ECON 815

Introduction

Winter 2020

What is the course about?

Modern macroeconomics is about understanding cyclical fluctuations.

Important for:

- forecasting
- analyze policy changes
- design optimal policy responses to shocks

Main issue:

The first task merely requires an econometric (reduced form) toolkit.

The second requires a theoretical (structural) model.

The third requires a combination of the two.

Goal

1) We develop (bare bone?) models for how the economy works.

Problem: We abstract from many (relevant?) issues.

2) We see how these models work empricially.

Problem: There aren't many (long) time series.

Good news is that we agree at least on the questions!

- What drives the moments in the data?
- Why are shocks persistent and amplified?
- What can policy do about it?

Macroeconomics? A history of disasters ...

1800s: Bank Panics
$\longrightarrow$ emergence of national currency and bank regulation

1873-1896: Long Depression
$\longrightarrow$ emergence of gold standard

1929-1939: Great Depression
$\longrightarrow$ emergence of Keynesian theories

1970s/80s: Stagflation
$\longrightarrow$ emergence of DSGE

2008: Great Recession
$\longrightarrow$???

Question: How much can these disasters be attributed to policy mistakes?

What is DSGE about?

Dynamic – how an economy evolves throughout time

Stochastic – in response to shocks

General – at a high level of aggregation

Equilibrium – based on (optimal) decision rules.

Key Aspects:

- The core is a structural, microfounded model.
- Due to non-linearities, the model is solved in an approximate way.
- The model is then compared to the data taking the model "seriously".
- It is thus a synthesis of reduced form and structural approaches.

Overview

Part I: Two-period economies

Part II: The Long-run

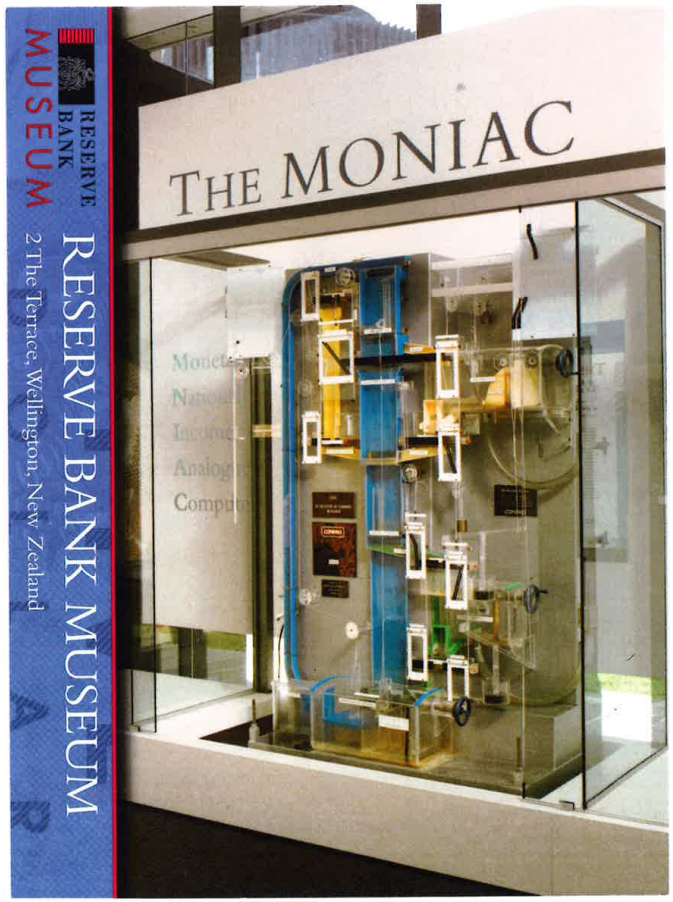
Part III: RBC Model

Part IV: VARs

Part V: New Keynesian Model

Part VI: Monetary Policy

How? The old way ...



