Advanced Macroeconomics II

New Keynesian DSGE Framework and Monetary Policy

Lecture 1. Overview

Spring 2015

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Course webpage

http://teach.xmu.edu.cn/DirList.aspx?DirID=3089

Or going through the following route:

厦大教学文件服务系统 http://teach.xmu.edu.cn/

==》首页->王亚南经济研究院->牛霖琳的文档目录->Advanced Macro II

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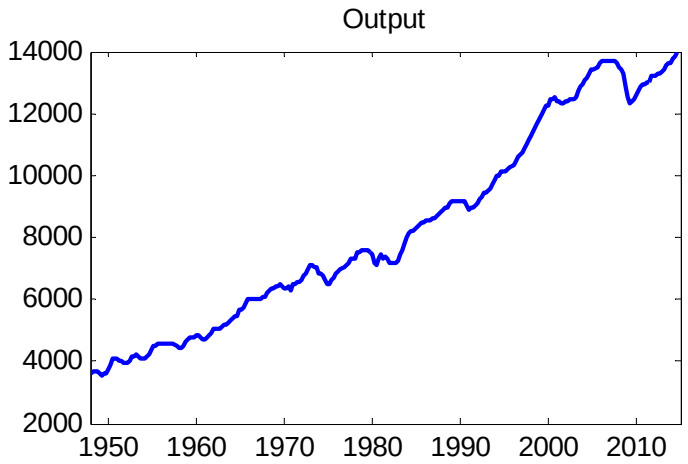
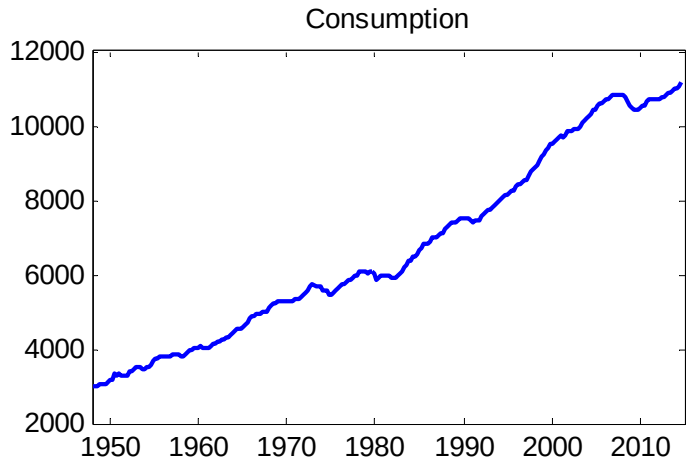
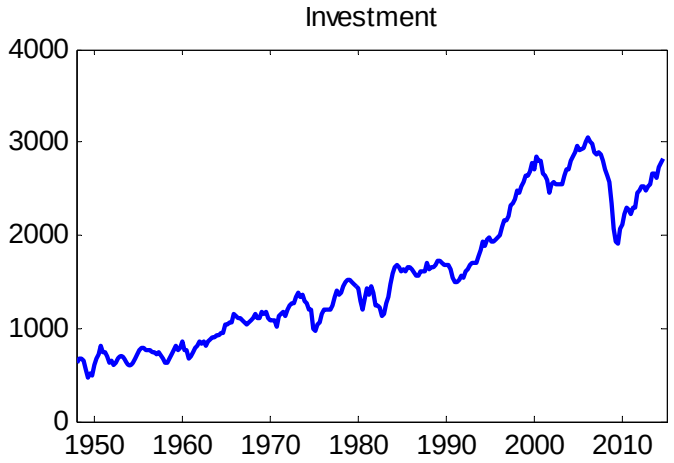
Grading (0-100 points)

