

dr hab Łukasz Patryk Woźny  
email: [lukasz.wozny@sgh.waw.pl](mailto:lukasz.wozny@sgh.waw.pl)  
[web.sgh.waw.pl/lwozny/](http://web.sgh.waw.pl/lwozny/)

## General equilibrium

**Goal:** Introduction to the general equilibrium theory and its applications in economics. We will formally define and analyze equilibria both in the finite and infinite, static and dynamic as well as deterministic and stochastic economies. We will also discuss some game theoretical foundations of the general equilibrium.

**Prerequisites:** Calculus I and II. Probability theory, Game Theory I.

**Grading:** 40% homework, 30% class presentations, 30% final.

**Readings:** ([Mas-Colell, Whinston, and Green 1995](#)): 15-20.

**Some additional readings:** [Aliprantis, Brown, and Burkinshaw \(1990\)](#), [Balasko \(2009\)](#), [Bewley \(2007\)](#), [Ellickson \(1993\)](#), [Hildenbrand \(1974\)](#), [McKenzie \(2002\)](#). For useful math prerequisites I recommend: ([Aliprantis and Border 1994](#)) and ([Moore 1999](#)) as well as: ([Berge 1997](#)), ([Rudin 1998](#)) and ([Rudin 2001](#)).

### Syllabi:

1. Historical and methodological introduction. Partial vs. general equilibrium. Examples.
2. Examples: exchange economy (Edgeworth's box) and production economy (Robinson's island) Assumptions on preferences and technology. Definition of feasible and Pareto-optimal allocation. Defining competitive (Walrasian) equilibrium. Intuitive introduction to the welfare theorems. Existence of equilibrium and Arrow's counterexample.  
**readings:** [Mas-Colell, Whinston, and Green \(1995\)](#): 15  
**add. readings:** [Bewley \(2007\)](#): 2
3. Defining economy and equilibrium. Equilibrium with transfers. Equilibrium vs. quasi-equilibrium. First and second welfare theorems. Proof. Pareto optimality and social welfare function. Kuhn-Tucker multipliers and Negishi method. Interpreting prices as Lagrange multipliers and Lagrange multipliers as weights.  
**readings:** [Mas-Colell, Whinston, and Green \(1995\)](#): 16  
**add. readings:** [Aliprantis, Brown, and Burkinshaw \(1990\)](#): 1, [Bewley \(2007\)](#) 3-6
4. Existence of equilibrium. Debreu-Gale-Kuhn-Nikaido lemma and its weak version. Its proof and conditions for equilibrium existence. Local uniqueness in regular economies. Debreu Theorem: "Almost all economies are regular". Index theorem. Conditions for (global) uniqueness.  
**readings:** [Mas-Colell, Whinston, and Green \(1995\)](#): 17
5. Sonnenschein-Mantel-Debreu Theorem. Brown-Matzkin Theorem. Existence of equilibrium using game theoretical approach (Arrow-Debreu-McKenzie).  
**readings:** [McKenzie \(2002\)](#): 4-6, [Mas-Colell, Whinston, and Green \(1995\)](#): 17
6. Foundations of competitive equilibrium I: cooperative games.  
Solutions. Core and the set of equilibria.  $n$ -th replicas. Debreu-Scarf theorem: convergence of the core to the equilibrium allocations. Large economy and theorem of Aumann (no proof). Anderson's theorem and its proof.  
**readings:** [Mas-Colell, Whinston, and Green \(1995\)](#): 18  
**add. readings:** [Hildenbrand \(1974\)](#): 1-4
7. Foundations of competitive equilibrium II: strategic (non-cooperative) market games (Shapley-Shubik). GE as a limit of the Cournot equilibrium in oligopolistic markets.  
**readings:** [Mas-Colell \(1982\)](#), [Novshek and Sonnenschein \(1986\)](#)

8. GE with uncertainty. Defining exchange economy. Arrow securities. Arrow-Debreu competitive equilibrium. Sequential and Radner equilibrium. Assets markets. (In)complete markets. Firm's behavior under uncertainty. Magill-Quinzii probabilistic approach to GE. Incomplete information and asymmetric information: examples. GE with ambiguity.  
**readings:** Mas-Colell, Whinston, and Green (1995): 19  
**add. readings:** Magill and Quinzii (2009), Bewley (2007): 7-8
  
