Computation in Economics

Computational Social Science Retreat

University of Pittsburgh, 2018

Motivation

Primary applications: solving economic models with optimizating agents

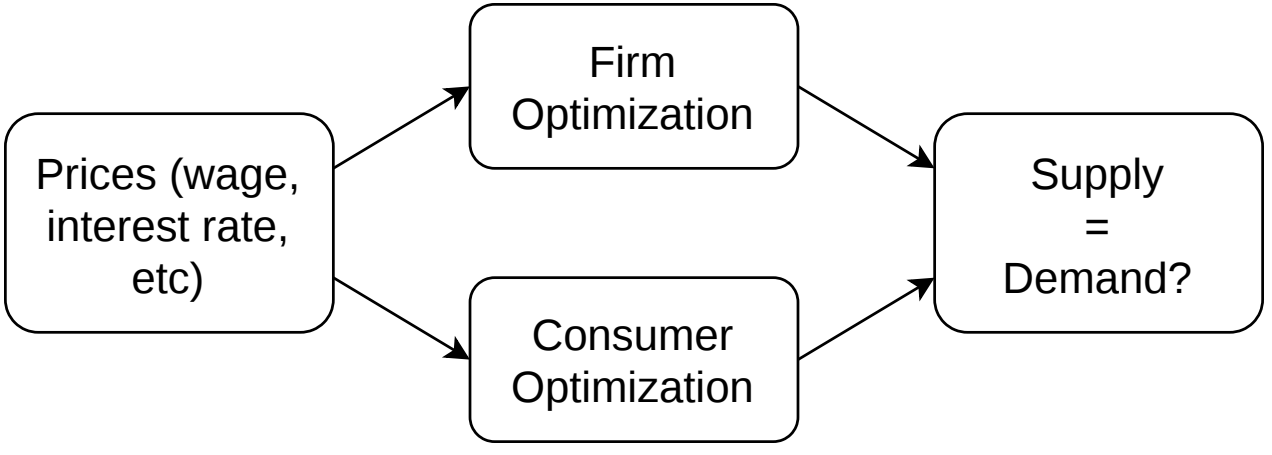
Major relevant subfields

- macroeconomics
- industrial organization
- structural micro
- game theory

Lots of empirical work too!

Walrasian Model

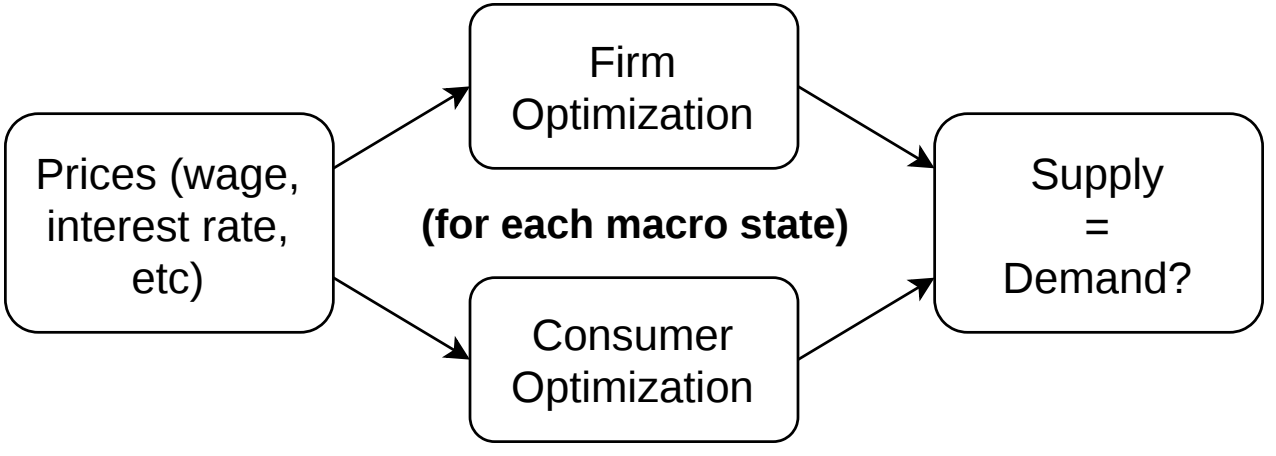
Firms and consumers take prices as given and solve some optimal choice problem (maximizing profit/utility)



For convex optimization problems, boils down to a (potentially large) system of equations in prices and quantities

Heterogeneity

In general, the macro state includes a distribution over micro states. This becomes a problem in the case of aggregate stochasticity



For tractability, we need some way to approximate dependence or summarize the state space

Game Theory

Walrasian models eliminate strategic interaction, but in the general setting, we know Nash equilibria are hard to compute

- interesting intermediate cases can be expressed using the language of graphical games

Stable matching problems are similarly difficult: kidney exchange, medical residency, firm-worker sorting

Rationality

Part of what makes computation hard is goal of *perfect* optimality

- is this even a reasonable goal?

Two possible routes to take

- numerical approximation
- "behavioral" approximation

Behavioral approaches include: quantal response equilibrium, sparse attention models, coarse information processing

Empirics

Large but not Big™ datasets are becoming more common

- Firms (Compustat: 400K, Census: 8.5M, China: 5M)
- Consumer (Equifax: 210M consumers, Nielsen: 4M products)
- Text data (Patents: ~6M US/CN, Wikipedia: 400M edits, 5M articles)
- Satellite imagery (various sources)

Lots of interest in machine learning but questions about interpretability of results (prediction vs inference)