General Introduction

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Introduction

- A copy of these slides is available at
  `https://steveambler.uqam.ca/511/introducs.pdf`
- The corresponding notes are available at
  `https://steveambler.uqam.ca/511/introduc.pdf`
- The "s" at the end of a file name signifies "slides".
- All documents for the course are available in the following subdirectory
  `https://steveambler.uqam.ca/511/`
- I will also be uploading them to CANVAS: I'm just getting used to the system

Key Words

- Macroeconomic aggregates
- Growth vs. fluctuations (business cycle)
- Trends and non-stationarity
- Partial vs. general equilibrium
- Microfoundations and the Lucas critique
- Walrasian vs. non-Walrasion general equilibrium
- Dynamic analysis, time series, dynamic optimization
- Aggregation
- Perfect competition, imperfect competition and market power
- Dynamic general equilibrium models (DGE) and stochastic models (DSGE)
- Stylized facts as ways of testing or evaluating models

What do we study in macro?

- Study of macroeconomic aggregates (Y, C, I, G, X, IM, N, U, K, etc.)
- Also some prices and relative prices (P, π, i, r, etc.)
- Study of their **long term** properties (growth) and their **short term properties** (fluctuations, business cycle)
- The difference between the short and long terms is somewhat artificial
- For example, business cycle models (which attempt to explain short-term fluctuations) often abstract **completely** from growth. They compare predictions with data where trends (long-term movements) are removed by mechanical "**filters**"
- We discuss the question of trends a little later in the context of stationarity
- We use models in which individuals (agents) **optimize**. We specify preferences and constraints (budget constraints, technological constraints)
- **Constrained optimization** is the core methodology

What do we study in macro? 2

- By insisting on individual optimization, we focus on what are called the **microfoundations** of macroeconomics
- Contrast with old-school traditional macro. Keynesian as opposed to New Keynesian models. More below
- **Time** is central to the analysis. We want to be able to explain **time series**.
- When consumers save or firms invest, they are thinking of the future.
- So not only constrained optimization but **dynamic optimization** is at the heart of modern macro
- Once again, this can be contrasted with old-school Keynesian macro

$$C = C(Y - T, r)$$

What do we study in macro? 3

- This raises the **aggregation problem**
- How do we go from (optimal) behavioral rules for individuals, households, firms, to the macro aggregates (**aggregation**)?
- A crucial problem in macro, not studied enough. "Representative agent" and "representative firm" models are often used as a shortcut
- **General equilibrium** is a crucial concept: interaction between different groups of agent and different markets
- Important qualification: **Walrasian** versus **non-Walrasian** general equilibrium
- Walrasian equilibrium: automatic adjustment of relative prices (auctioneer). Automatically involves agents who are price-takers and perfect competition
- Non-Walrasion equilibrium: allows certain prices to remain fixed in the short run and allows for **disequilibrium** (supply not necessarily equal to demand in every market)

What do we study in macro 4

- Without a Walrasian auctioneer, individuals and firms choose their own prices
- They are no longer price takers. This means imperfect competition and market power
- Importance of analyzing the interaction between different markets

Course structure

- See the syllabus for more details
  1. Stylized facts of the business cycle
  2. Evaluation of economic models. Comparing predictions with stylized facts (formally or informally)
  3. Basic neoclassical (Solow) growth model (which underlies RBC models)
  4. Basic real business cycle (RBC) model. What are the shortcomings that led to introduction nominal rigidities?
  5. Microfoundations of nominal rigidities. What are the incentives of households/firms to fix their prices and keep them constant for extended periods?
  6. Basic New Keynesian model. Also, the introduction of real rigidities
  7. Welfare costs of fluctuations. Why are fluctuations not costly in RBC models?
  8. Consumption and investment
  9. Monetary and fiscal policy
  10. Basic endogenous growth models
  11. More sophisticated endogenous growth models (Schumpeterian, etc.)
  12. International business cycles (time permitting)

Why do we insist on microfoundations?

- To repeat, traditional Keynesian models were built from **observed empirical regularities**
- Aggregate consumption function, aggregate investment function, money demand function, Phillips curve, etc.
- Used to make predictions and for policy analysis. Some of these relationships led policymakers to believe there were stable trade-offs that could be exploited
- Celebrated example: the Phillips curve (Phillips 1958), the stable relationship (in the data) between unemployment and inflation in UK data (1861–1957)
- Does that mean if we allow (or cause) inflation to increase, we can lower unemployment on average?
- No! Tried in the 1960s. The curve **shifted** up. With higher expected inflation, prices and wage settlements built this in
- Friedman (1968): first to say the Phillips curve is **vertical** in the long run: **natural rate of unemployment**

Why do we insist on microfoundations? 2

- **Lucas critique**: Lucas (1976) — if we base our models on ad hoc behavioural relationships, the parameters of those relationships may **shift** when government policies change
- Instead, we should build models (for prediction and policy evaluation) based on individuals who optimize subject to preferences and technological constraints
- This explains such a widespread use of formal models, dynamic optimization, and DSGE models.