9. GE in time. Utility function and technology set. Definition of (date-zero) competitive equilibrium and sequential equilibrium.  
**readings:** Mas-Colell, Whinston, and Green (1995): 20,  
**add. readings:** Bewley (2007): 9-10 Aliprantis, Brown, and Burkinshaw (1990): 5, McKenzie (2002): 7
  
10. Recursive competitive equilibrium. Definition, examples, existence.  
**readings:** Prescott and Mehra (1980), Coleman (1991)
  
11. GE with indivisibilities. Nonconvex consumption sets and lotteries.  
**readings:** Rogerson (1988)
  
12. Adverse selection and moral hazard in GE. (Large) economy with types and private information. Prescott-Townsend lotteries over consumptions sets.  
**A.** Adverse selection. Incentive compatibility and individual rationality. Defining GE (with firms) and week equilibrium (no firms). Constrained Pareto optimality. Existence of week equilibrium and non-existence of equilibrium. Interpreting IC as external effects.  
**B.** Existence of equilibrium and welfare theorems for the economy with moral hazard. The role of Lagrange multipliers.  
**readings:** Rustichini and Siconolfi (2008), Jerez (2005)  
**add. readings:** Prescott and Townsend (1984)
  
13. GE in search models  
**readings:** Jerez (2014)
  
14. GE with behavioral preferences. Time-inconsistency. Optimality and existence  
**readings:** Luttmer and Mariotti (2006), Dziwulski (2015), Herings and Rohde (2006), Gabrieli and Ghosal (2013), Kocherlakota (2001)
  
15. GE with strategic interactions: oligopolies and public goods.  
**readings:** Villanacci and Zenginobuz (2005)
  
16. GE in infinite dimensional spaces. Prices. Consumption set and its norm. Some known problems. (Geometric) Hahn-Banach theorem. Definition of the GE. Two welfare theorems.  
**readings:** Stokey, Lucas, and Prescott (1989): 15, Mas-Colell and Zame (1991)  
**add. readings:** Aliprantis, Brown, and Burkinshaw (1990): 2-4
  
17. Computing equilibria.  
**readings:** Kehoe (1991)

**Exams** are based on topics and problems discussed during the course and posted on the web pages of the instructors. The **homework** lists will be posted consecutively on the web. It is your responsibility to get it from there. Homework is due in class on the due date. Remember that homework is the most valuable part of the course. Always write correct English with complete sentences. You may talk about the problems with other students, but you must write up your own solutions in your own words.

I welcome questions at any time. Please don't hesitate to ask me during class if there is something that you don't understand or that you want to discuss. (The only exception is a question about the grading of your homework or exam paper. Please ask these questions before or after class, or in office

hours.) You may also ask questions in office hours, or any other time that you catch me in my office. You may also ask questions by email.

While studying you may find useful to use various scientific paper browsers like e.g.: [econpapers.repec.org](http://econpapers.repec.org), [ideas.repec.org](http://ideas.repec.org) and [scholar.google.com](http://scholar.google.com); article databases, e.g. [www.jstor.org](http://www.jstor.org), [www.sciencedirect.com](http://www.sciencedirect.com) and [www.nber.org](http://www.nber.org).

I invite all interested in economic theory to participate in **Warsaw Economic Seminar** ([sites.google.com/site/warsaweconseminars/](http://sites.google.com/site/warsaweconseminars/)).

