EC 613:
Advanced Topics in Financial Econometrics

FEC 514:
Applications in Financial Modeling

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About These Slides

- The present slides are not self-contained; they need to be explained and discussed. This will be done in the lectures.

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- 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.

Chapter 1:

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, Tolga Sezer, Vehbi Sinan Tunalıoğlu)
- Project 4: Population Dynamics With Leslie-Type Models
  (with Angi Rösch & Narod Erkol)

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

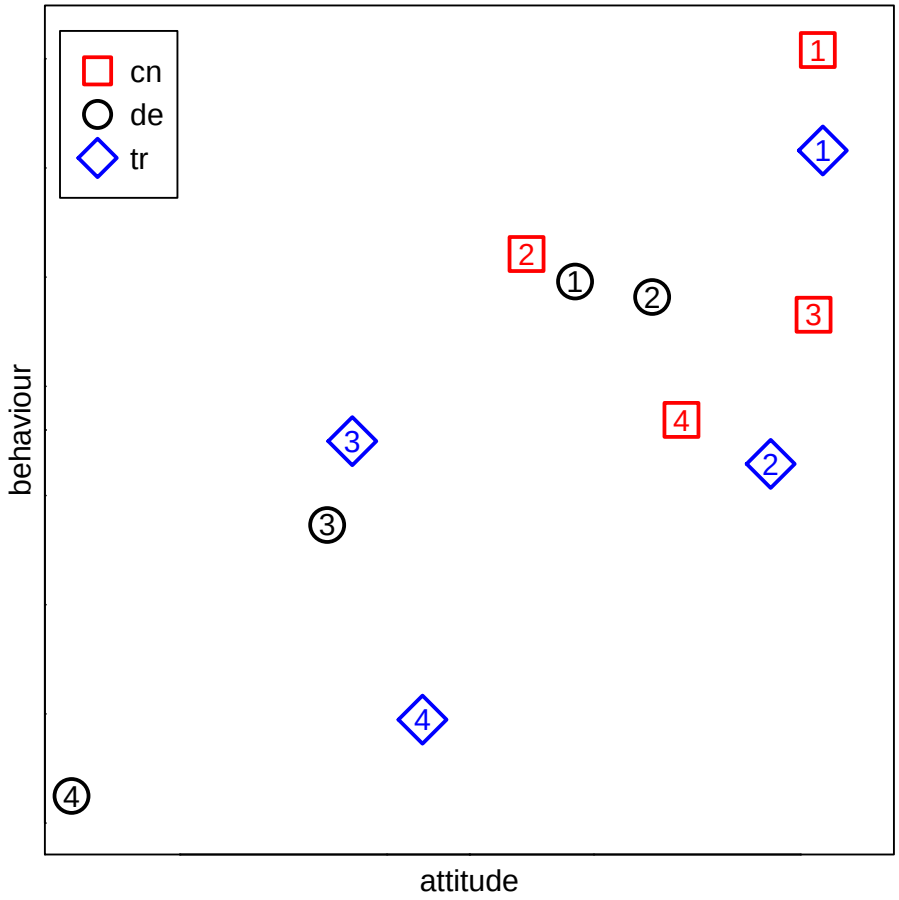
Project 1:
Green Segmentation: A Cross-National Study

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???