Objectives of next class

- Before looking at some business cycle stylized facts, let's look at what we will look at next (Tuesday), the basic Solow growth model and why we look at it first
  1. Develop a frame of reference to think about questions related to growth
  2. Start to reason in terms of general equilibrium
  3. Start to learn about dynamic optimization techniques
  4. Use Lagrangian techniques to stay closest to static constrained optimization theory
  5. Start to analyze general equilibrium in simple models

Business cycle stylized facts

- For now let's assume we have macroeconomic time series which are **stationary**
- We return to the question of non-stationarity later

Business cycle stylized facts 2

- Why do we pay so much attention to stylized facts?
- It's a good way of seeing if the business cycle has **common features** in different countries
- It's a cheap and easy way to evaluate the predictions of the models we construct
- Of course we can look at much more formal ways of evaluating models, including hypothesis testing using either classical or Bayesian statistics
- We'll see a simple example of this in the case of the correlation between real wages and employment, or productivity and employment
- We'll be able to understand this even without looking at a formal RBC model

Business cycle stylized facts 3

- We typically look at the following statistics
  1. **Volatility** as measured by **variances** and **standard deviations**
  2. The **relative volatilities** of different aggregates, such as consumption vs. GDP, investment vs. GDP, etc., as measured by **ratios** of standard deviations
  3. **Persistence** as measured by the **autocorrelations**
  4. **Comovements** as measured by correlations between different aggregates. **Procyclical** aggregate: has a positive measured correlation with GDP. **Countercyclical** aggregate: has a negative measured correlation with GDP
  5. **Leading** and **lagging** aggregates measured by non-contemporaneous correlations. A variable leads the cycle if its lags are more highly correlated with GDP than the contemporaneous correlation, and vice versa

Business cycle stylize facts 4

- **Many** possible sources for these numbers
- One possibility is Backus, Kehoe and Kydland (1993). They look at a dozen countries or groups of countries. Let's just look at 3

Statistic/Country	US	Japan	Germany
$\sigma(Y)$	1.92	1.35	1.51
$\sigma(C)/\sigma(Y)$	0.75	1.09	0.90
$\sigma(I)/\sigma(Y)$	3.27	2.41	2.93
$\sigma(N)/\sigma(Y)$	0.61	0.36	0.61
$\sigma(Y_t, Y_{t-1})$	0.86	0.80	0.65
$\sigma(Y, C)$	0.82	0.80	0.66
$\sigma(Y, I)$	0.94	0.82	0.84
$\sigma(Y, N)$	0.88	0.60	0.59

Business cycle stylized facts 4a

- The notation used in the table is quite standard
  1. $\sigma(X)$ is the **standard deviation** of variable X
  2. $\sigma^2(X)$ would be the **variance** of variable X
  3. $\sigma(X, Y)$ is the **correlation coefficient** between variables X and Y
  4. $\sigma(X_t, X_{t-i})$ is the correlation between a variable X and its i^{th} lag. We call this the i^{th}-order autocorrelation. The one which is most often reported in the literature is the first-order autocorrelation

Business cycle stylized facts 5

- A number of regularities are apparent
  1. Output volatility is similar across countries
  2. Consumption is less volatile than output (Japan is an exception)
  3. Investment is more volatile than output (no exceptions)
  4. Employment is less volatile than output (few exceptions)
  5. Output is highly persistent (no exceptions)
  6. Consumption, investment and employment are highly correlated with output

Business cycle stylize facts 6

- Let's look at another stylized fact, the correlation between real wages and employment (or total hours worked). Gamber and Joutz (1997): "This paper investigates the sources of fluctuations in aggregate hours and the economy-wide average real wage. Of particular interest is the weak correlation between real wages and aggregate hours over the business cycle. This correlation is essentially zero, has been the source of much debate . . . Models driven solely by productivity shocks such as Kydland and Prescott (1982) predict a strong positive correlation between real wages and aggregate hours. Models which assume sticky wages and are driven solely by demand shocks such as Fischer (1977) predict a strong negative correlation between real wages and aggregate hours."

Stationarity

- Consider

$$\ln(X_t) = a + \ln(X_{t-1}) + \varepsilon_{xt},$$

$$\ln(Y_t) = b + \ln(Y_{t-1}) + \varepsilon_{yt},$$

  $a, b > 0$

- These two series both grow over time, at an uneven rate because of the error terms ε_{xt} and ε_{xt}, which we suppose to be uncorrelatd
- Exercise: easy to show that, for most samples of data, $\hat{\sigma}(\ln(X_t), \ln(Y_t)) > 0$ (and statistically significant). But **by construction** the two series are unrelated
- This is a **spurious correlation**

Stationarity 3

- Many possible real world examples
  1. Swedish money supply, real GDP in Morocco. Both series have positive average growth rates and will be highly correlated in levels (or log levels)
  2. Seasonal example: in countries with cold winters, the correlation between ice cream consumption and shark attacks. In this case, it's an **omitted variable** problem. Temperature explains both

Stationarity 2

- What can we do?
  1. **Filter** the data. One possibility is to use the Hodrick-Prescott filter (or some other mechanical filter), which calculates the deviations of X_t and Y_t from a smooth trend. We will look at this more closely later in the course
  2. Another possibility is to use **growth rates**

$$\ln(X_t) - \ln(X_{t-1}) \equiv \Delta \ln(X_t) = a + \varepsilon_{xt},$$

$$\ln(Y_t) - \ln(Y_{t-1}) \equiv \Delta \ln(Y_t) = b + \varepsilon_{yt},$$

  3. Exercise: easy to show that, for a sample of data, $\hat{\sigma}\left(\Delta \ln(X_t), \Delta \ln(Y_t)\right) \approx 0$ and not statistically significant

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