## References

- ALIPRANTIS, C. D., AND K. C. BORDER (1994): *Infinite Dimensional Analysis. A Hitchhiker's Guide*. Springer-Verlag Heilbelberg.
- ALIPRANTIS, C. D., D. BROWN, AND O. BURKINSHAW (1990): *Existence and optimality of Competitive Equilibria*. Springer-Verlag Heilbelberg.
- BALASKO, Y. (2009): *The equilibrium manifold. Postmodern Developments in the Theory of General Economic Equilibrium*. MIT Press.
- BERGE, C. (1997): *Topological spaces*. Dover Publications, New York.
- BEWLEY, T. F. (2007): *General Equilibrium, Overlapping Generations Models, and Optimal Growth Theory*. Harvard University press.
- COLEMAN, WILBUR JOHN, I. (1991): "Equilibrium in a Production Economy with an Income Tax," *Econometrica*, 59(4), 1091–1104.
- DZIEWULSKI, P. (2015): "Efficiency of competitive equilibria in economies with time-dependent preferences," *Journal of Economic Theory*, 159, 311–325.
- ELICKSON, B. (1993): *Competitive Equilibrium: Theory and Application*. Cambridge University Press.
- GABRIELI, T., AND S. GHOSAL (2013): "Non-existence of competitive equilibria with dynamically inconsistent preferences," *Economic Theory*, 52, 299–313.
- HERINGS, P., AND K. ROHDE (2006): "Time-inconsistent preferences in a general equilibrium model," *Economic Theory*, 29(3), 591–619.
- HILDENBRAND, W. (1974): *Core and equilibria of a large economy*. Princeton University Press, Princeton.
- JEREZ, B. (2005): "Incentive Compatibility and Pricing under Moral Hazard," *Review of Economic Dynamics*, 8(1), 28–47.
- JEREZ, B. (2014): "Competitive equilibrium with search frictions: A general equilibrium approach," *Journal of Economic Theory*, 153, 252 – 286.
- KEHOE, T. J. (1991): "Computation and multiplicity of equilibria," in *Handbook of Mathematical Economics*, ed. by W. Hildenbrand, and H. Sonnenschein, vol. 4 of *Handbook of Mathematical Economics*, chap. 38, pp. 2049–2144. Elsevier.
- KOCHERLAKOTA, N. R. (2001): "Looking for evidence of time-inconsistent preferences in asset market data," *Quarterly Review*, (Sum), 13–24.
- LUTTMER, E. G. J., AND T. MARIOTTI (2006): "Competitive equilibrium when preferences change over time," *Economic Theory*, 27(3), 679–690.
- MAGILL, M., AND M. QUINZII (2009): "The probability approach to general equilibrium with production," *Economic Theory*, 39(1), 1–41.
- MAS-COLELL, A. (1982): "The Cournotian foundations of Walrasian equilibrium theory: an exposition of recent theory," in *Advances in Economic Theory*, ed. by W. Hildenbrand.
- MAS-COLELL, A., M. D. WHINSTON, AND J. R. GREEN (1995): *Microeconomic theory*. Oxford University Press.

- MAS-COLELL, A., AND W. ZAME (1991): “Equilibrium Theory in Infinite Dimensional Spaces,” in *Handbook of Mathematical Economics*, ed. by W. Hildenbrand, and H. Sonnenschein, vol. IV, chap. 34, pp. 1835–1898. Elsevier.
- McKENZIE, L. W. (2002): *Classical General Equilibrium Theory*. The MIT Press.
- MOORE, J. C. (1999): *Mathematical Methods for Economic Theory*, vol. 1,2. Springer, Heidelberg.
- NOVSHEK, W., AND H. SONNENSCHNEIN (1986): “Non-cooperative Marshallian-like foundations for general equilibrium theory,” in *Contributions to mathematical economics in honour of G. Debreu*, ed. by W. Hildenbrand, and A. Mas-Colell.
- PRESCOTT, E. C., AND R. MEHRA (1980): “Recursive Competitive Equilibrium: The Case of Homogeneous Households,” *Econometrica*, 48(6), 1365–79.
- PRESCOTT, E. C., AND R. M. TOWNSEND (1984): “Pareto Optima and Competitive Equilibria with Adverse Selection and Moral Hazard,” *Econometrica*, 52(1), 21–45.
- ROGERSON, R. (1988): “Indivisible labor, lotteries and equilibrium,” *Journal of Monetary Economics*, 21(1), 3 – 16.
- RUDIN, W. (1998): *Analiza rzeczywista i zespolona*. Wydawnictwo Naukowe PWN, Warszawa.
- (2001): *Analiza funkcjonalna*. Wydawnictwo Naukowe PWN, Warszawa,.
- RUSTICHINI, A., AND P. SICONOLFI (2008): “General equilibrium in economies with adverse selection,” *Economic Theory*, 37(1), 1–29.
- STOKEY, N., R. LUCAS, AND E. PRESCOTT (1989): *Recursive methods in economic dynamics*. Harward University Press.
- VILLANACCI, A., AND E. ZENGINOBUZ (2005): “Existence and regularity of equilibria in a general equilibrium model with private provision of a public good,” *Journal of Mathematical Economics*, 41(4-5), 617–636.