# Undergraduate Program in International Relations

## Data Analysis in Economics and Finance
## (Winter 2019)

Course objectives:

To provide an introduction to applications of R in finance and enable students to conduct financial research in a reproducible fashion.

Learning Outcomes:

- Mastering R packages for empirical finance (quantmod, PerformanceAnalytics, etc.)
- Applying efficient algorithms for financial data wrangling
- Computing optimal asset allocations based on modern approaches

Course outline

1. Introduction to Modern Portfolio Theory

Role of quantitative data analysis in finance. Decision-making process. Utility function. Risk vs return. Measures of return. Measures of risk.

2. Evaluation of portfolio performance.

Data sources. Performance metrics. Choice of benchmark. Backtesting and its biases. Overfitting and p-hacking.

3. Naïve 1/N portfolio

Selecting universe of stocks. Downloading and transforming data. Simulating trading process. Benchmarking against S&P 500.

4. Markowitz Portfolio Theory

Portfolio return rates. Covariance matrix. Mean-variance analysis. The efficient frontier. Rolling covariations. Instability of covariance matrix.

5. Risk Parity

Limitations of the classical mean-variance portfolio. Relationship between the risk contribution, return contribution and volatility contribution. Risk budgeting portfolios.

6. Hierarchical Risk Parity

Evaluation of out-of-sample portfolios performance. HRP as the most advanced technique. Tree clustering. Quazi-diagonalization. Recursive bisection.

Duration: Winter 2019 (Module 3)

Course Materials:

1. Instructor's Handouts
2. Markowitz, H. (1952). Portfolio selection. The journal of finance, 7(1), 77-91.
3. Roncalli, Thierry, Introducing Expected Returns into Risk Parity Portfolios: A New Framework for Asset Allocation (April 2014). Available at SSRN: https://ssrn.com/abstract=2321309 or http://dx.doi.org/10.2139/ssrn.2321309
4. López de Prado, Marcos, Building Diversified Portfolios that Outperform Out-of-Sample (May 23, 2016). Journal of Portfolio Management, 2016, Forthcoming. Available at SSRN: https://ssrn.com/abstract=2708678 or http://dx.doi.org/10.2139/ssrn.2708678
5. DeMiguel, V., Garlappi, L., & Uppal, R. (2007). Optimal versus naive diversification: How inefficient is the 1/N portfolio strategy?. The review of Financial studies, 22(5), 1915-1953.

Course Structure: The course revolves around mainstream approaches to portfolio construction, which will be illustrated through case studies and backtests in R.

Forms of Final Assessment: home assignments+group project

Module Grade: 50% - home assignments, 50% - group project

(96-100% - 10, 90-95% - 9, 80-89% - 8, 75-79% - 7, 65-74% - 6, 55-64% - 5, 45-54% - 4, 35-44% - 3, 25-34% - 2, 0-24% - 1)

Instructors: Mikhail Vladimirovich Kamrotov (kamrotov@gmail.com)

Office hours: by appointment

Classroom policies:

- Hand-in assignments policy: All home assignments should be submitted electronically via instructor's email on the due date. No deadline extensions are possible.
- Cheating policy: In case of any kind of plagiarism (with the detected source), the assignment is evaluated as zero without the chance to make up for it. In case of two written assignments with the similarity index of 50% and higher from two students, both get a zero for the assignment.