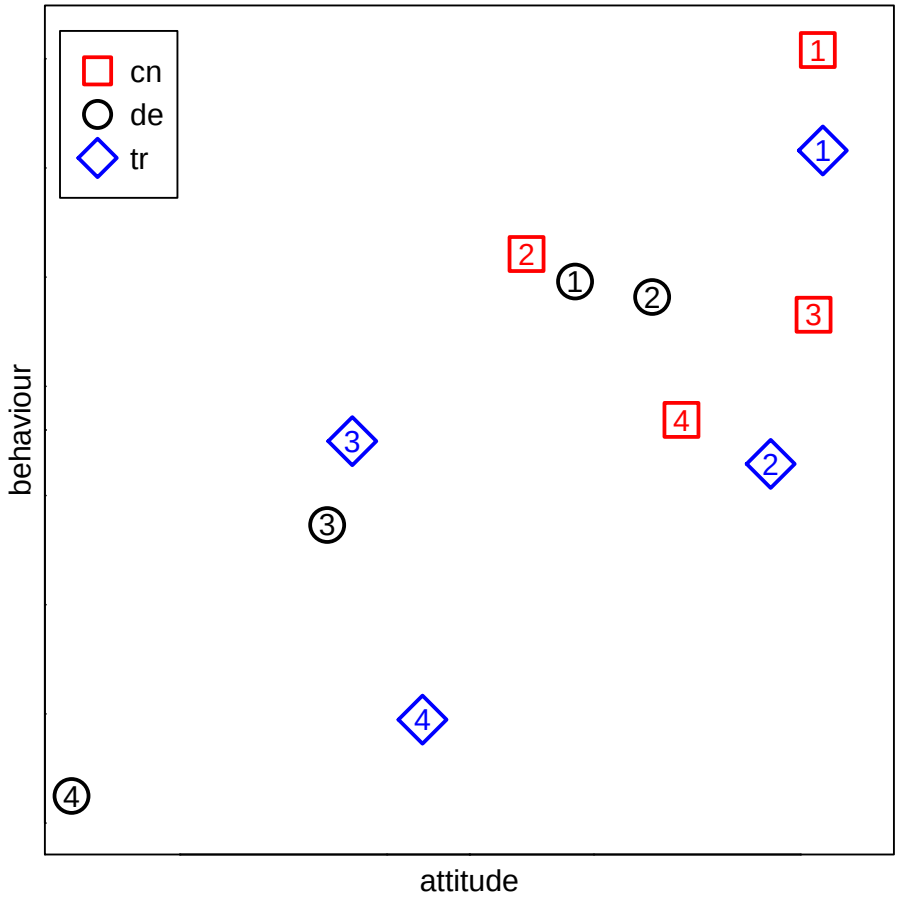
Project 1:
Green Segmentation: A Cross-National Study

Data & Analysis.

- Data (convenience sample) from China (395), Germany (360), Turkey (660)
- students enrolled in business-related programmes in private/public universities
- "Split the difference"-method used to eliminate gender effect
- For each country: four segments (clusters) obtained using "pam"

Project 1:
Green Segmentation: A Cross-National Study

Characterizing clusters.



Project 1:
Green Segmentation: A Cross-National Study

Managerial Implications.

- Focus on segment-specific customer expectations.
- Incentive for shifting customers to "greener segment"?
- "Positive marketing": parties exchange value such that they are better off
- Environmental attitude and purchase channel choice???

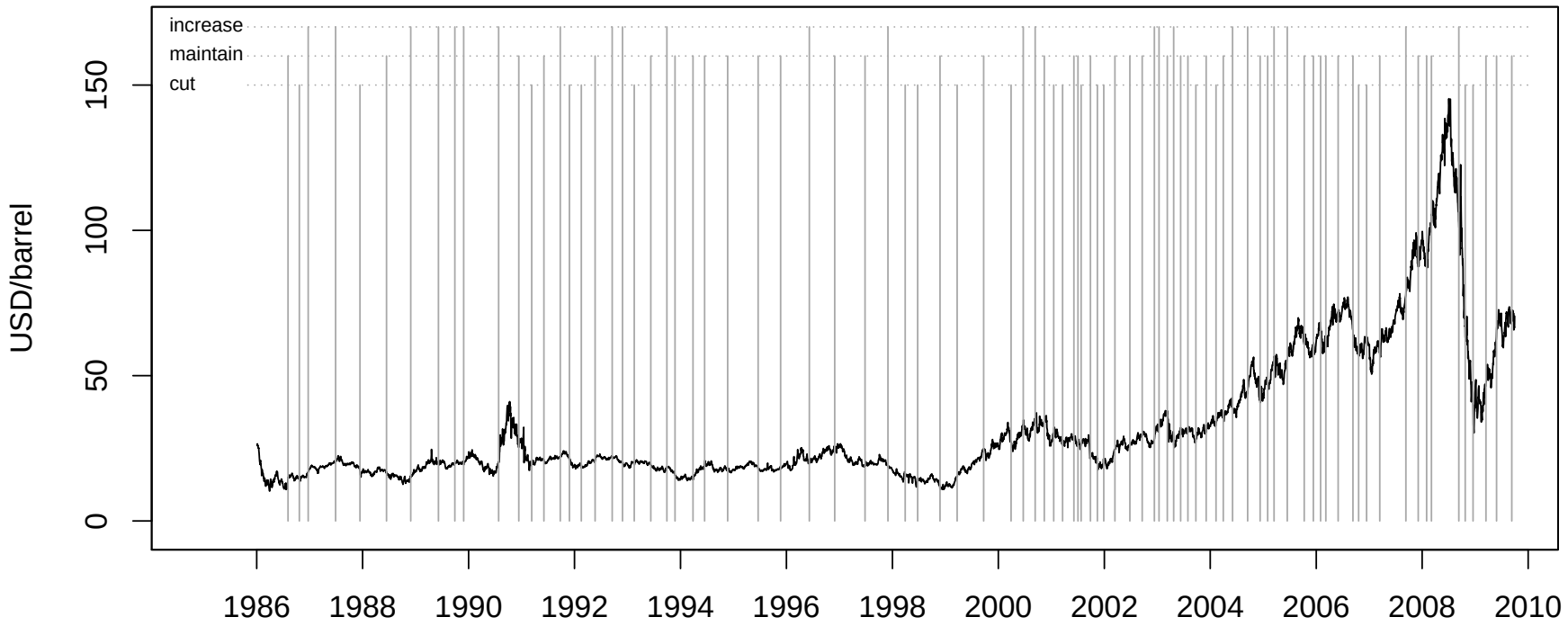
Project 2:
OPEC Announcements and Oil Price Volatility

Crude oil prices and OPEC announcements.