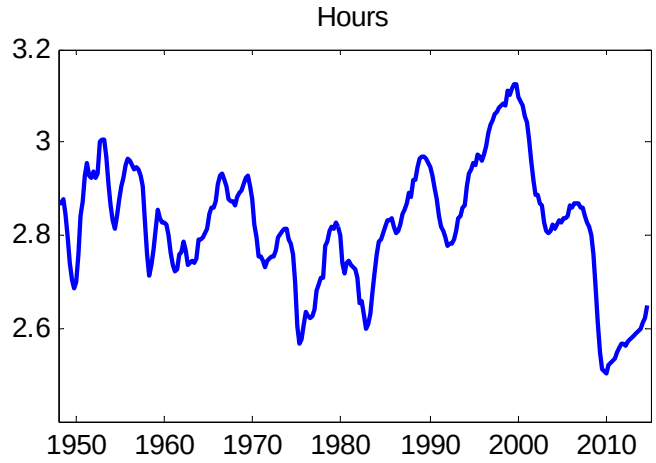
- **40% on quizzes and problem sets**
- **30% on midterm**
- **30% on final**
- **Bonus: extra points added to the overall score which is up to 100.**

U.S. Macro Variables (1948:Q1 – 2014:Q4) -- Level

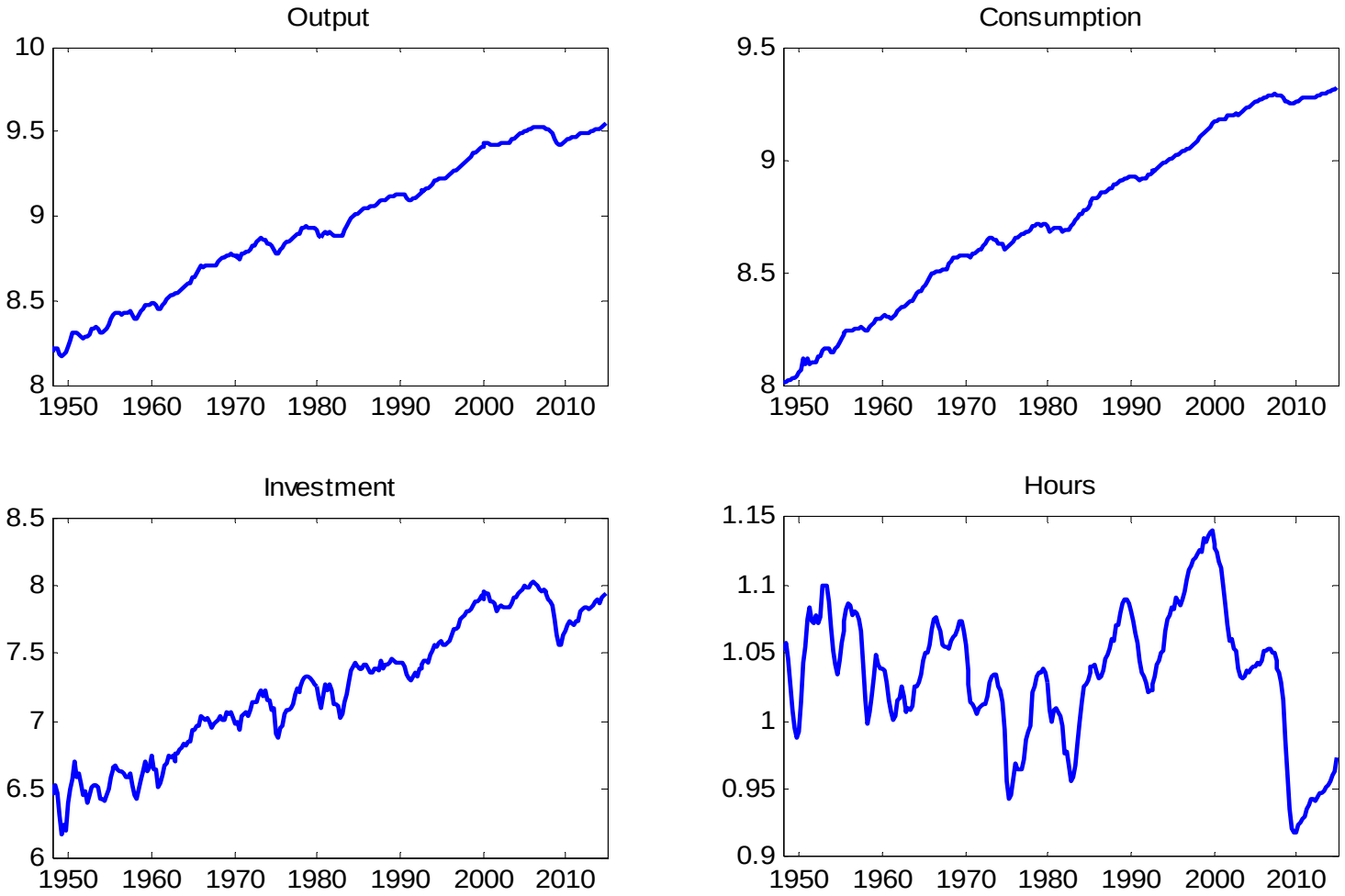




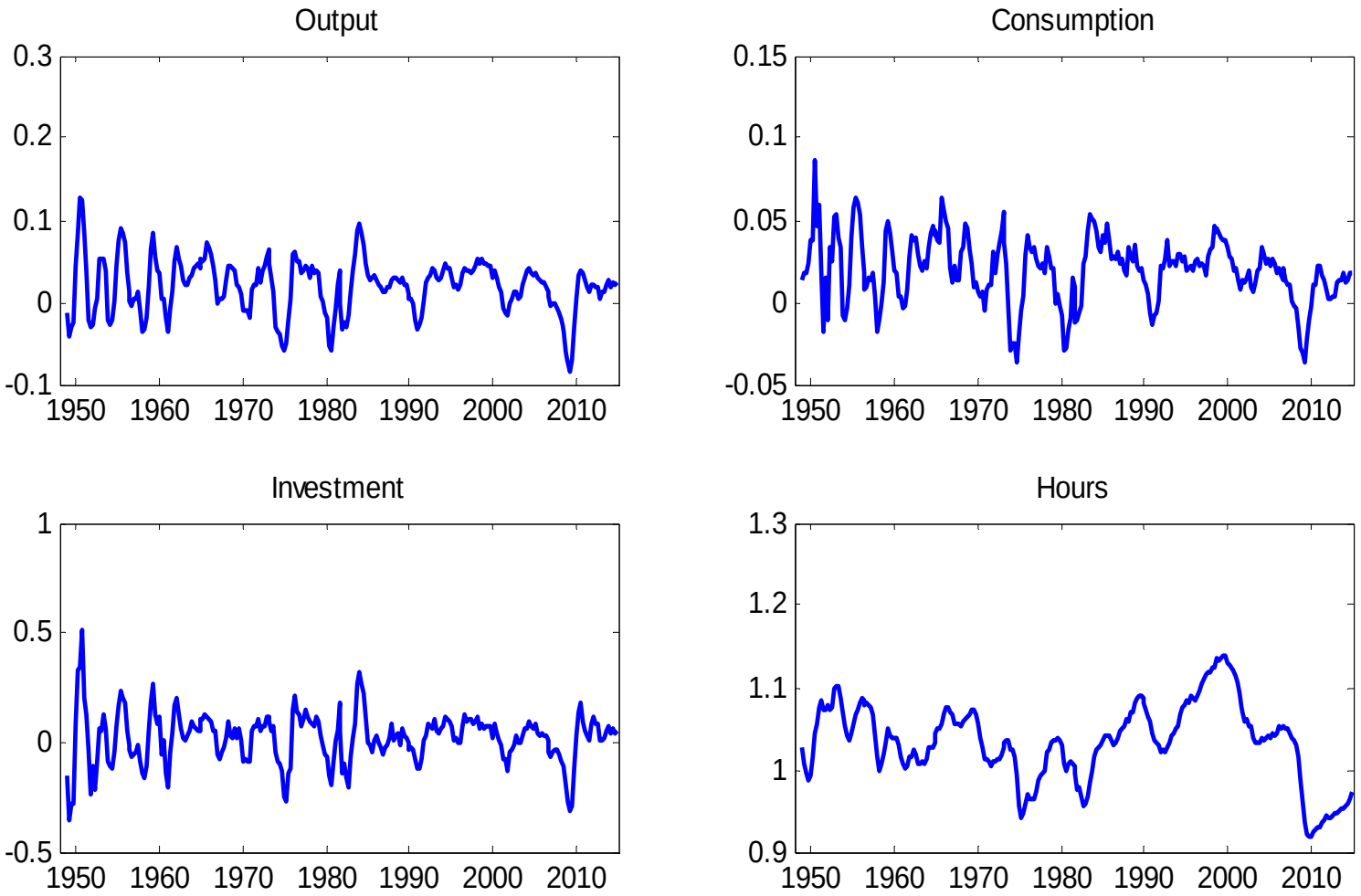




