

Economic Modeling

Prof. Iwan J Azis

August-December Semester, 2018

TA: Fandy Rahardi, Nabil Rizky

Time & place: Wednesday, 08.00 – 10.30 (GMT+7); Room: A.101

Office hour: by appointment (ija1@cornell.edu)

Purpose:

Mathematical models are used to build a *simplified* framework or theoretical construct to illustrate *complex* economic processes. Thus, they represent a “language” that should make a complex concept simpler. As a simplified description of reality, any economic model is subjective in design, hence judged differently by different economists. Built to yield hypotheses about economic behavior that is testable, a mathematical model typically contains a set of variables and some logical and/or quantitative relationships between them.

Unlike a standard course on mathematical economics, which usually covers basic concepts such as logics, sets, real numbers, discrete and continuous functions, convexity, vectors, differentiation, integration, and matrices, the purpose of this course is instead to show the *applications of mathematical approaches and models in economic analysis* using some examples of micro and macroeconomic issues. The emphasis is to combine the concepts and models with their applications, and the goal is to help students understand better how those models are used--and be able to conduct modeling work--for economic analysis.

For each topic, we will always discuss first the issues before going into the mathematical models and the socio-economic meaning of those models. In explaining each of the models, we will highlight the important elements, assumptions, hypothesis, and the applications of it. To provide a hands-on skill and experience, rather than just seeing how it is being done or reading about it, students will conduct a research for their final paper on a particular topic utilizing relevant models and actual data.

Evaluation:

After the first 6 weeks of the semester, students are expected to select the topic for final paper.

- (1) participation in class, Lab sessions, and the progress of final paper (20%)
- (2) mid-term: research proposal (20%)
- (3) final project paper (60%).

Reading Materials and Topics:

The required reading for this class is *Mathematical Models For Economic Analysis: Selected Topics and Applications*, by Iwan J Azis (2018). The book contains the detailed explanations on the issues, problems, and questions of interest, as well as some examples of programming using computer software to solve those problems. When necessary, we will also recommend other reading materials.

Topics & Schedule: The week-by-week schedule below is tentative (subject to change) depending on the speed at which the class will progress

- I. Week 1: Overview and Optimization. Static linear, Non-linear, Dynamic (discrete and continuous)
- II. Week 2: Dynamic System of Motions. Differential and Difference Equations; Basic Concepts of Bifurcations (static and dynamic); Growth Models, Interregional Flows (with constant and non-constant returns to scale)
- III. Weeks 3-5: Economy-Wide with Indirect Effects (From Input-Output to Endogenous Households). Economic-Base; Input-Output (IO), Social Accounting Matrix, Structural Path Analysis (SPA); Financial SAM
- IV. Weeks 6-8: Economy-Wide with Endogenous Prices. From Computable General Equilibrium (CGE) to Financial CGE
- V. Weeks 9: Game Theory
- VI. Weeks 10-13: Perception-Based Modeling (Non-Bayesian). Analytic Hierarchy Process (AHP), and Analytic Network Process (ANP)
- VII. Week 14: Final paper presentation; summary: key things to consider how to select and use mathematical models for a research topic