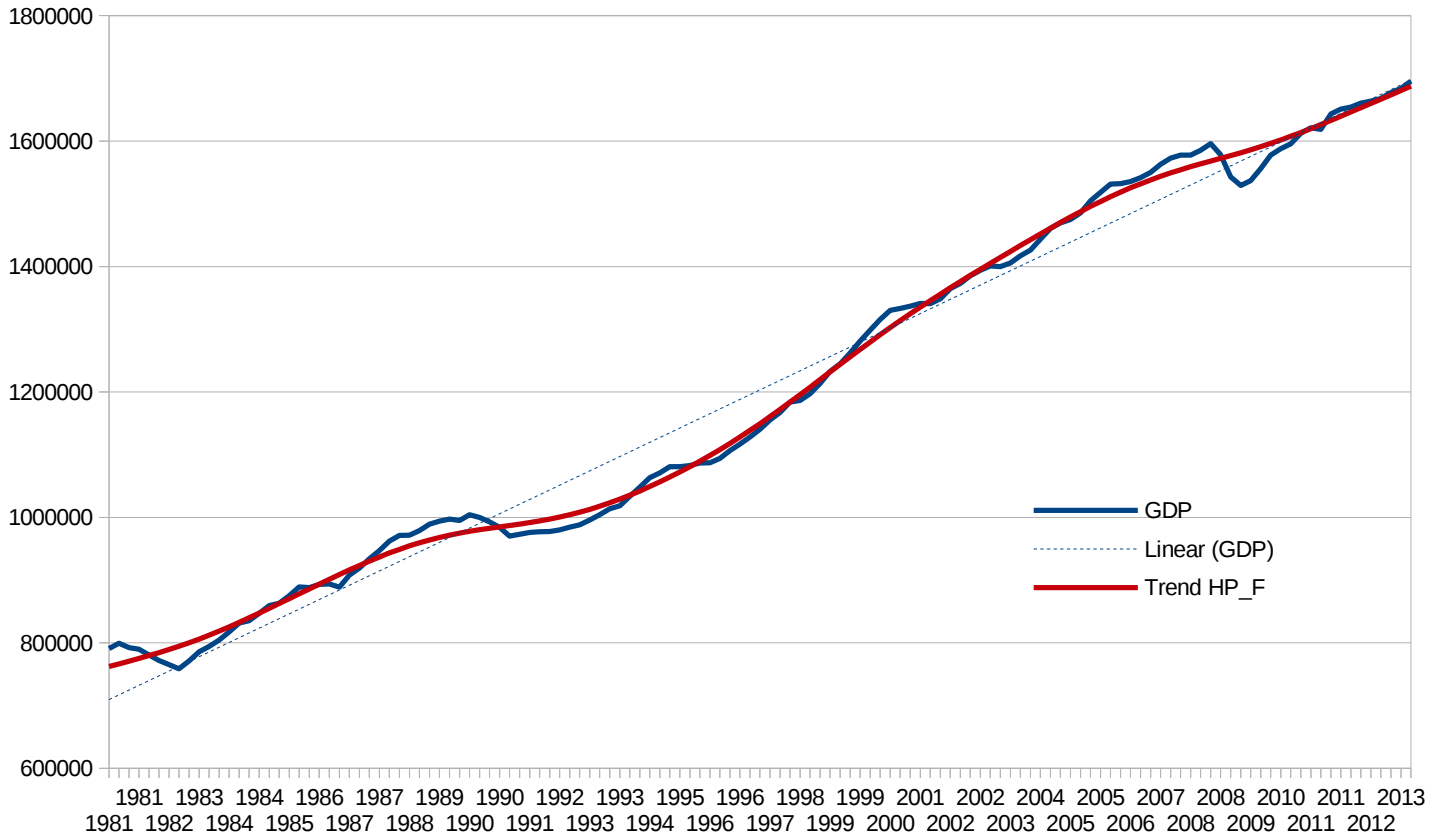
The MONIAC – by A.W. Phillips

... and the new way!

