Macroeconomic Cycle and Economic Policy

Lecture 1

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Introduction

- Macroeconomics as the study of fluctuations in economic aggregate
- Questions:
  - What do economic fluctuations looks like?
  - Are economic fluctuations an equilibrium or a disequilibrium phenomenon?
  - Should (could) economic policy (monetary and fiscal policy) do something about it?
- Close correlation between development of macroeconomics and developments in economic policies
  - Keynesian fine tuning (1950's - 1980's)
  - Monetarism and Rational Expectations revolution (1980's)
  - New Keynesianism and the dominance of monetary policy (Inflation Targeting and Great Moderation)(1990's-2007)
  - Today - age of uncertainty

Introduction

- This Course
  - RBC models - Modelling with Dynare
  - New Keynesian Models
  - Monetary Policy - Inflation targeting and Zero Lower Bound
  - Credit and Economic Stability
  - Fiscal Policy
- **First: Learn to look at the DATA**

Business Cycle Regularities

Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle

Burns and Mitchel (1946)

Business Cycle Measurament

- Divide the real variables into two components:

1. Long term component: moves slowly, smooth, driven by economic growth, structural changes, etc.
2. Business-cycle component: moves more quickly, cycle length of 2 to 8 years.

Hodrick-Prescott Filter

- The Hodrick-Prescott filtering is probably the most commonly used method of extracting business cycle components in macroeconomics.
- The general idea is to compute the growth (trend) component g_t and cyclical component c_t of y_t by minimizing the magnitude

$$\sum_{t=1}^{T} \underbrace{(y_t - g_t)^2}_{c_t} + \lambda \sum_{t=1}^{T-1} \left[(g_{t+1} - g_t) - (g_t - g_{t-1}) \right]^2$$

The growth component g_t should not be to far from actual data y_t , i.e.

$$y_t - g_t$$

should not be too high

Hodrick-Prescott Filter

- The growth rate of growth component

$$(g_{t+1} - g_t) - (g_t - g_{t-1})$$

- should not fluctuate too much.
- The smoothing parameter λ tells how much (relative) weight is given to the second objective.
- If $\lambda = 0$, $g_t = y_t$ (no smoothing).
- The greater λ is, the smoother the growth component. When $\lambda \rightarrow \infty$ g_t is a straight line.
- There is a trade-off between these two goals.
- Typically $\lambda = 1600$ for quarterly data and $\lambda = 100$ for annual data to extract the growth component whose wavelength is larger that eight years.

Hodrick-Prescott Filter

- Example - GDP Trend and Cycle in The United States

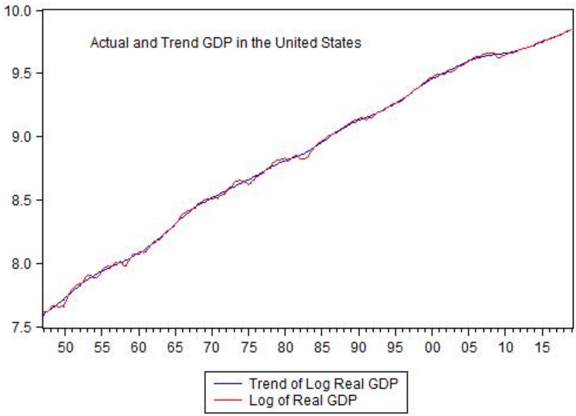

Figure: Trend in the USA Real GDP - 1947-2019

$$(c_t = y_t - g_t)$$

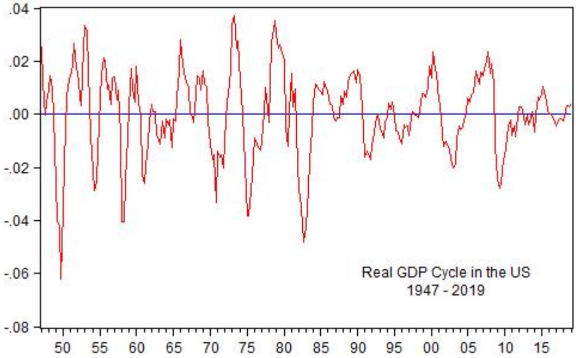

Figure: Cycle in the USA Real GDP - 1947-2019

Problems with HP

- Trend and cycle are independent
- Each variables has its own trend; some theories say that it should be common
- It is moving-average: initial and end-point problems (observations lost)
- Passes very short term fluctuations (use bandpass filter instead)

Other Statistics

"data moments"

- Variances; relative to output
- Autocorrelations: how consecutive observations are correlated
- Cross-correlations (a) how different variables are correlated; (b) how leads/lags of different variables are correlated
- Spectrum: how important are cycles of different frequencies
- Great ratios: consumption/output, investments/output, output/capital, labour share, ...
- Impulse responses of structural VARs.

