Research Methods for PhD students
Vilnius University, Autumn 2016

1. **Contact Details of Lecturers**
    a. Matthias Weber: mweber@lb.lt.
    b. Patrick Grüning: patrick.gruening@ef.vu.lt.
    c. Povilas Lastauskas: PLastauskas@lb.lt.

2. **Course times**
    a. Matthias:
        i. 6 October 2016 (17:00-18:30, 18:45-20:15)
        ii. 20 October 2016 (17:00-18:30, 18:45-19:30)
        iii. 24 October 2016 (17:00-18:30, 18:45-19:30)
    b. Patrick:
        i. 27 October 2016 (17:00-18:30, 18:45-19:30)
        ii. 3 November 2016 (17:00-18:30, 18:45-19:30)
        iii. 10 November 2016 (17:00-18:30, 18:45-20:15)
    c. Povilas:
        i. 17 November 2016 (17:00-18:30, 18:45-19:30)
        ii. 24 November 2016 (17:00-18:30, 18:45-20:15)
        iii. 1 December 2016 (17:00-18:30, 18:45-20:15)

3. **Course location**
    Room 303, Faculty of Economics, Vilnius University.

4. **Purpose of course**
    The aim of this course is to provide an introduction to the most up-to-date research techniques in economics, both in terms of theories and numerical applications.

5. **Course outline**
    a. How to write a scientific paper and statistics with R (Matthias)
        i. How to write and publish a scientific paper.
        ii. Introduction to R (and RStudio).
        iii. Data analysis in R.
    b. Continuous-Time Methods and Matlab (Patrick)
        i. Ordinary and Partial Differential Equations (~6 academic hours)
            1. Theory and Applications in Economics or Finance
            2. Numerical Methods and Introduction to Matlab

        ii. Stochastic Differential Equations (~4 academic hours)

1. Theory and Applications in Economics or Finance
2. Numerical Methods using Matlab

c. Econometric Modelling (Povilas)
   i. The use of regression techniques for model building
      1. Conditional expectation function, its properties
      2. Convergence concepts
   ii. Causality
      1. Selection bias
      2. IVs, matching, proxies, controls
   iii. Program evaluation
   iv. Estimation and testing methods
      1. OLS, 2SLS, ML, GMM
      2. Classical tests (time permitting)

6. Exam and Grading

a. There will be a **Take-home exam** with questions on theory and assignments to solve models or problems with the computer.
b. The grade will solely be based on this take-home exam.
c. The exam will be sent out by e-mail by 15 December 2016 with a deadline of 19 January 2017.

7. Literature

There is no need to study the literature beforehand – which literature to use for which purpose will become clear during the course. Some more references might be added later on.

a. Research Project Design and Statistics with R (ordered according to relevance)

Venables, W. N., Smith, D. M., and the R Core Team. *An Introduction to R – Notes on R: A Programming Environment for Data Analysis and Graphics*, available online at https://cran.r-project.org/doc/manuals/R-intro.pdf, 2015.
Nikolov, P. Writing Tips for Economics Research Papers, available online at http://www.people.fas.harvard.edu/~pnikolov/resources/writingtips.pdf, 2013.
Maindonald, J., and Braun, J. *Data analysis and graphics using R: an example-based approach*. Cambridge University Press, 2006.
Bonnini, S., Corain, L., Marozzi, M., and Salmaso, L. *Nonparametric Hypothesis Testing: Rank and Permutation Methods with Applications in R*. John Wiley & Sons, 2014.

b. Continuous-Time Methods and Matlab

Butcher, John: *Numerical Methods for Ordinary Differential Equations*. John Wiley & Sons; 2nd ed., Chichester, 2008.

Logemann, Hartmut; Ryan, Eugene P.: Ordinary Differential Equations: Analysis, Qualitative Theory and Control. Springer, 1st ed., London, 2014.
Thomas, James W.: *Numerical Partial Differential Equations: Finite Difference Methods*. Springer, 2nd ed. corr. print., New York, 1998.
Evans, Lawrence C.: *Partial Differential Equations*. American Mathematical Society, 2nd ed., Providence, 2010.
Kloeden, Peter E.; Platen, Eckhard: *Numerical Solution of Stochastic Differential Equations*. Springer, 2nd ed. corr. print., Berlin, 1995.
Glasserman, Paul: *Monte Carlo Methods in Financial Engineering*. Springer, New York, 2004.

Matlab learning resources:
http://se.mathworks.com/academia/student_center/tutorials/launchpad.html.

Matlab user guide:
http://se.mathworks.com/help/pdf_doc/matlab/getstart.pdf?s_tid=int_tut.

c. Econometric Modeling

Though the course is not built on a single text, the following one will prove most useful:
Angrist, Joshua D. and Jörn-Steffen Pischke: *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, 2009.

Supplementary readings include
Buse, A. The Likelihood Ratio, Wald, and Lagrange Multiplier Tests: An Expository Note, *The American Statistician*, **3(1)**: 153-157, 1982.
Engle, Robert F. Wald, likelihood ratio, and Lagrange multiplier tests in econometrics, in: Z. Griliches & M. D. Intriligator (ed.), *Handbook of Econometrics*, **1(2)**, Ch 13, 775-826, 1984.

Those with less formal grounding in econometrics should consult
Stock, J. H. and M. W. Watson: *Introduction to Econometrics*, Third Edition, Pearson Education, 2014.
Wooldridge, Jeffrey M.: *Introductory Econometrics: A Modern Approach,* Fifth Edition, Cengage Learning, 2013.

Useful more advanced texts in micro and macro-econometrics, respectively, are
Cameron, A. C. and P. Trivedi, *Microeconometrics: Methods and Applications*, Cambridge University Press, 2005.
Pesaran, M. Hashem: *Time Series and Panel Data Econometrics,* Oxford University Press, 2015.