DYNARE

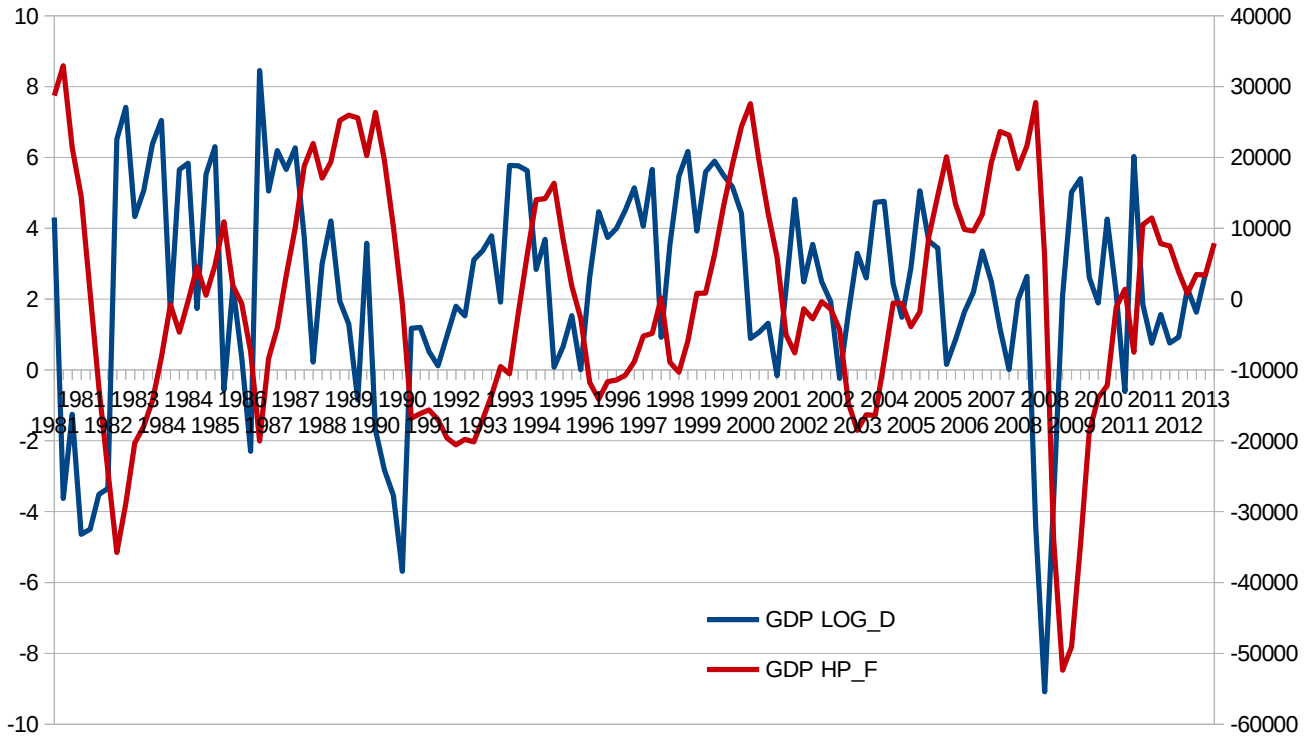
Check it out! – www.dynare.org

What is the cycle?



Canadian Real GDP – 1981:1 - 2013:3

Issue: GDP is I(1) and we want to explain fluctuations around a trend.



Fluctuations in Real GDP – 1981:1 - 2013:3

Issue: There are many ways to "detrend" the data.