- Impact of OPEC announcements on crude oil prices?
- Impact on the distribution of daily returns, in particular:
  - on the expectation of daily returns?
  - on the variance of daily returns?
- What can be said about expectation and volatility. . .
  - right *before* an announcement will be made (anticipation of the announcement),
  - right *after* an announcement has been made (aftereffect of the announcement)?

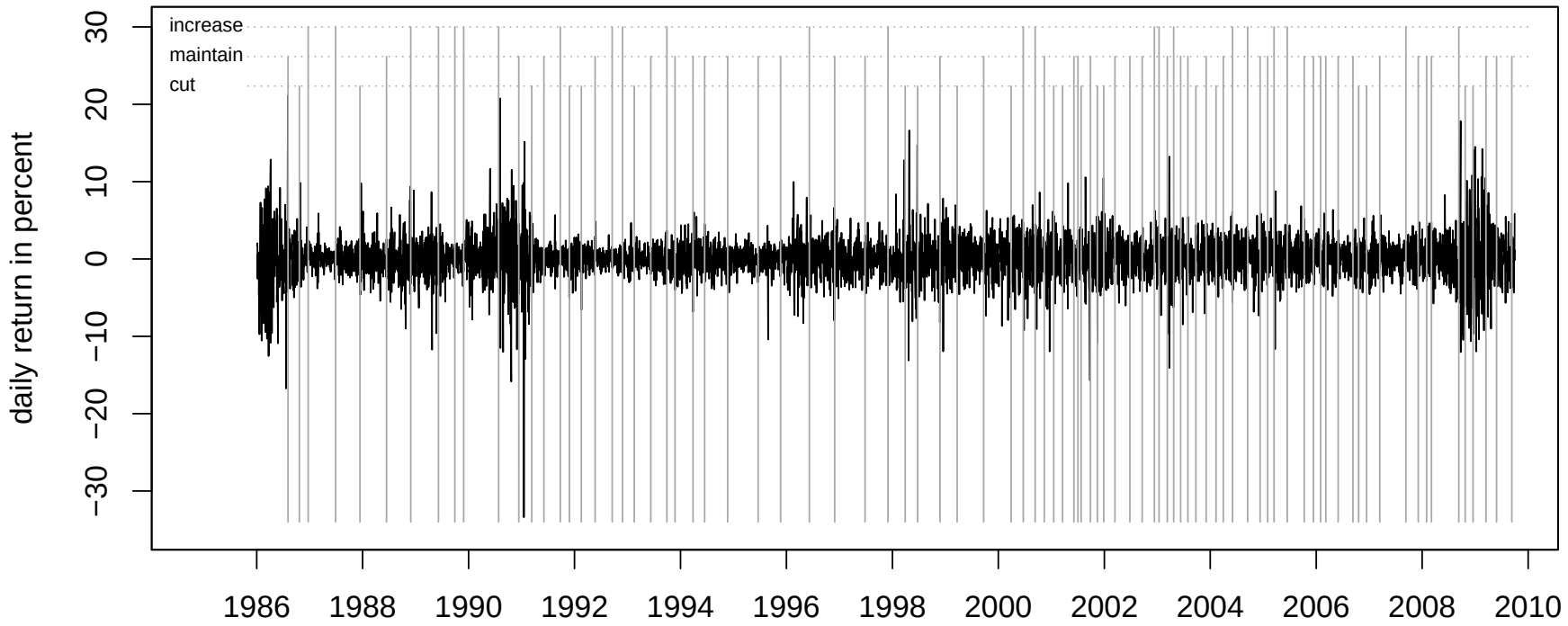
Project 2:
OPEC Announcements and Oil Price Volatility

The WTI price series and OPEC announcements.



Project 2:
OPEC Announcements and Oil Price Volatility

The daily WTI return series and OPEC announcements.



Project 2:
OPEC Announcements and Oil Price Volatility

Regression: conditional expectation; GARCH: conditional variance.

$$r_t = c + \sum_{s \geq 1} a_s r_{t-s} + \sum_i b_i d_{it} + \epsilon_t, \tag{1}$$

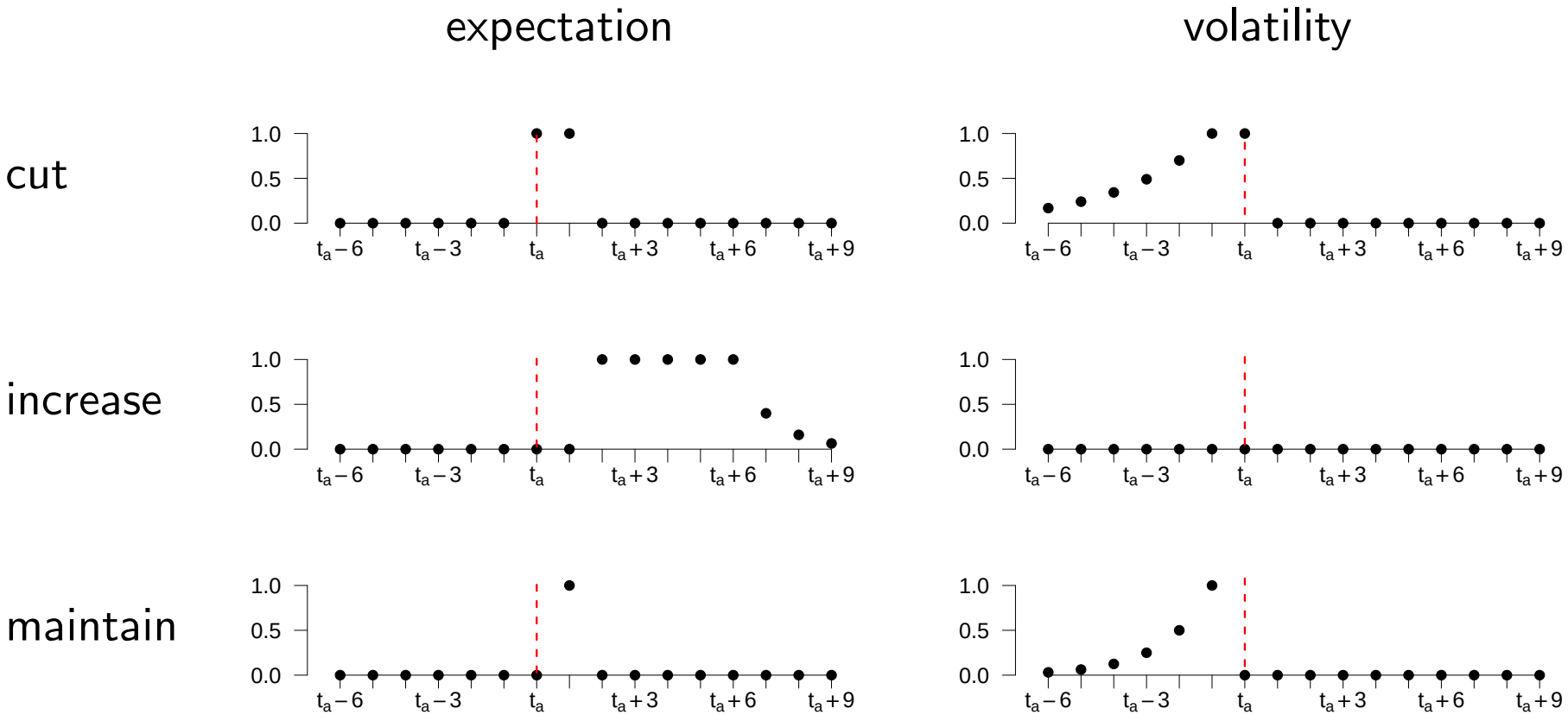
$$\epsilon_t = \nu_t \cdot \sqrt{h_t}, \tag{2}$$