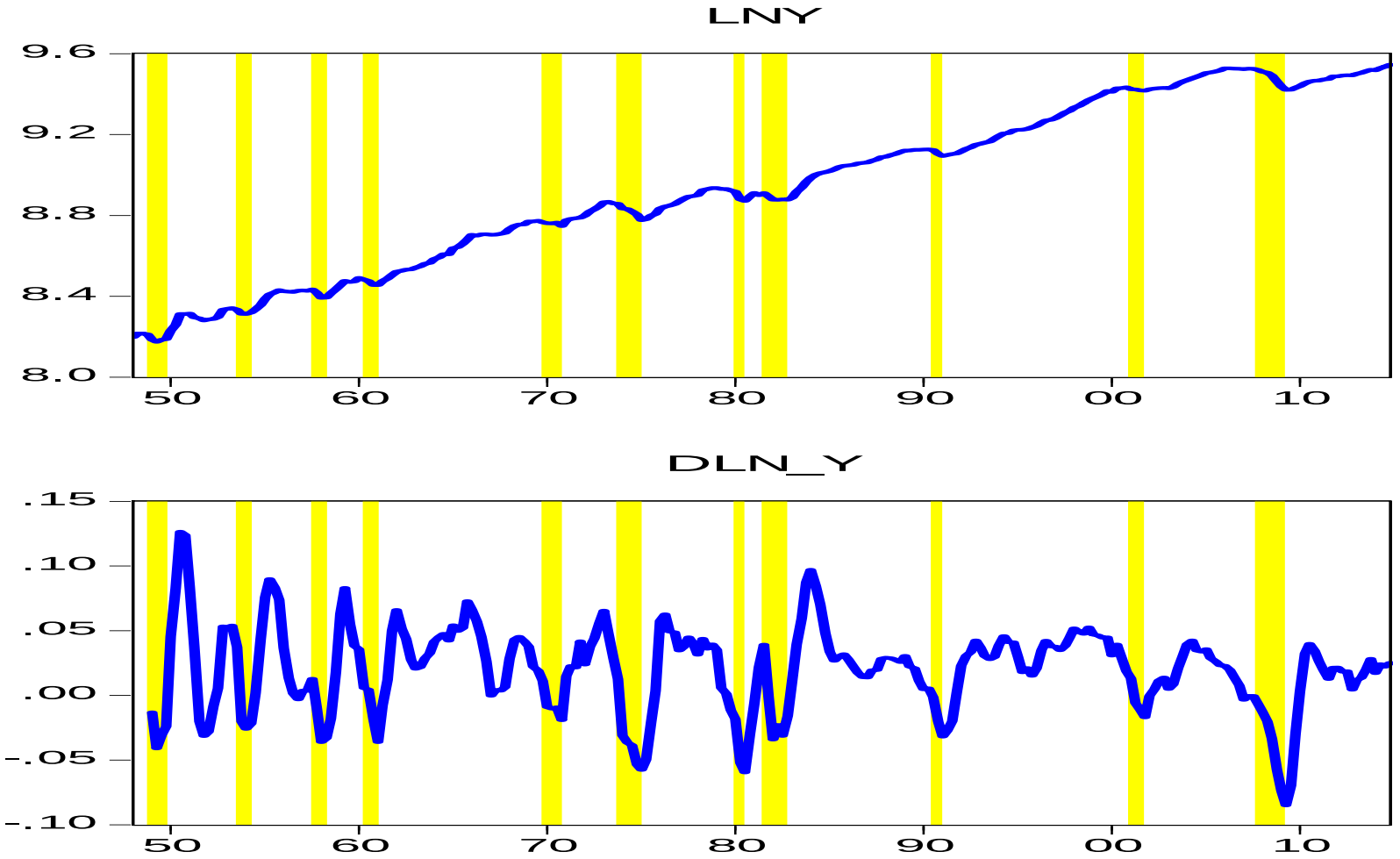
U.S. Macro Variables (1948:Q1 – 2014:Q4) -- Log



Annual difference: percentage changes (1949:Q1 – 2014:Q4)