Detrending

1) First-differences

- growth rates are given by $\frac{\dot{y}_t}{y_t} = \frac{d \ln y_t}{dt}$
- or: $\frac{y_t - y_{t-1}}{y_{t-1}}$ which can be approximated by $\Delta \ln y_t$
- tends to emphasize very high frequencies

2) HP filter

- decompose series into a trend and a cyclical component

$$y_t = y_t^g + y_t^c$$

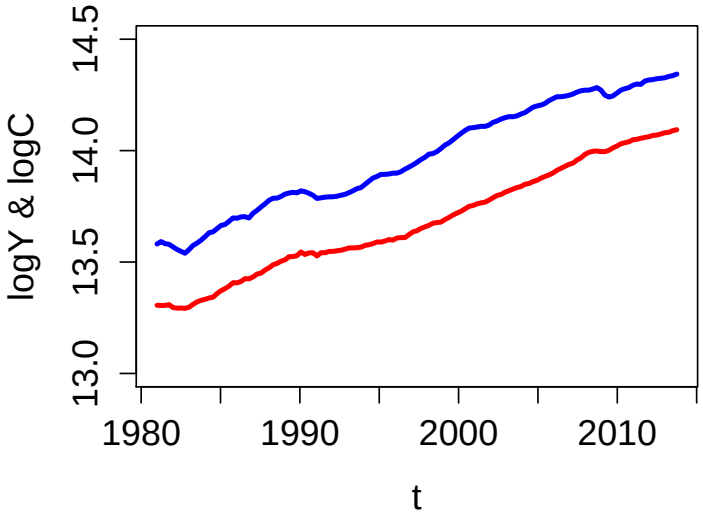
- least square estimator

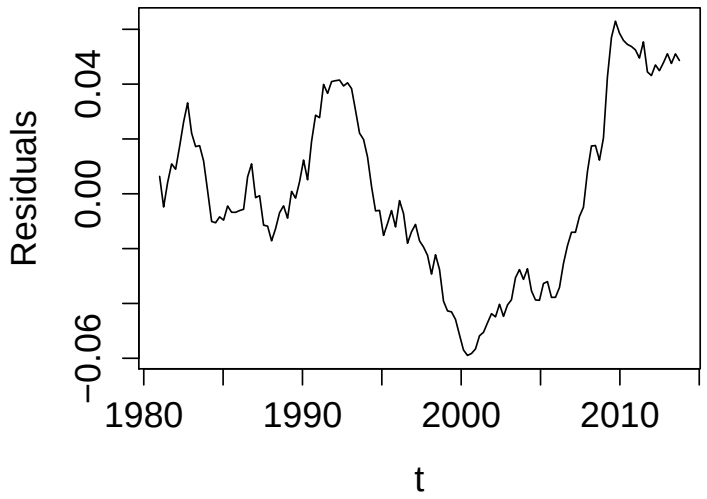
$$\min_{y_t^g} \sum_{t=0}^{T} (y_t - y_t^g)^2 + \lambda \sum_{t=0}^{T} \left((y_{t+1}^g - y_t^g) - (y_t^g - y_{t-1}^g) \right)^2$$

- for quarterly business cycle data set $\lambda = 1600$ for 2-3 year frequencies (serial correlation)

Variables move together!