$$h_t = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \beta h_{t-1} + \sum_i \gamma_i d_{it}. \tag{3}$$

- (r_t): series of daily returns on WTI crude oil price
- (d_{it}): (modified) dummy variables for announcements of kind i
- (ν_t): Gaussian white noise with $\mathrm{var}(\nu_t) = 1$
- b_i, γ_i: parameters (impact of an announcement of kind i)

Project 2:
OPEC Announcements and Oil Price Volatility

Summary: The optimal model structure.



Project 2:

OPEC Announcements and Oil Price Volatility

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OPEC news announcements: Effects on oil price expectation and volatility

Harald Schmidbauer [a,*], Angi Rösch [b]

[a] Department of Business Administration, Bilgi University, Istanbul, Turkey
[b] FOM University of Applied Sciences, Munich, Germany

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ABSTRACT

Several times a year, OPEC hosts conferences among its members to agree on further oil production policies. Prior to OPEC conferences, there is usually rampant speculation about which decision concerning world oil production levels (no change, increase, or cut) will be announced. The purpose of our investigation is to assess the impact of OPEC announcements on expectation and volatility of daily oil price changes (returns). We modify dummy variables indicating the day of an OPEC announcement to reflect a certain pattern of impact on return expectation and volatility. A combination of regression and GARCH models can then differentiate between pre- and post-announcement effects, and distinguish between the three kinds of OPEC decisions.
We find evidence for a post-announcement effect on expectation, which is negative in the case of a cut decision and positive in case of an increase or maintain decision, while there is a positive pre-announcement effect on volatility, which is strongest in the case of a cut decision.

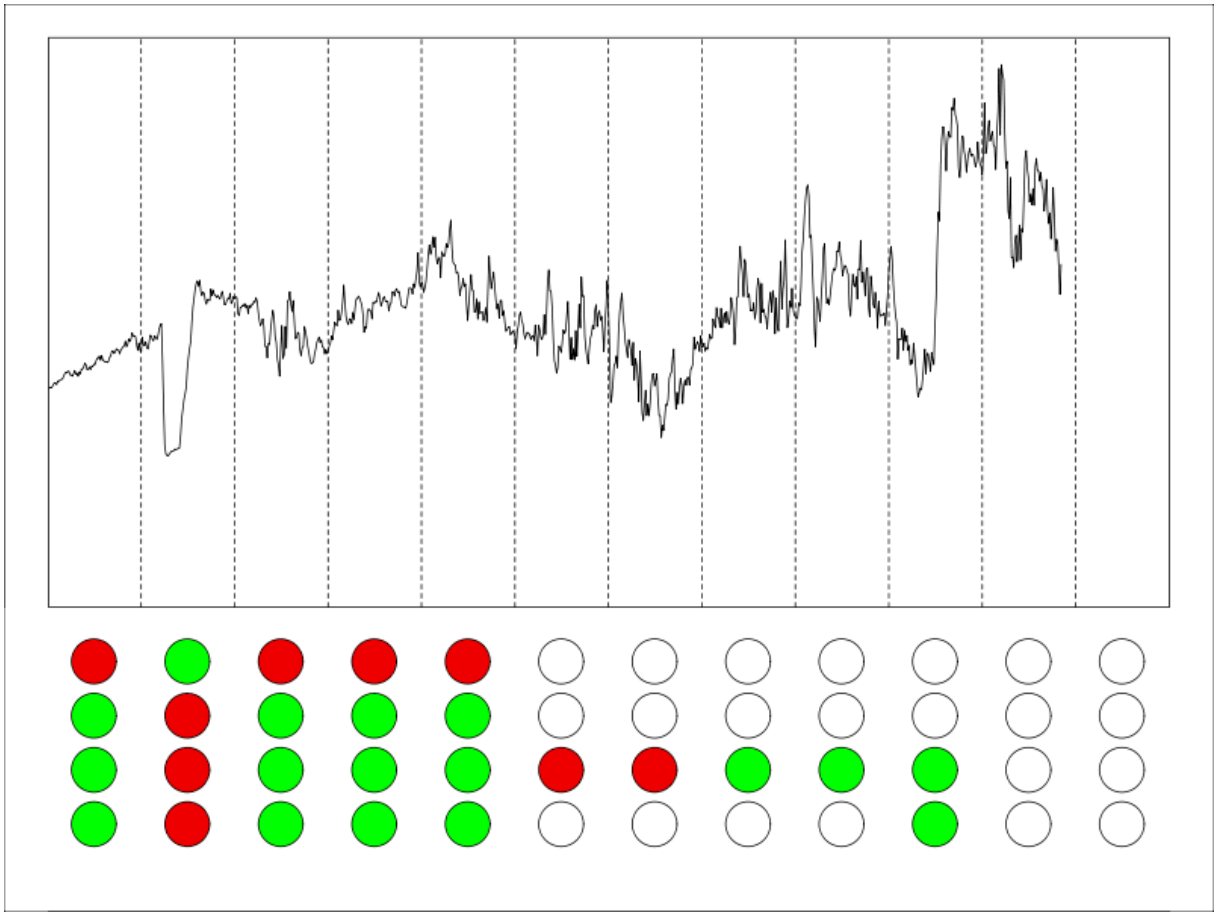
Project 3:
Algorithmic Trading

Algorithmic trading.