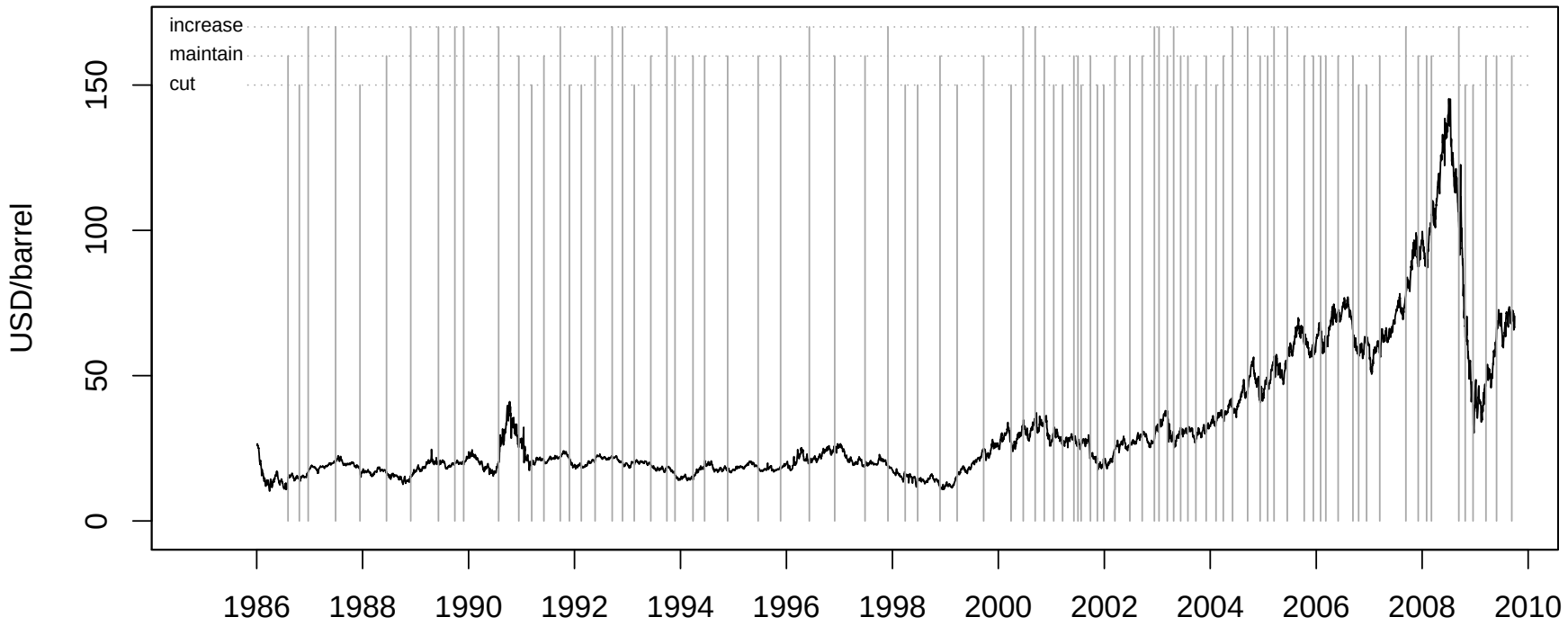
Project 2:
OPEC Announcements and Oil Price Volatility

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)?

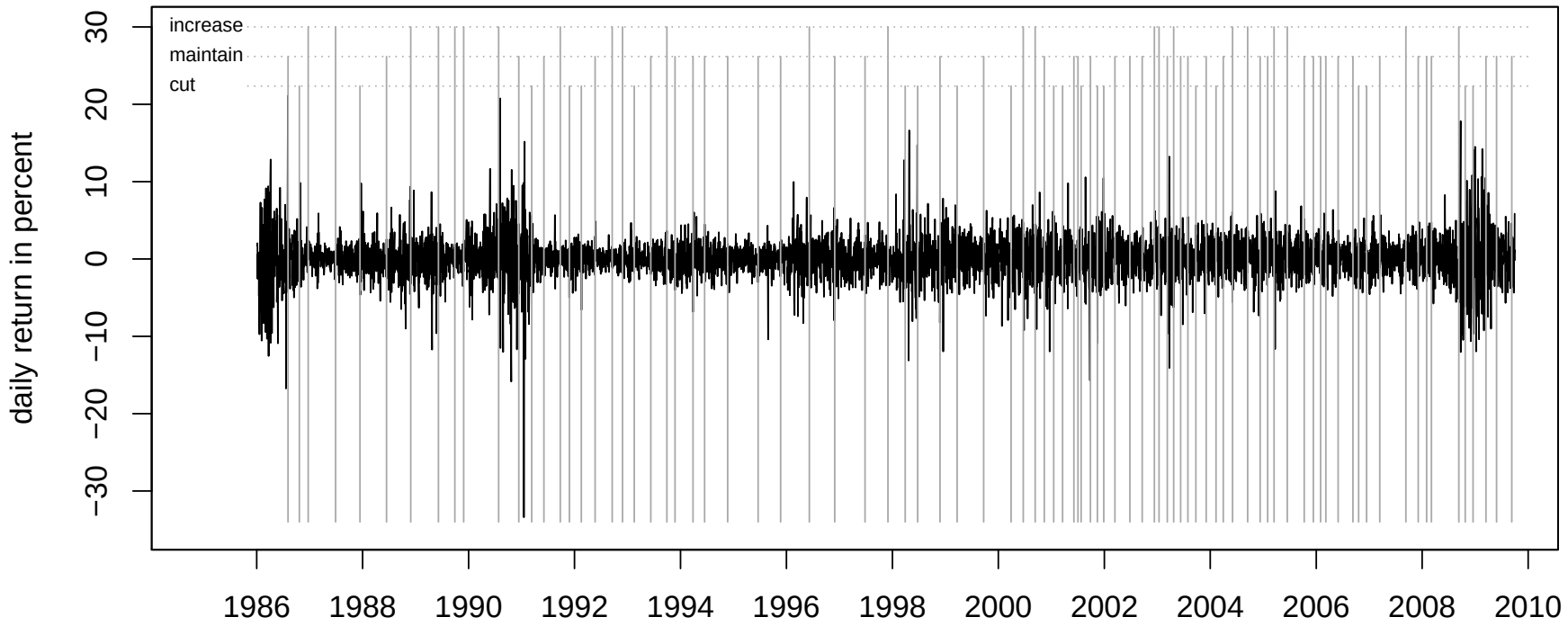
Project 2:
OPEC Announcements and Oil Price Volatility

