DYNAMIC GAMES IN EMPIRICAL INDUSTRIAL ORGANIZATION

INCAE PhD Summer Academy 2022

Victor Aguirregabiria (University of Toronto and CEPR)

Monday, June 20th to Friday, June 24th 2022

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A. COURSE DESCRIPTION

This course deals with Empirical Industrial Organization. It covers topics related to **econometric models and empirical applications** of competition in industries. We study empirically the determinants of firms' behaviour and market outcomes in the context of problems of market entry/exit, investment, and innovation. The course focuses on research papers using **dynamic structural models** to investigate firms' strategies and competition. The course emphasizes the importance of combining data, economic models, and appropriate identification strategies and econometric techniques to answer empirical questions in economics. The ten sessions of the course are organized into 5 lectures and 5 hands-on tutorials. In the lectures, we will learn about models, methods, and applications. In the tutorials, we will go through computer code and datasets to implement the techniques covered in the lectures.

B. LECTURES

- Ten (10) sessions of 1h 20m each, from Monday, June 20th to Friday, June 25th 2022.
- One lecture and one hands-on tutorial per day.
- Please, bring your laptop to the tutorial for writing and running your own code. The code that I will use in class will use standard commands available in any programming language such as Matlab, Gauss, R, Julia, or Python. You are encouraged to use your favorite programming language.

C. GENERAL REFERENCES

The following are general references which are useful for all the topics covered in this course.

- Aguirregabiria, V. (2019): "Empirical Industrial Organization: Models, Methods and Applications," Chapters 6 to 9.
- Aguirregabiria, V., A. Collard-Wexler, and S. Ryan (2021): "Dynamic Games in Empirical Industrial Organization," *Handbook of Industrial Organization*, Volume 4, Chapter 4, pp. 225-343.
- Aguirregabiria, V., and A. Nevo (2013): "Recent developments in empirical IO: Dynamic demand and dynamic games," *Advances in Economics and Econometrics*, 3, 53–122.

D. OUTLINE AND REFERENCES

Lecture 1: Single-agent dynamic discrete choice: Model and solution

References

- Aguirregabiria, V., and P. Mira (2010): "Dynamic Discrete Choice Structural Models: A Survey," *Journal of Econometrics,* 156(1), 38-67.

Tutorial 1: Code for solution of dynamic model of market entry-exit

References

- Code available at the course webpage.

Lecture 2: Single-agent dynamic discrete choice: Estimation

References

- Rust, J. (1987): "Optimal replacement of GMC bus engines: An empirical model of Harold Zurcher," *Econometrica*, 999–1033.
- Rust, J. (1994): "Structural estimation of Markov decision processes," *Handbook of Econometrics*, Volume 4, 3081–3143.
- Hotz, J., and R. Miller (1993): "Conditional choice probabilities and the estimation of dynamic models," *The Review of Economic Studies*, 60 (3), 497–529.

Tutorial 2: Data and code for estimating Rust's (1987) machine replacement model

References

- Data and code available at the course webpage.

Lecture 3: Dynamic games of oligopoly competition: Model and solution

References

- Ericson, R. and A. Pakes (1995): "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies,* 62, 53-82.
- Pakes, A. and P. McGuire (1994): "Computing Markov Perfect Nash Equilibrium: Numerical Implications of a Dynamic Differentiated Product Model," *RAND Journal of Economics*, 25, 555-589.

Tutorial 3: Code for solving dynamic game of market entry-exit

References

- Code available at the course webpage.

Lecture 4: Structural estimation of dynamic games

References

- Aguirregabiria, V., and P. Mira (2007): "Sequential estimation of dynamic discrete games," *Econometrica*, 75, 1-53.
- Bajari, P., L. Benkard and J. Levin (2007): "Estimating dynamic models of imperfect competition," *Econometrica*, 75, 1331-1370.

Tutorial 4: Data and code for the estimation of dynamic game of market entry-exit

References

- Code available at the course webpage.

Lecture 5: Uncertainty and firms' investment decisions

References

- Collard-Wexler, A. (2013): "Demand fluctuations in the ready-mix concrete industry," *Econometrica*, 81(3), 1003-1037.
- Kalouptsidi, M. (2014): "Time to build and fluctuations in bulk shipping," *American Economic Review*, *104*(2), 564-608.

Tutorial 5: Data and code for the estimation of dynamic game of investment

References

- Code available at the course webpage.

E. CLASS SCHEDULE

LECTURE	DATE	TOPIC
Lecture 1:	Monday, June 20th (Morning)	Single-agent dynamic discrete choice: model and solution
Tutorial 1:	Monday, June 20th (Afternoon)	Code for solving a model of market entry-exit
Lecture 2:	Tuesday, June 21st (Morning)	Single-agent dynamic discrete choice: estimation
Tutorial 2:	Tuesday, June 21st (Afternoon)	Data and code for estimating Rust's model
Lecture 3:	Wednesday, June 22nd (Morning)	Dynamic games: Model and solution
Tutorial 3:	Wednesday, June 22nd (Afternoon)	Code for solving dynamic game of market entry-exit
Lecture 4:	Thursday, June 23rd (Morning)	Dynamic games: Estimation
Tutorial 4:	Thursday, June 23rd (Afternoon)	Data and code for the estimation of dynamic games
Lecture 5:	Friday, June 24th (Morning)	Uncertainty and firms' investment decisions
Tutorial 5:	Friday, June 24th (Afternoon)	Data and code for estimation of dynamic game of investment