- Can we combine simple trading rules to generate profit?
- Example: €-$ trading.
  - Trading every 5 minutes.
  - Use 2 days' data to construct a trading rule.
  - Use this rule for the next day.

Project 3:
Algorithmic Trading

A sequence of trading signals.



Project 3:
Algorithmic Trading

How to obtain complex trading rules?

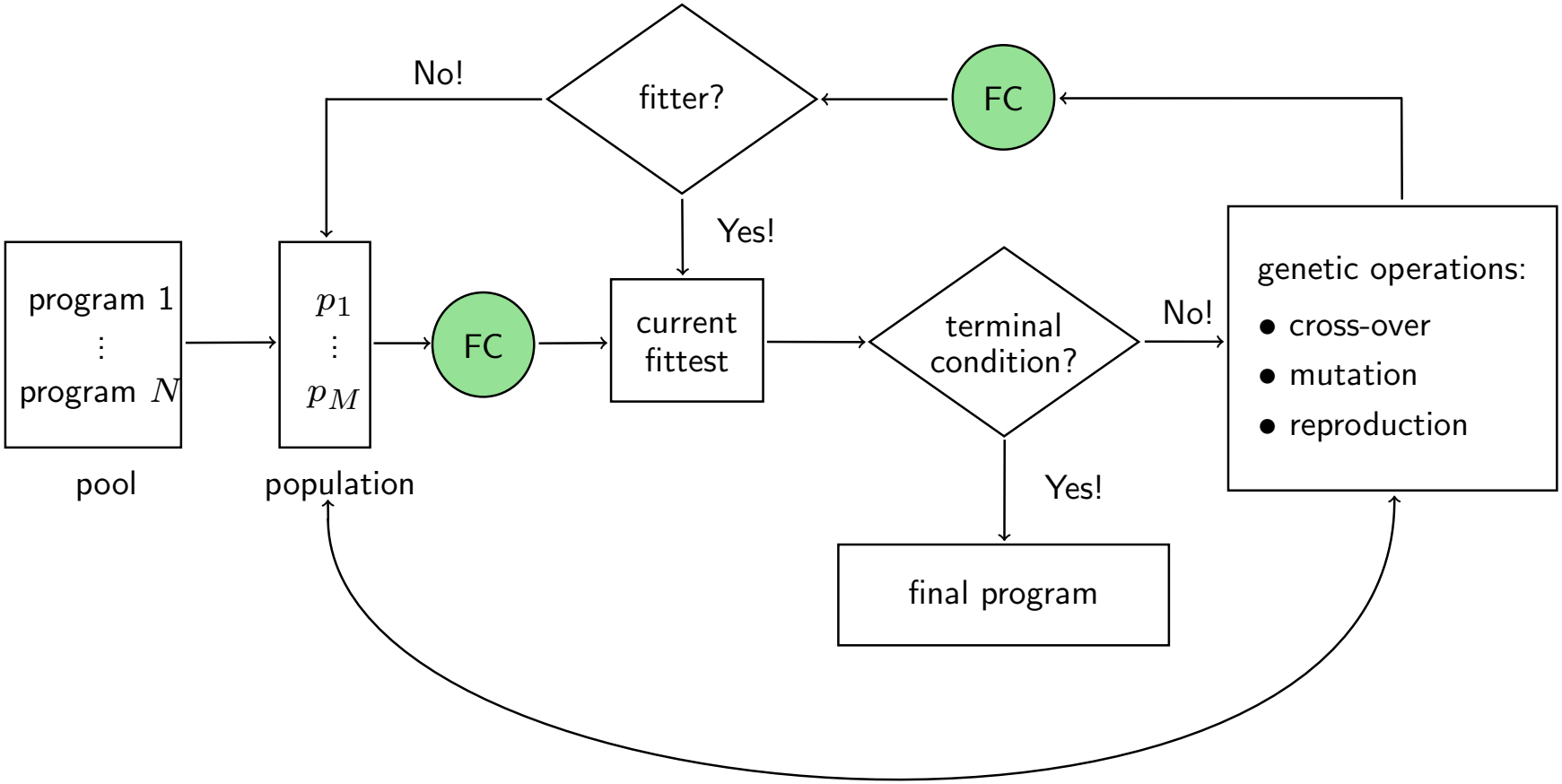
- Genetic algorithm: based on
  - cross-over
  - mutation
  - reproduction
- Example of a program:

(IF $TR_1 =$ "buy!") AND NOT $\Big($($TR_2 =$ "sell!") OR ($TR_3 =$ "sell!")$\Big)$

THEN "buy!"

Project 3:
Algorithmic Trading

Creating a Program.



Project 3:
Algorithmic Trading

Keywords.

- data-snooping bias
- robustness
- time series bootstrap
- tick data

Project 3:
Algorithmic Trading

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ROBUST TRADING RULE SELECTION AND FORECASTING ACCURACY

SCHMIDBAUER Harald · RÖSCH Angi · SEZER Tolga · TUNALIOĞLU Vehbi Sinan

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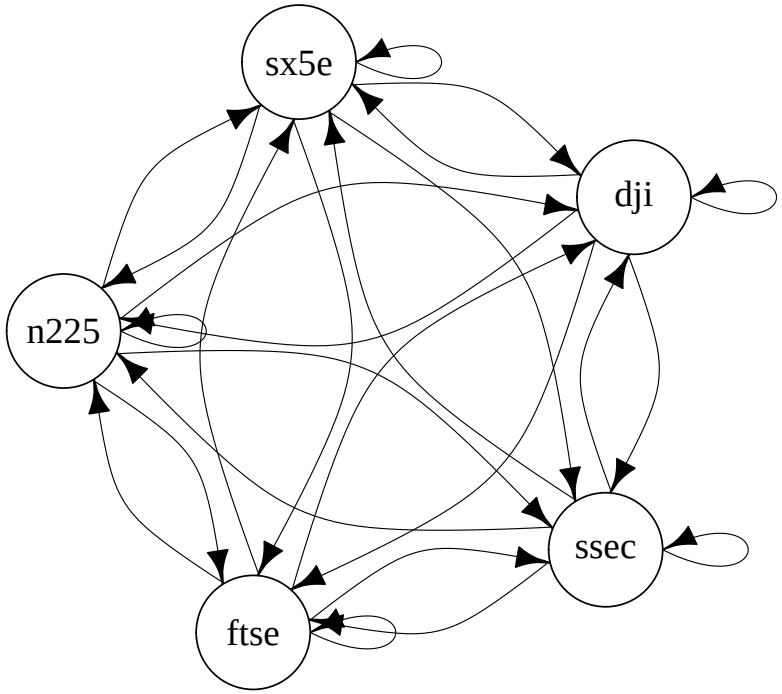
Abstract Trading rules performing well on a given data set seldom lead to promising out-of-sample results, a problem which is a consequence of the in-sample data snooping bias. Efforts to justify the selection of trading rules by assessing the out-of-sample performance will not really remedy this predicament either, because they are prone to be trapped in what is known as the out-of-sample data-snooping bias. Our approach to curb the data-snooping bias consists of constructing a framework for trading rule selection using a-priori robustness strategies, where robustness is gauged on the basis of time-series bootstrap and multi-objective criteria. This approach focuses thus on building robustness into the process of trading rule selection at an early stage, rather than on an ex-post assessment of trading rule fitness. Intra-day FX market data constitute the empirical basis of the proposed investigations. Trading rules are selected from a wide universe created by evolutionary computation tools. The authors show evidence of the benefit of this approach in terms of indirect forecasting accuracy when investing in FX markets.