Trends and cycles (1949:Q1 – 2014:Q4)

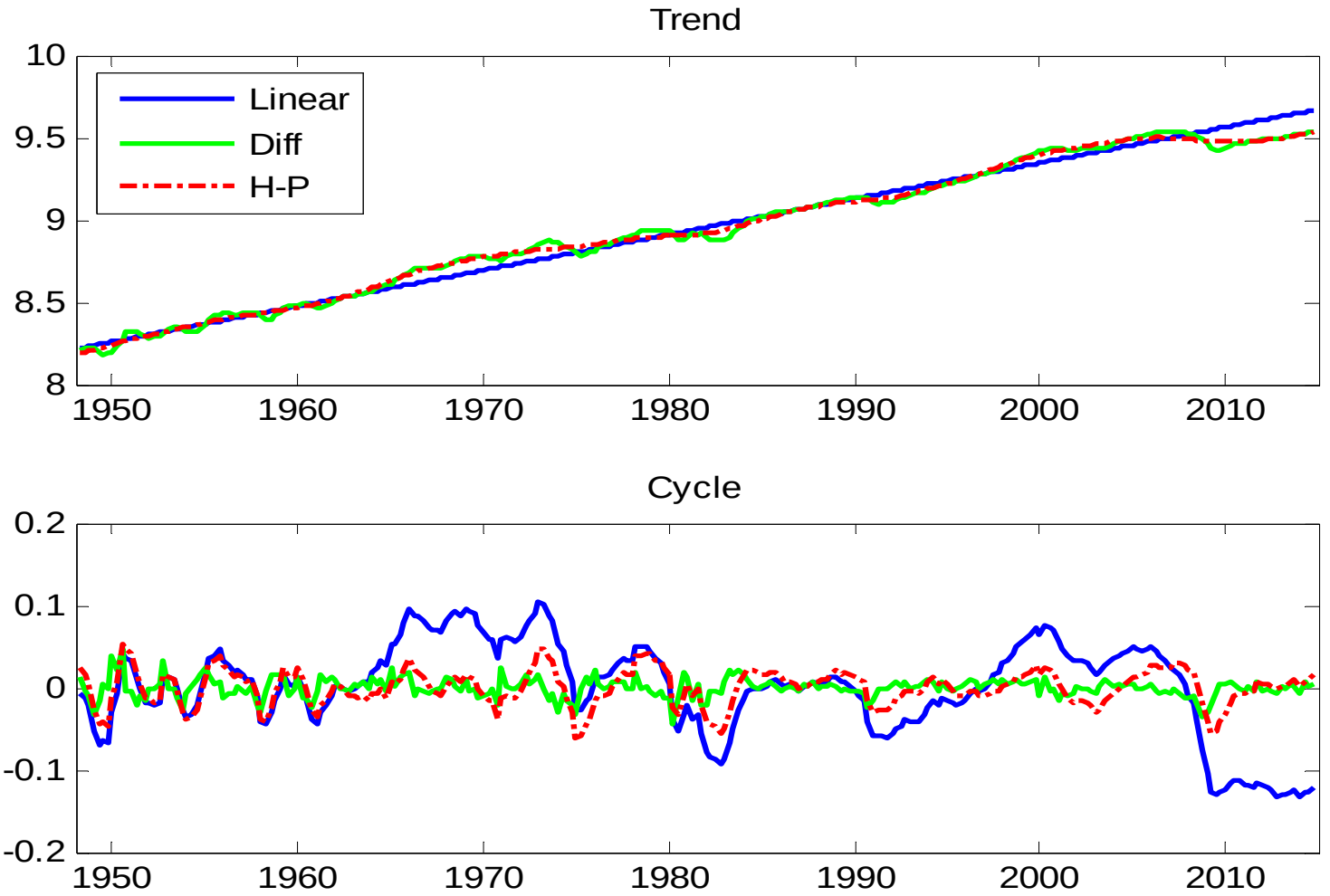


NBER recessions (1948 – 2014)