Example: Consumption and Output





Canadian Real GDP (blue) and Consumption (red) – 1981:1 - 2013:3

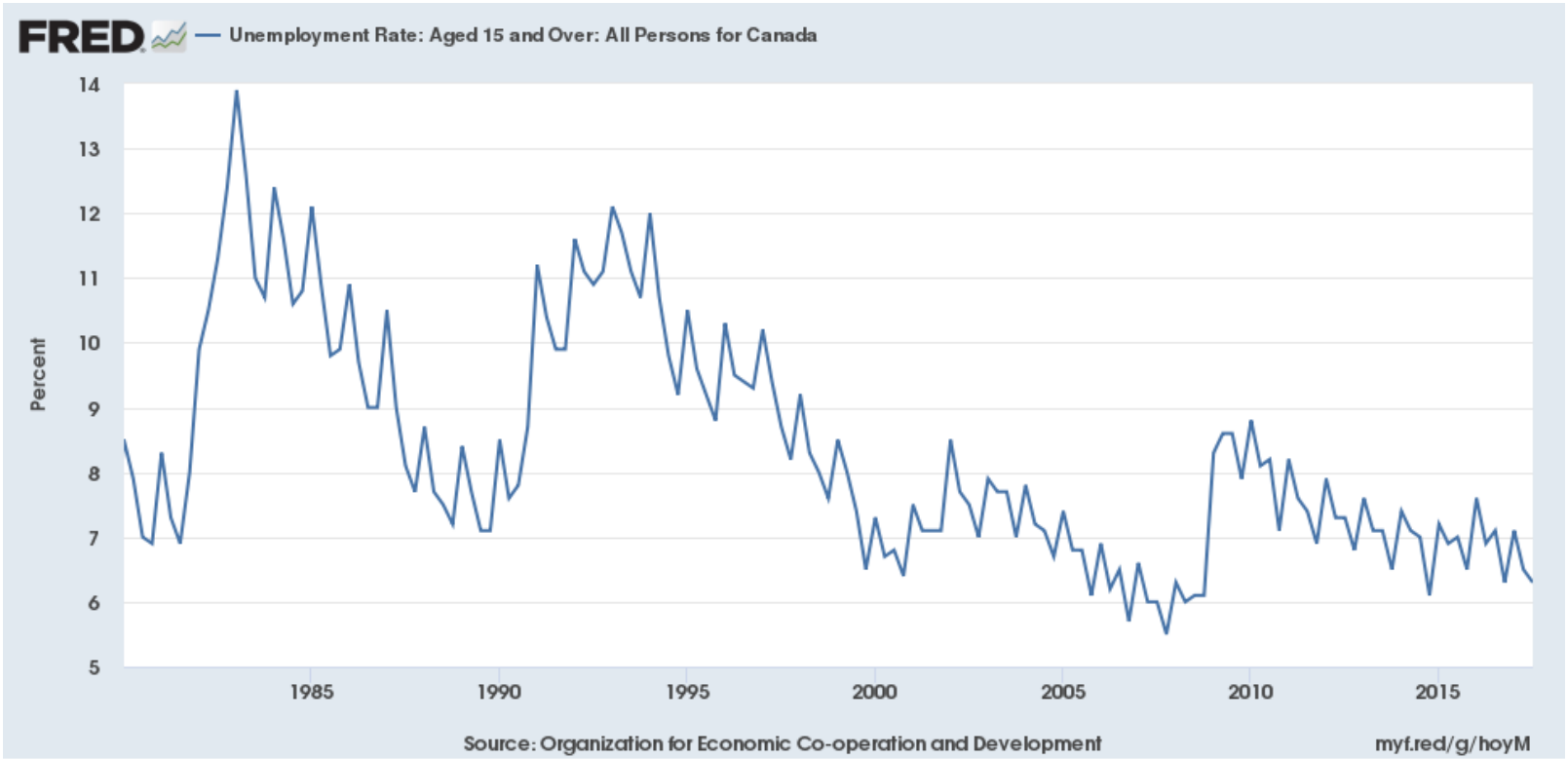
Residuals from Cointegration

Issue: What matters is the deviation from the long-run relationship.

3) Cointegration

- Take two time series, y_t and x_t.
- They are cointegrated whenever there exists some γ s.th. $\epsilon_t = y_t - \gamma x_t$ is I(0).
- If the variables are cointegrated, they have a common trend.
- Then simply differencing variable by variable would lose information.
- We want to purge the common trend from the variables to study short-term deviations from that trend.