Project 4:
Shock dynamics in networks of asset markets

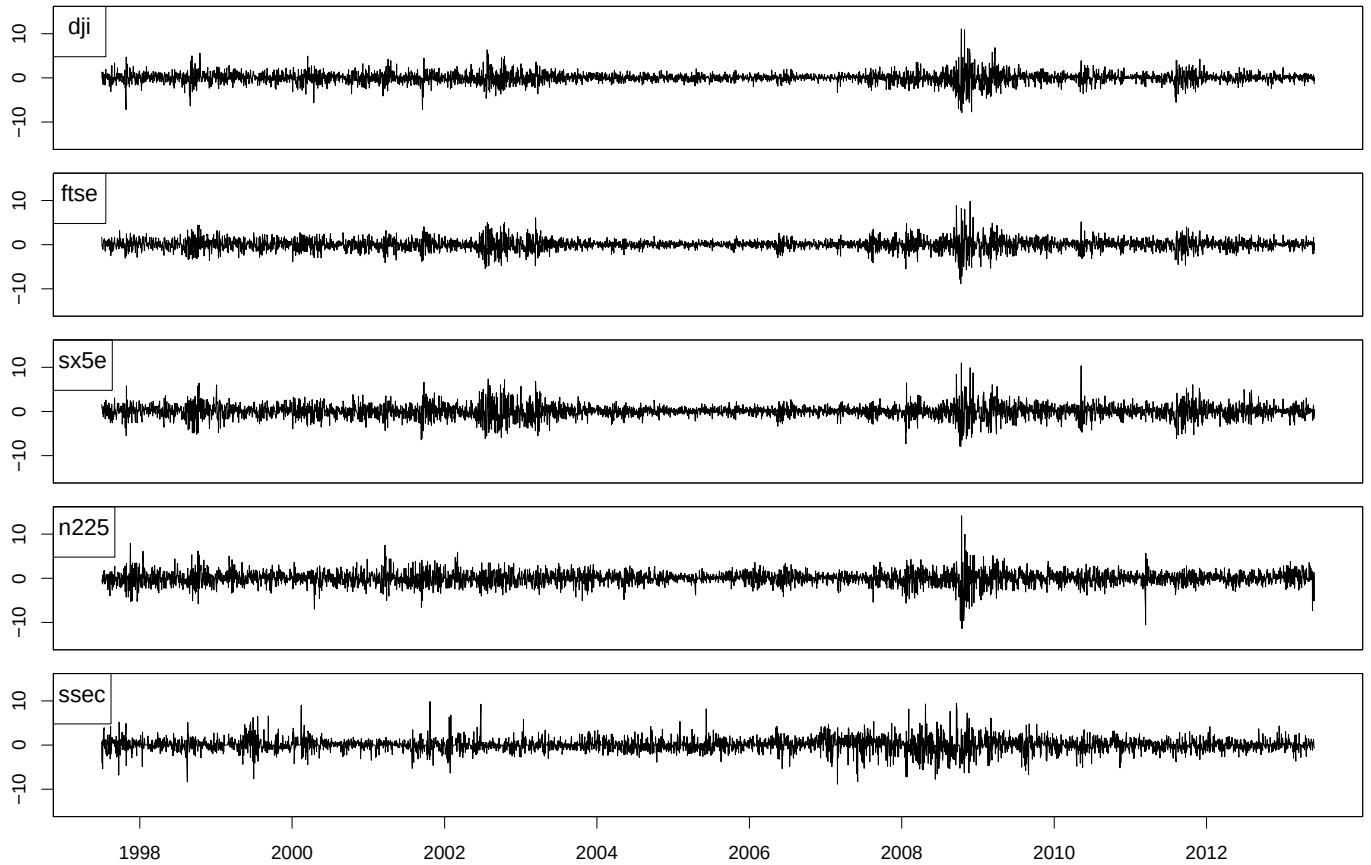
A network.



- edge weight: volatility spillovers (VAR model, fevd)
- importance of node?
- network stability?

