Graduate Macro Sequence: Roadmap and Motivation

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Why this sequence?

What you will be able to do after this sequence

- Translate a macro question into **states**, **choices**, and **equilibrium conditions**
- Solve for **policy functions**, **prices**, and sometimes a **distribution**
- Use the model to run **counterfactuals** (policy, shocks, institutions)
- Read modern papers and quickly identify:
  - what is new,
  - what drives results,
  - what is testable in data

The throughline: one language, many applications

Across the entire course, we will repeatedly do:

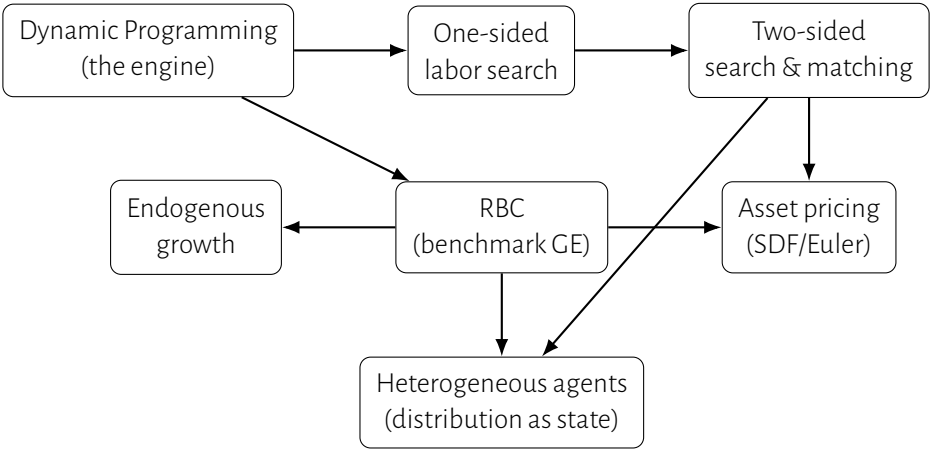
1. A **dynamic decision problem** $\rightarrow$ policy rules

2. **Equilibrium** $\rightarrow$ market clearing, pricing, aggregation

3. **Quantitative discipline** $\rightarrow$ moments, impulse responses, counterfactuals

Think of this as learning the **objects** of macro: policies, prices, and (sometimes) distributions.

Course map (how the pieces fit)



We start simple, then add realism by adding **search frictions**, **risk pricing**, **growth forces**, and **heterogeneity**.

Why start from models?

Models are useful when they:

- Turn a complicated environment into a **transparent mechanism**
- Produce **quantitative** implications (not just signs)
- Give a disciplined language for:
  - decomposition (what drives fluctuations?),
  - welfare (who gains/loses?),
  - policy design (which margin matters?)

Dynamic programming

Dynamic programming: the recursive mindset

A dynamic economic problem has four ingredients:

$$\text{state } x_t, \quad \text{choice } a_t, \quad x_{t+1} = f(x_t, a_t, \varepsilon_{t+1}), \quad \text{payoff } u(x_t, a_t).$$

- **State** summarizes everything today that matters for tomorrow
- **Policy function** $a_t = g(x_t)$ is what we want
- Recursion turns "infinite horizon" into a **stationary** problem

The Bellman equation (what we solve)

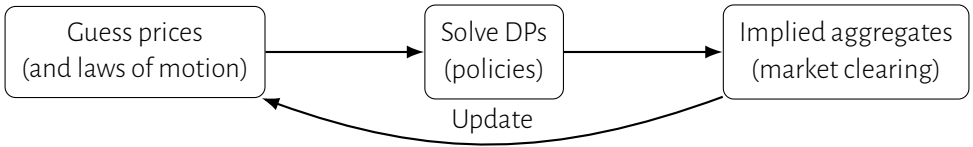
$$V(x) = \max_{a \in \Gamma(x)} \left\{ u(x,a) + \beta \, \mathbb{E}\left[V(x') \,\middle|\, x, a \right] \right\}, \qquad x' = f(x, a, \varepsilon').$$

- Unknowns are **functions**: $V(\cdot)$ and $g(\cdot)$
- Economic meaning:
  - $V(x)$ = best achievable value starting from x
  - $g(x)$ = optimal behavior as a rule

From DP to macro: equilibrium as a fixed point

Many macro models add prices and aggregation:

- Given prices, agents solve DPs $\rightarrow$ policies
- Policies imply aggregates $\rightarrow$ market clearing prices
- Equilibrium is a **consistency** (fixed point)