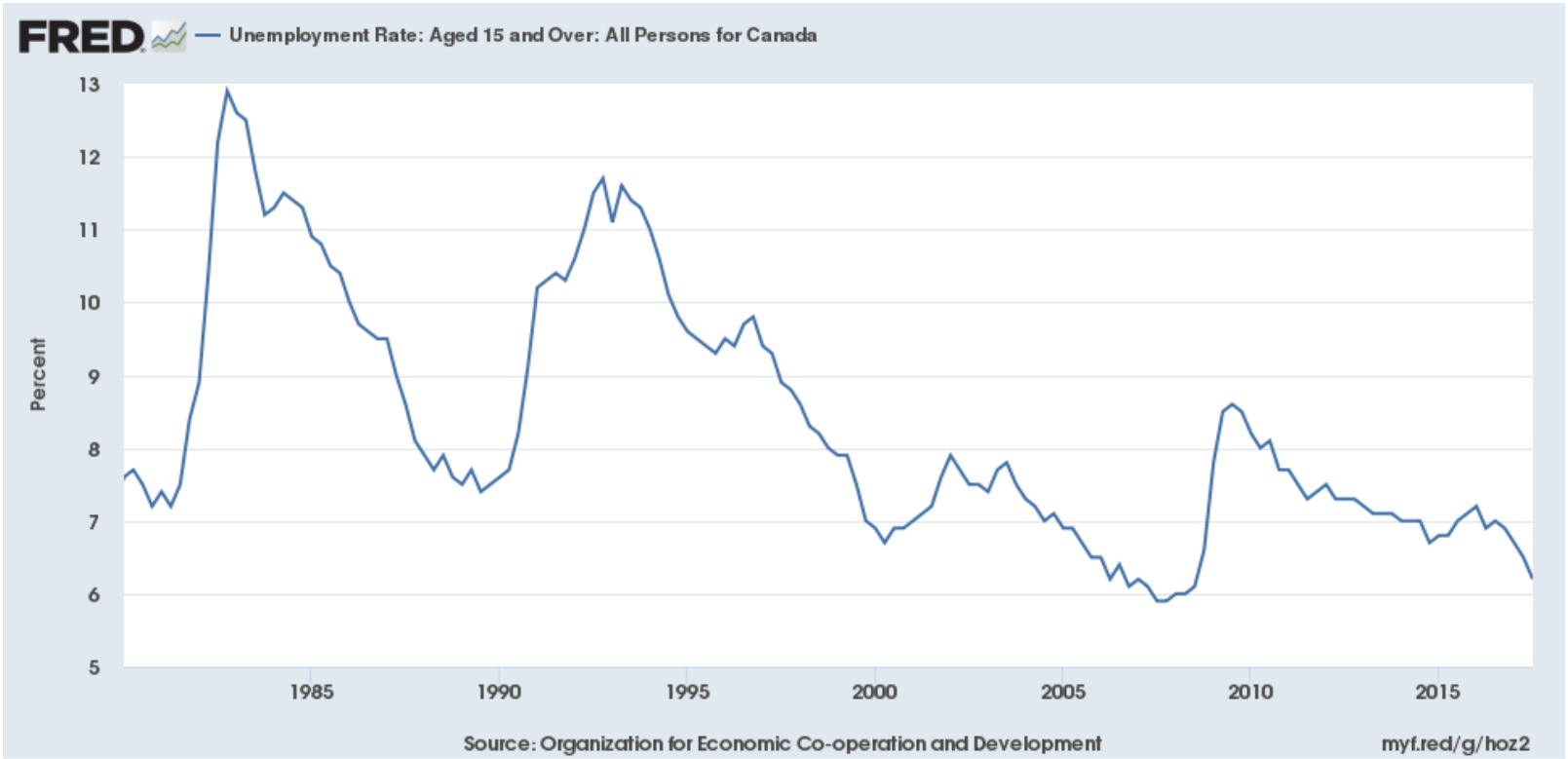
Different Frequencies



Unemployment – 1980:1 - 2017:3

Issue: There are patterns at particular frequencies that can be evaluated further by spectral analysis.

Using Seasonal Adjustment



Unemployment (seasonally adj.) – 1980:1 - 2017:3

Spectral Analysis

Question: Which frequencies matter most?