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.

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

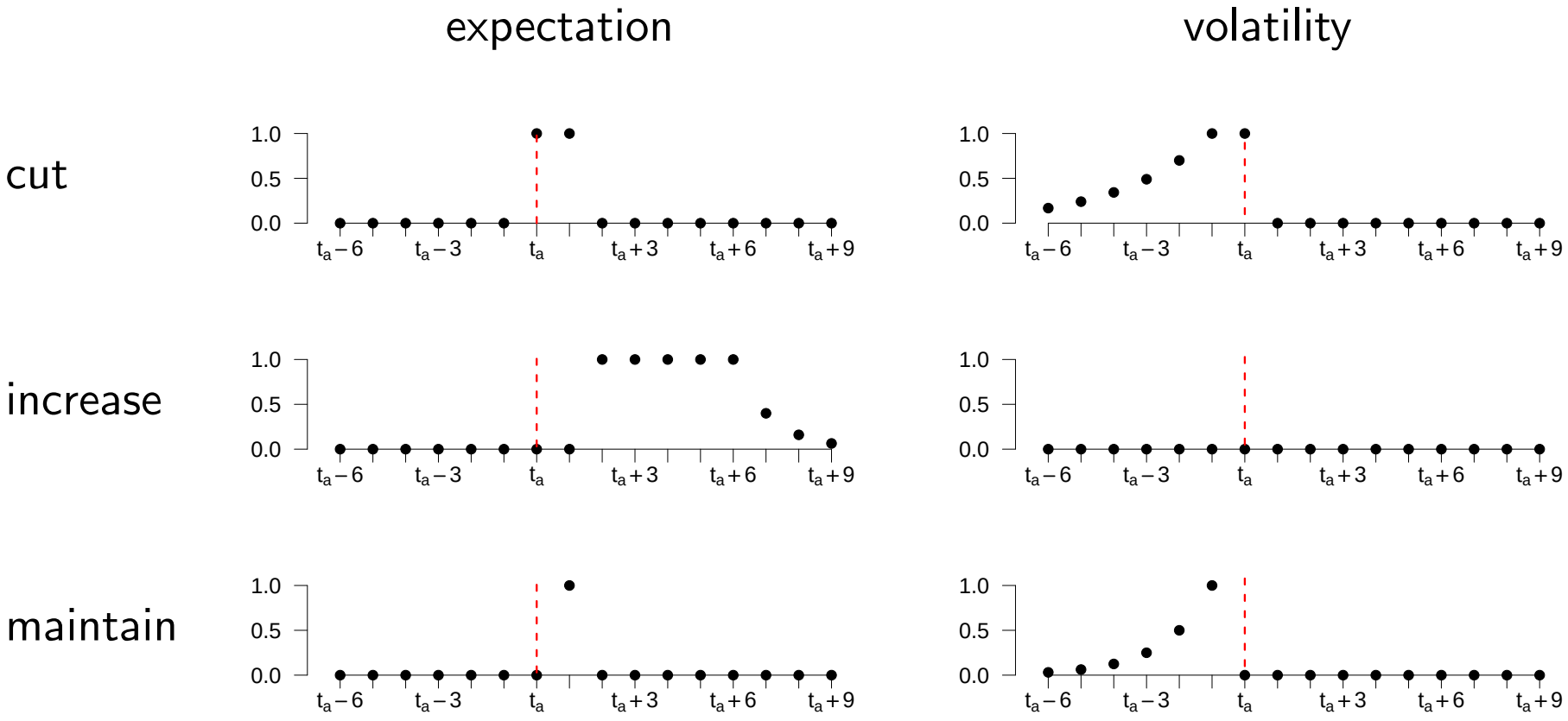
$$\epsilon_t = \nu_t \cdot \sqrt{h_t}, \tag{2}$$