What "learning DP" really means in this class

You will learn to:

- Choose states that make the problem **Markov**
- Use Euler equations and envelopes to understand **margins**
- Compute policies using:
  - value/policy iteration,
  - discretization and simulation,
  - (when appropriate) linearization

One-sided labor search

One-sided labor search (job search): why it matters

Motivation:

- Unemployment duration and wage dispersion can arise from **search frictions**

- Policy (benefits, taxes) works by shifting **accept/reject** incentives

Key object:

$$\text{Reservation wage } w^\star \quad \Rightarrow \quad \text{accept if } w \geq w^\star.$$

Job search as a DP problem (structure, not details)

State and choice:

$$x_t \in \{\text{employment status},\ \text{offer } w_t\}, \qquad a_t \in \{\text{accept}, \text{reject}\}.$$

Recursion creates:

- an option value of waiting,
- a simple acceptance rule,
- predictions for hazards, durations, wage distributions.

Two-sided search and matching

Two-sided search (DMP): why it matters

Motivation:

- Firms also search (vacancies), not just workers

- **Unemployment and vacancies** move in systematic ways

Core objects:

$$m(u, v) \text{ (matching)}, \qquad \theta = \frac{v}{u} \text{ (tightness)}.$$

What DMP adds relative to job search

Endogenous job creation:

- Firms compare vacancy posting cost to expected hiring surplus
- Wages depend on surplus division (bargaining, wage posting, etc.)

Quantitative payoffs:

- Beveridge curve, job-finding rates, vacancy-filling rates
- Propagation of shocks through θ (a key amplification margin)

Asset pricing

Asset pricing in macro: the price of risk

Motivation:

- Macro is not only quantities—prices contain information

- Risk premia reveal how agents value states of the world

Central restriction:

$$1 = \mathbb{E}_t\left[M_{t+1} R_{t+1}\right], \qquad M_{t+1} \text{ (stochastic discount factor)}.$$

Why you should care (even if you “don’t do finance”)

Asset pricing tools help you:

- Diagnose what risks the economy is exposed to
- Measure how constraints/frictions change risk sharing
- Connect macro shocks to observed returns and spreads

Many modern papers combine: heterogeneous agents + incomplete markets + risk premia.

Real business cycle

RBC: the benchmark general equilibrium model

Why RBC first:

- A disciplined baseline: preferences, technology, market clearing
- Clear propagation: intertemporal substitution, capital accumulation

Outcome:

- A full set of equilibrium objects:
  - policy functions, prices, aggregates,
  - impulse responses and moments.

How RBC organizes your intuition

RBC teaches you to separate:

- **shocks** (what hits the economy),
- **propagation** (how the economy transmits shocks),
- **measurement** (what we call output, labor, productivity).

Then we add frictions (search, heterogeneity, constraints) and see what changes.

Endogenous growth

Endogenous growth: where does the trend come from?

Motivation:

- Cycles fluctuate around a trend; growth determines long-run welfare
- Innovation/ideas create sustained growth, often with externalities

Key deliverables:

- Balanced growth paths and transitions
- Policy analysis: R&D subsidies, education, market structure, IP

Heterogeneous agents

Heterogeneous-agent macro: distribution as a state variable

Motivation:

- Inequality and imperfect insurance are first-order
- Many policies have strong **distributional** effects

Core idea:

- Individuals face idiosyncratic risk and incomplete markets
- Aggregate outcomes depend on the **wealth/income distribution**

Why HA models changed modern macro

They let you study:

- MPCs and the power of redistribution/transfer policy
- Monetary/fiscal policy with heterogeneous balance sheets
- Labor-market risk interacting with saving and asset pricing

Computational skill: compute stationary distributions and transitions reliably.

Wrap-up

Putting it together: the frontier is modular

Modern research often combines modules:

- Search frictions + HA $\rightarrow$ unemployment risk, welfare, policy
- HA + asset pricing $\rightarrow$ macro-finance with inequality
- RBC core + growth $\rightarrow$ shocks, innovation, medium-run dynamics

The goal of this course is to make these combinations feel **natural**, not intimidating.

How to succeed in this sequence

- Focus on **objects**: state, policy, price, distribution
- Always ask: **which margin moves?** (consumption/saving, vacancy posting, acceptance, pricing of risk)
- Treat computation as part of economics:
  - if you can simulate it, you can measure it
  - if you can measure it, you can test it