Our data are usually described in the **time domain** as

$$Y_t = \sum_{j=0}^{\infty} \psi_j \epsilon_{t-j}$$

The goal is to estimate the coefficients ψ_j which tell us how the data are correlated across time.

We can also view the data in the **frequency domain** as approximated by wave-like functions

$$Y_t = \sum_{j=1}^{k} A_j \sin(2\pi\nu_j t) + B_j \cos(2\pi\nu_j t)$$

The coefficients represent how the data are correlated at different frequencies ν_j.

Periodogram

A **periodogram** decomposes the total variance of a time series into autocorrelations at different frequencies.

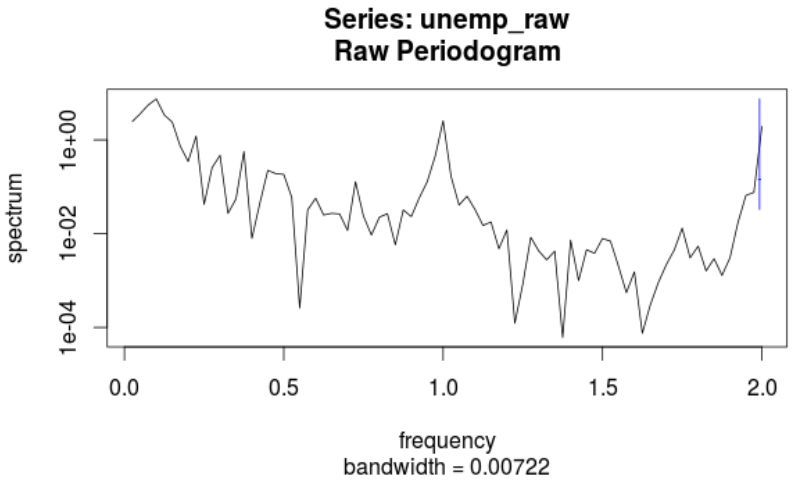
By default, one plots the cycle in units of radians per unit of observation:

- highest frequency is 2π
  $\equiv$ 0.5 cycles per quarter
  $\equiv$ 2 quarters per cycle

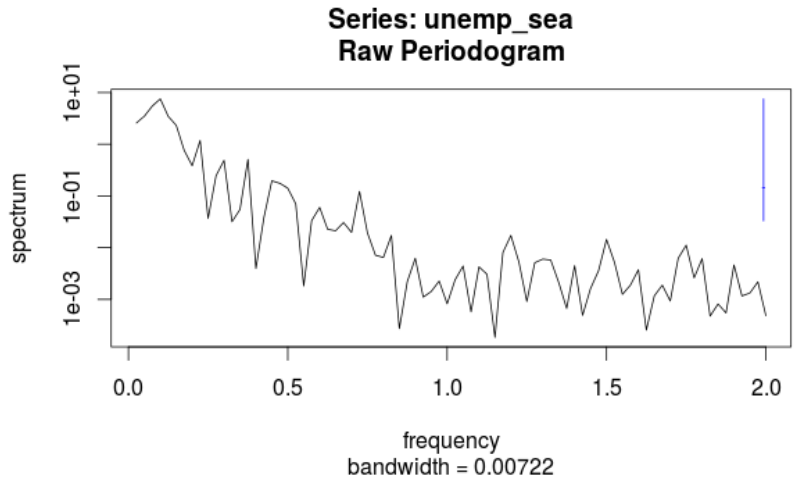
- lowest frequency is $2\pi/T$
  $\equiv 1/T$ cycles per quarter
  $\equiv T$ quarters per cycle