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

- (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.



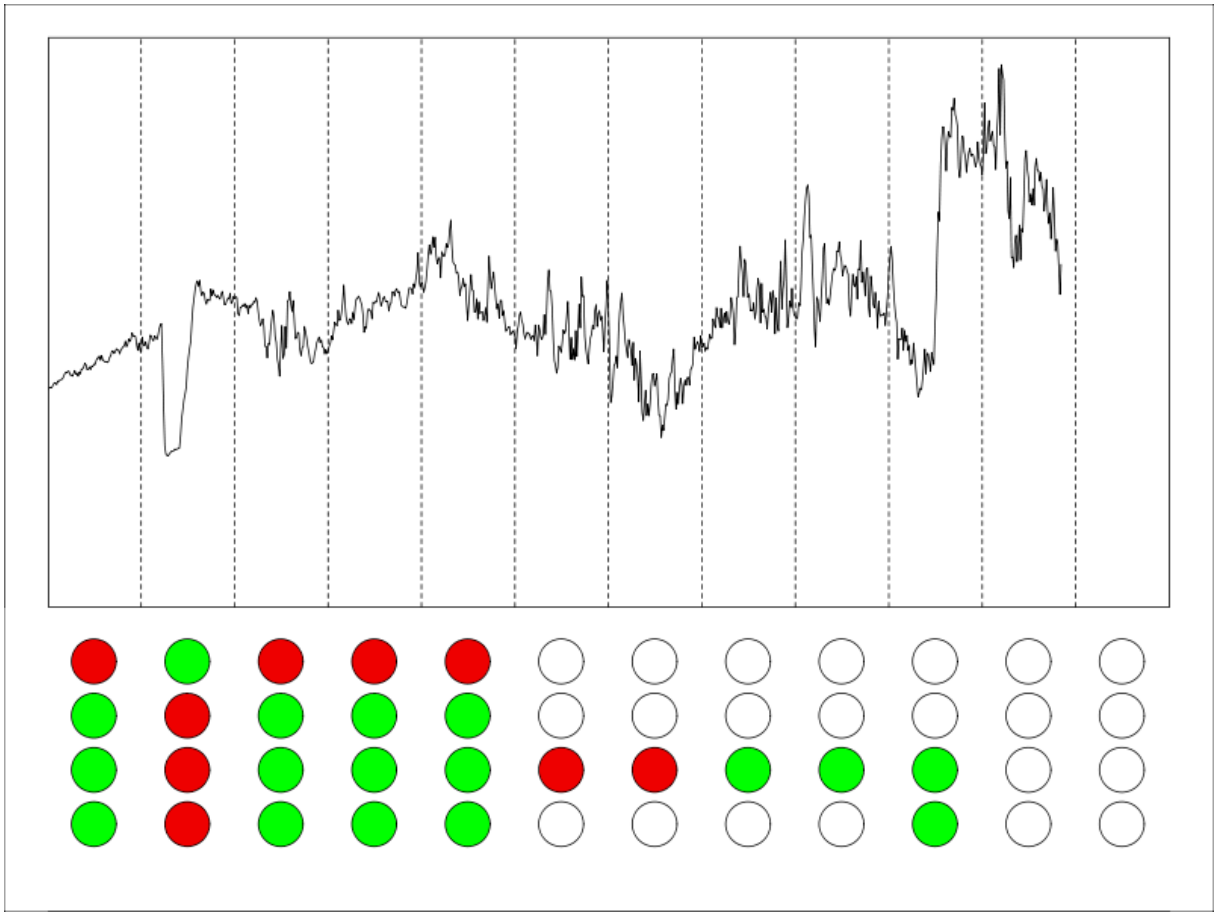
Project 3:
Algorithmic Trading