Project 4:
Shock dynamics in networks of asset markets

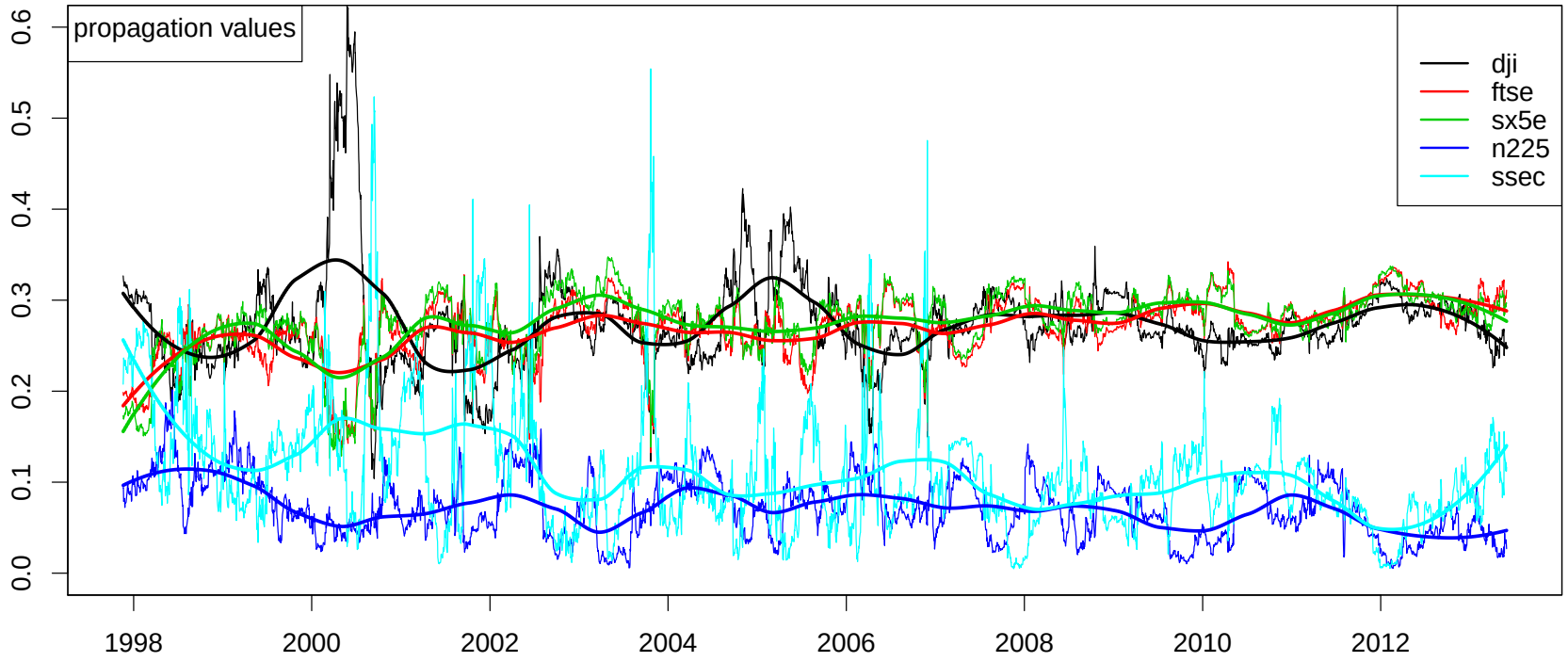
Daily returns.



Project 4:

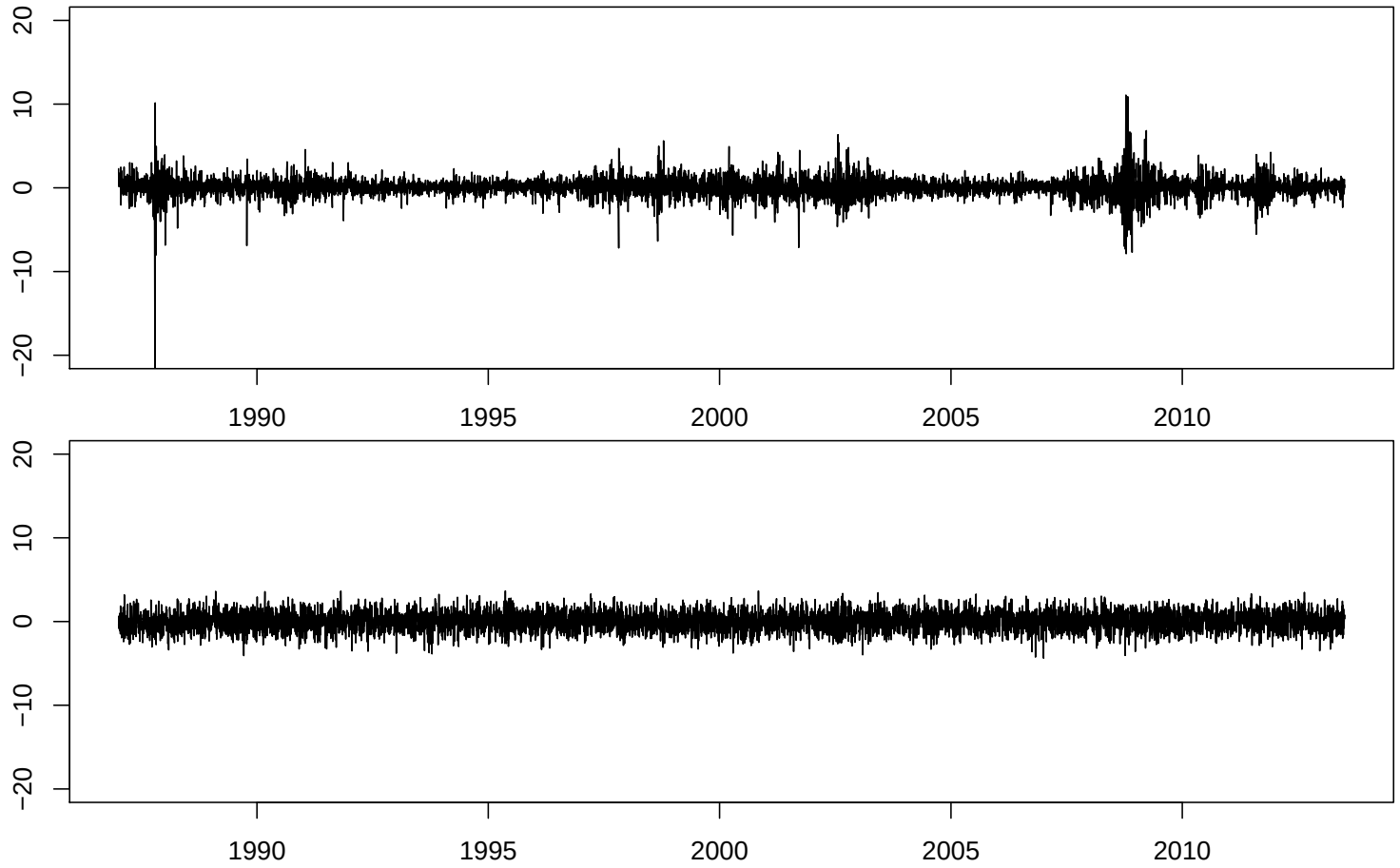
Shock dynamics in networks of asset markets

One result: propagation values.