Examples: (i) white noise; (ii) AR(1) process

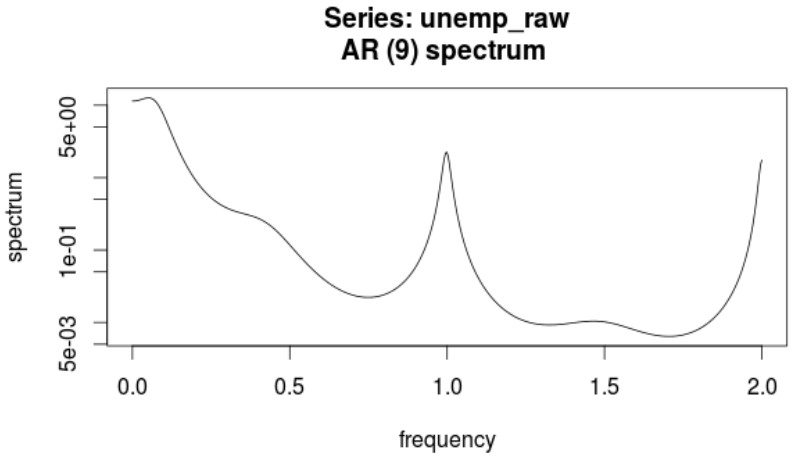
Using Spectral Analysis



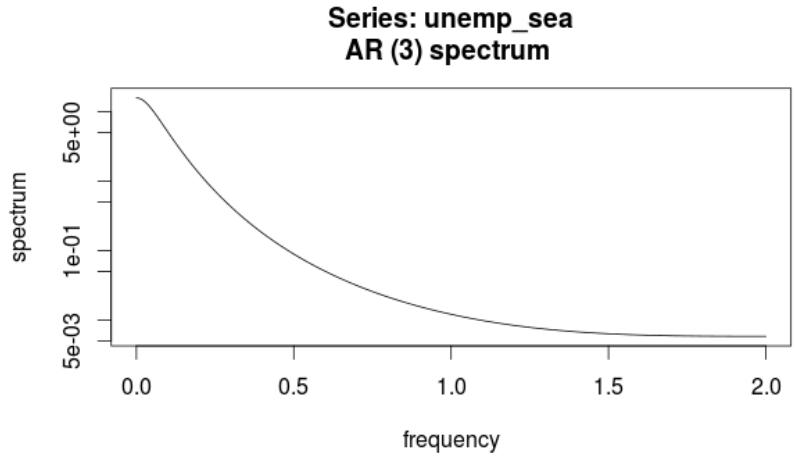
(a) Raw Data Series



(b) Seasonally Adjusted Series



(c) Raw Data – AR smoothed



(d) Seas. Adj. – AR smoothed

Second Moments

"Classic" Approach of DSGE:

- calibrate to the data
- solve the model
- simulate the model
- compare moments (or IRFs to shocks)

Mean Annual Growth, Standard Deviation and Covariance with Output
(Canada 1981:1 – 2013:3)

	Mean	$\frac{SD}{SD_Y}$	-4	-3	-2	-1	0	1	2	3	4
Output	2.35	1	0.03	0.21	0.31	0.55	1	0.55	0.31	0.21	0.03
Cons.	2.43	0.72	-0.13	0.21	0.24	0.32	0.53	0.31	0.26	0.15	0.07
Inv.	2.92	5.12	-0.01	0.09	0.32	0.47	0.59	0.48	0.15	0.00	-0.07
Hours	1.22	0.97	-0.08	0.07	0.25	0.53	0.70	0.61	0.35	0.18	0.09
Prod.	1.13	0.76	0.15	0.19	0.10	0.05	0.41	-0.05	-0.04	0.05	-0.08

Stylized RBC Facts

- stable long-run trend growth (balanced growth path)
- investment fluctuates more than output
- consumption is smooth relative to output
- hours and output fluctuate about the same (but avg. weekly hours fluctuate much less)
- productivity is procyclical, but fluctuates somewhat less than output
- real wages vary less than productivity and avg. compensation not correlated with output

Conclusion:

Technology shocks should play a role with investment and labor input being the main propagating mechanism.

Aggregate demand is far less important, unless something else than technology shocks matter.