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?

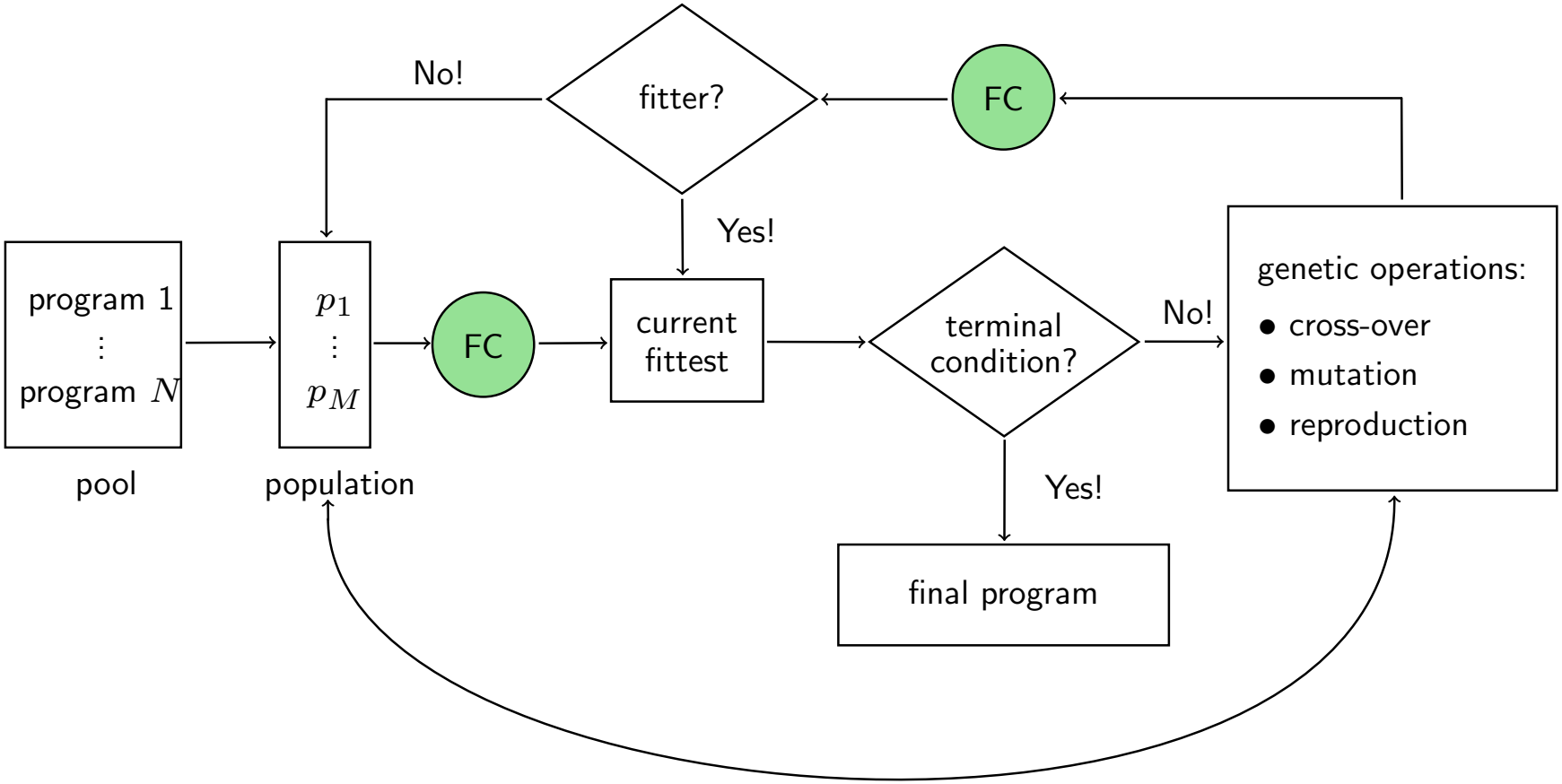
- Genetic algorithm: based on
  - cross-over
  - mutation
  - reproduction
- Example of a program:

(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 4:
Population Dynamics With Leslie-Type Models

The classical Leslie model.

- Leslie model:
  a discrete, age-structured model of population growth
- time-constant age-specific fertility and mortality rates
- population is closed to migration
- only females considered
- three 15-year intervals of age covering ages 0 to 45

Project 4:
Population Dynamics With Leslie-Type Models

The classical Leslie model.

- Equation of the Leslie model:

$$\begin{pmatrix} n_{1,t} \\ n_{2,t} \\ n_{3,t} \end{pmatrix} = \begin{pmatrix} f_1 & f_2 & f_3 \\ p_1 & 0 & 0 \\ 0 & p_2 & 0 \end{pmatrix} \cdot \begin{pmatrix} n_{1,t-1} \\ n_{2,t-1} \\ n_{3,t-1} \end{pmatrix}$$

$$\vec{n}_t = \mathtt{M} \cdot \vec{n}_{t-1}$$

Project 4:
Population Dynamics With Leslie-Type Models

A Leslie-type model for a population with constant immigration.

$$\left(\begin{array}{c} n_{1,t} \\ n_{2,t} \\ n_{3,t} \\ \hline n^*_{1,t} \\ n^*_{2,t} \\ n^*_{3,t} \\ \hline R \end{array}\right) = \left(\begin{array}{ccc|ccc|c} f_1 & f_2 & f_3 & f^*_1 & f^*_2 & f^*_3 & 0 \\ p_1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & p_2 & 0 & 0 & 0 & 0 & 0 \\ \hline 0 & 0 & 0 & 0 & 0 & 0 & r_1 \\ 0 & 0 & 0 & p^*_1 & 0 & 0 & r_2 \\ 0 & 0 & 0 & 0 & p^*_2 & 0 & r_3 \\ \hline 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{array}\right) \cdot \left(\begin{array}{c} n_{1,t-1} \\ n_{2,t-1} \\ n_{3,t-1} \\ \hline n^*_{1,t-1} \\ n^*_{2,t-1} \\ n^*_{3,t-1} \\ \hline R \end{array}\right)$$

(Schmidbauer & Rösch, 1995)

Project 4:
Population Dynamics With Leslie-Type Models

A Leslie-type model with two populations.

$$
\begin{pmatrix}
n_{c1,t} \\ n_{c2,t} \\ n_{c3,t} \\ \hline
n^*_{c1,t} \\ n^*_{c2,t} \\ n^*_{c3,t} \\ \hline
n_{v1,t} \\ n_{v2,t} \\ n_{v3,t} \\ \hline
n^*_{v1,t} \\ n^*_{v2,t} \\ n^*_{v3,t}
\end{pmatrix}
=
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\end{array}\right)
\cdot
\begin{pmatrix}
n_{c1,t-1} \\ n_{c2,t-1} \\ n_{c3,t-1} \\ \hline
n^*_{c1,t-1} \\ n^*_{c2,t-1} \\ n^*_{c3,t-1} \\ \hline
n_{v1,t-1} \\ n_{v2,t-1} \\ n_{v3,t-1} \\ \hline
n^*_{v1,t-1} \\ n^*_{v2,t-1} \\ n^*_{v3,t-1}
\end{pmatrix}
$$

Project 4:
Population Dynamics With Leslie-Type Models

Turkey: Long-run growth and urbanization.