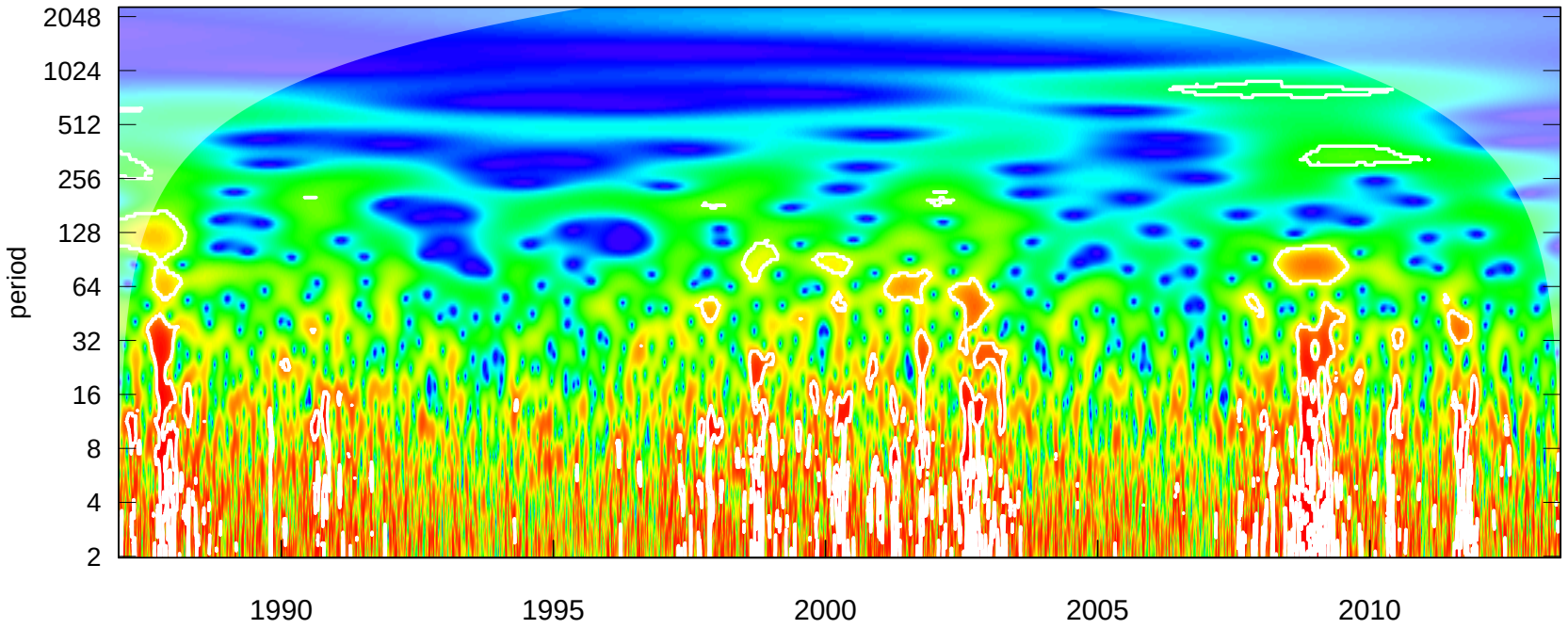
Project 5:
Applied wavelets

DJIA daily returns; white noise.



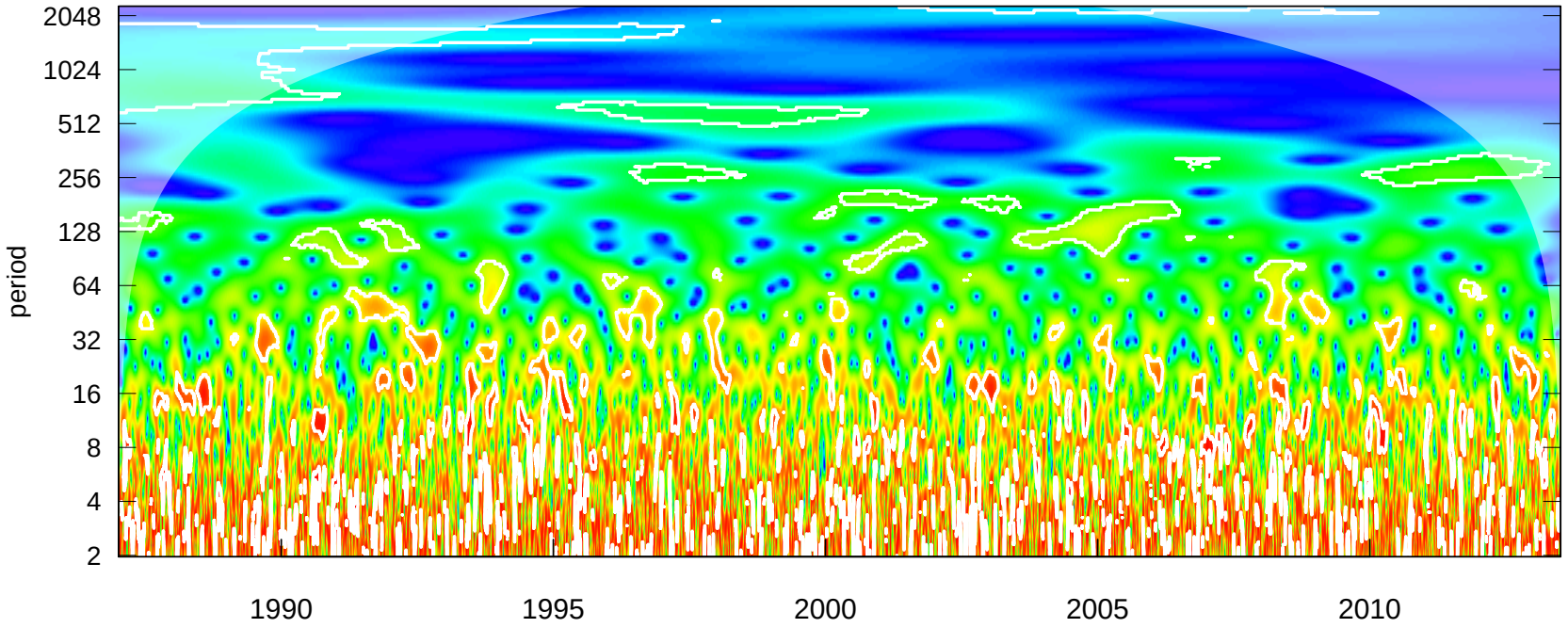
Project 5:
Applied wavelets

Wavelet power spectrum: DJIA returns.



