

# List 05. VAR/VECM with Python. Cointegration

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#1. Consider **weekly** historical data from 2000 to nowadays on the following variables

- first difference for 3-Month Treasury Bill
- first difference for 6-Month Treasury Bill
- first difference for Treasury Securities at 10-Year Constant Maturity

Import data and visualize it

1. Given order
  - (a) Fit models VAR(1), VAR(2), VAR(3)
  - (b) evaluate 10 periods forward forecast for each
  - (c) Perform cross-validation for these models. Which one is preferable?
2. «Optimal» order
  - (a) For VAR of «optimal» order
  - (b) Perform its diagnostic
  - (c) Forecast for 5 periods forward. Evaluate FEVD
  - (d) Evaluate IRF using default ordering
  - (e) Perform Granger's causality test.

#2. Consider **daily** historical data from 2000 to nowadays on the following variables

- first difference for 3-Month Treasury Bill
- first difference for 6-Month Treasury Bill
- first difference for Treasury Securities at 10-Year Constant Maturity

Import data and visualize it

1. Given order
  - (a) Fit models VAR(1), VAR(2), VAR(3)
  - (b) evaluate 10 periods forward forecast for each
  - (c) Perform cross-validation for these models. Which one is preferable?
2. «Optimal» order
  - (a) For VAR of «optimal» order
  - (b) Perform its diagnostic
  - (c) Forecast for 5 periods forward. Evaluate FEVD
  - (d) Evaluate IRF using default ordering
  - (e) Perform Granger's causality test.

#3. Consider **monthly** historical data from 1995 to nowadays on the following variables

- first difference for 3-Month Treasury Bill
- first difference for 6-Month Treasury Bill
- first difference for Treasury Securities at 10-Year Constant Maturity
- log-return of M2

Import data and visualize it

1. Given order

- (a) Fit models VAR(1), VAR(2), VAR(3)
- (b) evaluate 10 periods forward forecast for each
- (c) Perform cross-validation for these models. Which one is preferable?

2. «Optimal» order

- (a) For VAR of «optimal» order
- (b) Perform its diagnostic
- (c) Forecast for 5 periods forward. Evaluate FEVD
- (d) Evaluate IRF using default ordering
- (e) Perform Granger's causality test.

#4 (VECM). Рассмотрим **weekly** data from 2005 to nowadays on the following variables

- 3-Month Treasury Bill
- 6-Month Treasury Bill
- Treasury Securities at 1-Year Constant Maturity
- 10-Year Treasury Securities at 10-Year Constant Maturity

Import data and visualize it

1. Find cointegration rank
2. Fit VECM of «optimal» order
3. Perform model's diagnostic
4. Forecast for 5 periods forward. Evaluate FEVD
5. Постройте IRF, используя исходное упорядочивание переменных
6. Проведите тест Гренджера на причинность