Example

Eric Sims 2015

Series	Correlation with GDP
GDP	1.00
Consumption	0.78
Investment	0.85
Hours	0.87
Real Wage	0.14
Real Interest Rate	-0.05

Figure: Unites States: Correlations of the HP filtered series with HP filtered GDP

Example

M Aguiar, G Gopinath - 2004 - (Essential Reading)

Table 1: Emerging Vs Developed Markets (Averages)

	Emerging Markets		Developed Markets	
	HP	BP	HP	BP
$\sigma(Y)$	2.74	2.02	1.34	1.04
$\sigma(\Delta Y)$	1.87	1.87	0.95	0.95
$\rho(Y)$	0.76	0.86	0.75	0.90
$\rho(\Delta Y)$	0.23	0.23	0.09	0.09
$\sigma(C)/\sigma(Y)$	1.45	1.32	0.94	0.94
$\sigma(I)/\sigma(Y)$	3.91	3.96	3.41	3.42
$\sigma(TB/Y)$	3.22	2.09	1.02	0.71
$\rho(TB/Y,Y)$	-0.51	-0.58	-0.17	-0.26
$\rho(C,Y)$	0.72	0.74	0.66	0.69
$\rho(I,Y)$	0.77	0.87	0.67	0.75

This table lists average values of the moments for the group of emerging (13) and developed (13) economies. The values for each country separately are reported in Table 2. HP refers to hp-filtered data using a smoothing parameter of 1600. BP refers to Band Pass filtered data at frequencies between 6 and 32 quarters with 12 leads and lags. The standard deviations are in percentages. The definition of an emerging market follows the classification in S&P (2000).

Figure: Example Time Series Moments

Lucas, Robert (1976). "Econometric Policy Evaluation: A Critique" - methodological milestone

Before

- System-of-equations macroeconometric models
  - Dealt with each equation separately
  - Solved system given policy actions and predetermined variables, for current outcomes
- Assume equations policy-invariant
- typical example: IS-LM model

Lucas, Robert (1976). "Econometric Policy Evaluation: A Critique" - methodological milestone
After

- Dynamic, fully articulated model economies
  - People maximize given price processes
  - Firms maximize
  - Markets clear
- Preferences and technology policy-invariant
- Observed Structure function of the policy followed

Macroeconomic Policy

Policy Before and After

- Before: Given situation, what policy action is best?
- After: What is a good policy rule to follow?

From Optimal Control to Dynamic Games

Economic Policy Theory Studies The Interaction Between Policy and Economic Agents.

The Time Inconsistency of Policy

Question: What policy rule is best?

- Problem: Principle of optimality fails
- Why? Because people think and anticipate
- Outcome: Time consistent policy rule is not best
- Solution: Pick a good rule and follow it

Example: Time Inconsistency and Central Bank Independence

Suppose nominal wage set so real wage too high

- Problem:
  - Ex post, can undo distortion with inflation
  - If anticipated, result is high inflation and distortion
- Solution:
  - Independent central bank committed to low inflation

Bottom Line on Policy

- Rules rather than discretion
- Need good theory to quantitatively assess rules
- Theory must be Dynamic and Stochastic.

Example: Consumption/Saving Decision under Uncertainty

objective function

$$\max E\left[\sum_{i=0}^{\infty} \beta^i U\left(C_{t+i}\right) \mid I_t\right] \tag{1}$$

dynamic constraint

$$C_{t+i} + S_{t+i} = Z_{t+i} F\left(K_{t+i}, 1\right) \tag{2}$$

$$K_{t+i+1} = (1-\delta) K_{t+i} + S_{t+i} \tag{3}$$

Optimality Conditions

$$L = E\sum_{i=0}^{\infty}\left[\begin{array}{c}\beta^{i}U\left(C_{t+i}\right)+\\ \beta^{i}\lambda_{t+i}\left(K_{t+i+1}-\left(1-\delta\right)K_{t+i}-Z_{t+i}F\left(K_{t+i},1\right)+C_{t+i}\right)\mid I_{t}\end{array}\right] \tag{4}$$

First Order Conditions

$$C_t : E\left(U'\left(C_t\right) = \lambda_t \mid I_t\right) \tag{5}$$

$$K_{t+1} : E\left[\lambda_t = \beta\lambda_{t+1}\left(1-\delta+Z_{t+1}F_K\left(K_{t+1},1\right)\right) \mid I_t\right] \tag{6}$$

Define the expected gross return on capital as:

$$R_{t+1} = 1-\delta+Z_{t+i}F_K\left(K_{t+1},1\right)$$

Optimality Conditions

$$U'(C) = \lambda_t \tag{7}$$

$$\lambda_t = E\left[\beta R_{t+1}\lambda_{t+1} \mid I_t\right] \tag{8}$$

- The marginal utility of consumption must equal to the marginal value of capital. (wealth)
- The marginal value of capital must be equal to the expected value of the marginal value of capital tomorrow times the expected gross return on capital, times the subjective discount factor.

Or, merging the two:

$$U'(C_t) = E\left[\beta R_{t+1} U'(C_{t+1}) \mid I_t\right] \tag{9}$$

Keynes - Ramsey Rule

Effect of Shocks

Steady State

$$C_t = C_{t+1} \to R = 1 - \delta + ZF_K\left(K^*, 1\right) = 1/\beta \to K^* \qquad (10)$$

$$ZF_K\left(K^*, 1\right) - \delta = \frac{1-\beta}{\beta} \qquad (11)$$

$$ZF\left(K^*, 1\right) - \delta K^* = C$$

Permanent shock on Z. - From (10) - permanent increase in K, so that $Z^+ F_K\left(K^+, 1\right)$ constant (as implied by **??**).
Thus a positive technological shock induces a transitory increase in investment.
C must increase by less than $ZF(K, 1)$.
After that? Not much

Approaches to Model Solution

- Find special cases which solve explicitly.
- Ignore uncertainty, go to continuous time, and use a phase diagram.
- Linearize or log linearize, and get an explicit solution (numerically or analytically).
- Set it up as a stochastic dynamic programming problem, and solve numerically.

Next Time - Modelling with Dynare