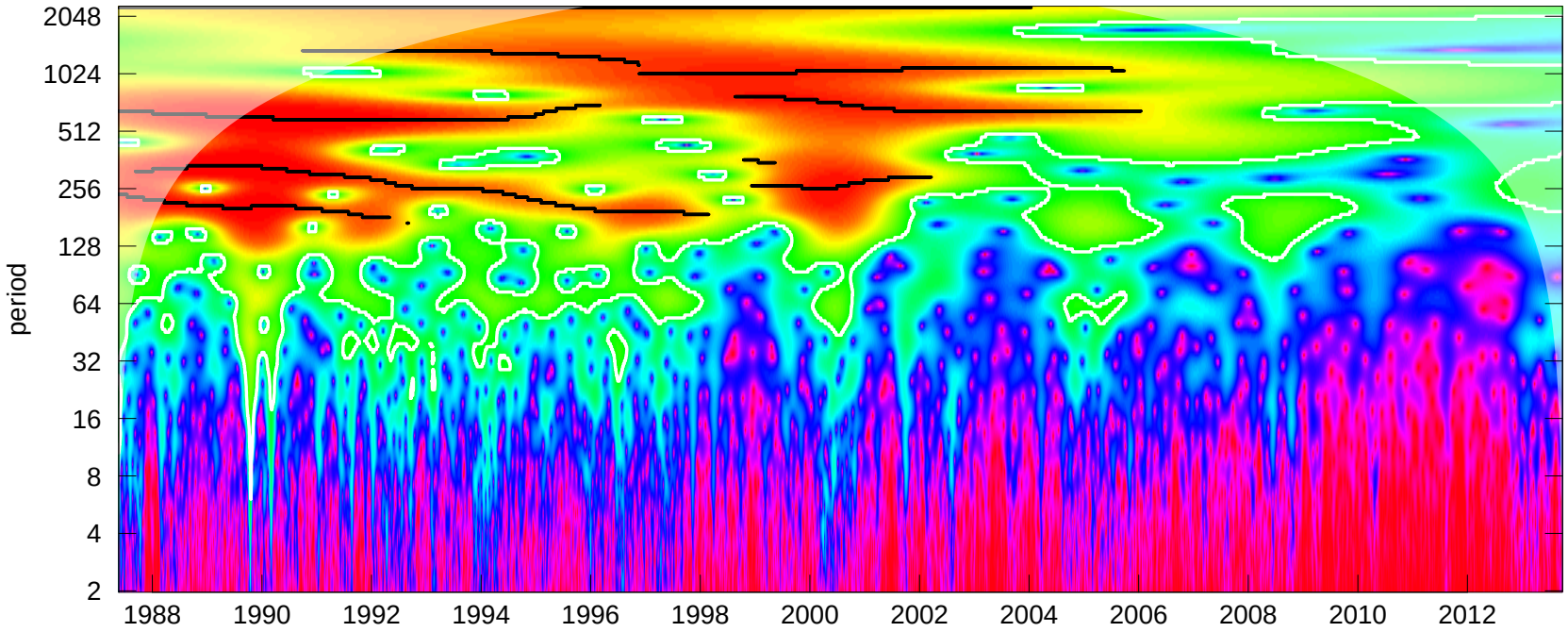
Project 5:
Applied wavelets

Wavelet power spectrum: white noise.



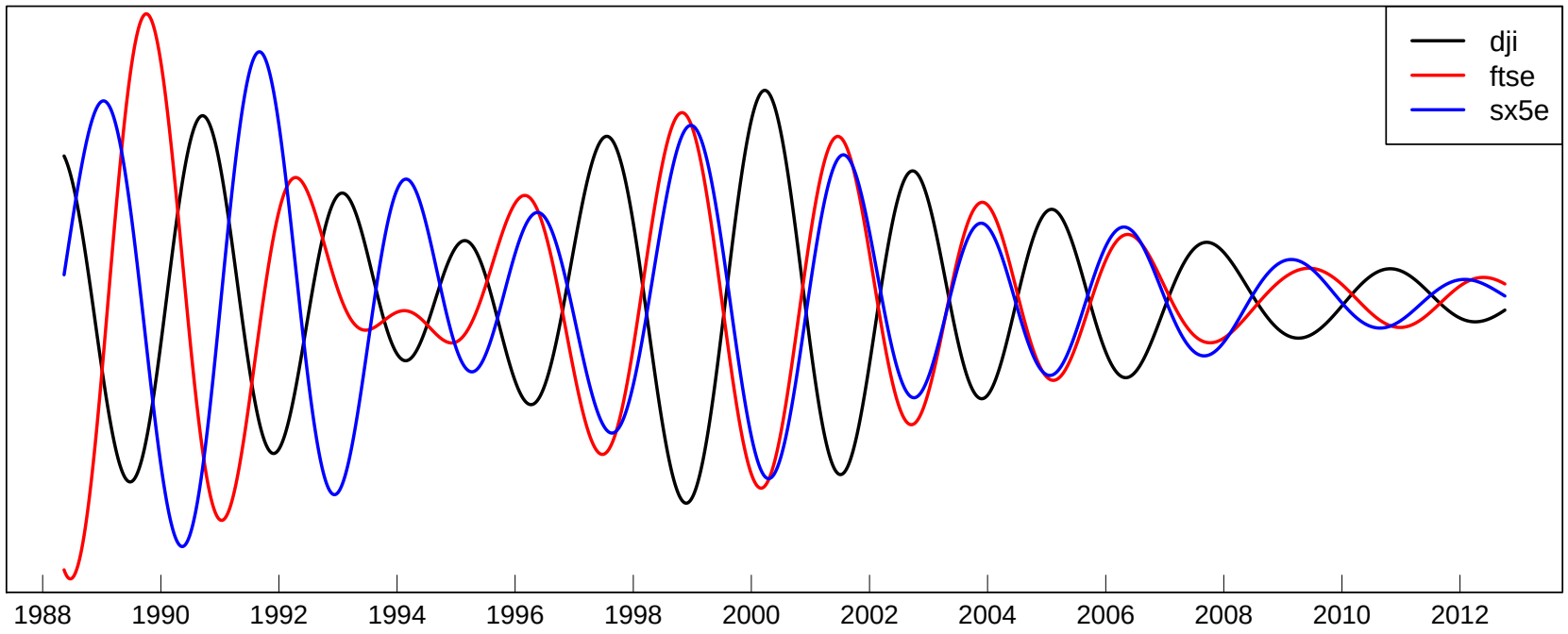
Project 5:
Applied wavelets

Wavelet power spectrum: propagation values, DJIA.



Project 5:
Applied wavelets

Reproducing propagation values, period = 750.



Further projects

Further projects, among others:

- festivals and gold prices
- population dynamics with Leslie-type models
- Crude oil price and USD/euro exchange rate volatility spillovers
- applications of connectedness/shock dynamics
- WaveletComp: R package
- . . .