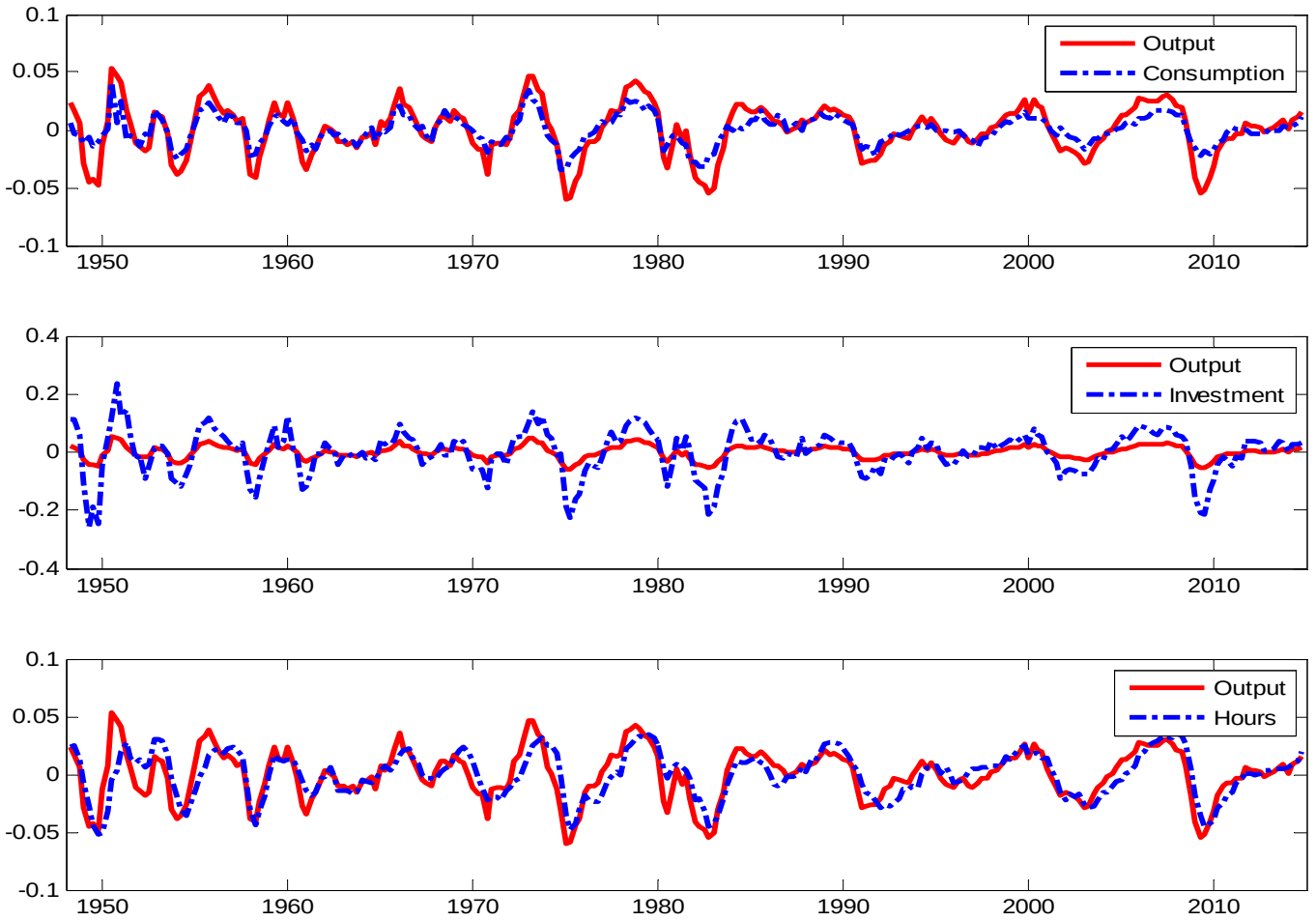
(http://www.nber.org/cycles.html)

Peak	Trough
November 1948(IV)	October 1949 (IV)
July 1953(II)	May 1954 (II)
August 1957(III)	April 1958 (II)
April 1960(II)	February 1961 (I)
December 1969(IV)	November 1970 (IV)
November 1973(IV)	March 1975 (I)
January 1980(I)	July 1980 (III)
July 1981(III)	November 1982 (IV)
July 1990(III)	March 1991(I)
March 2001(I)	November 2001 (IV)
December 2007 (IV)	June 2009 (II)

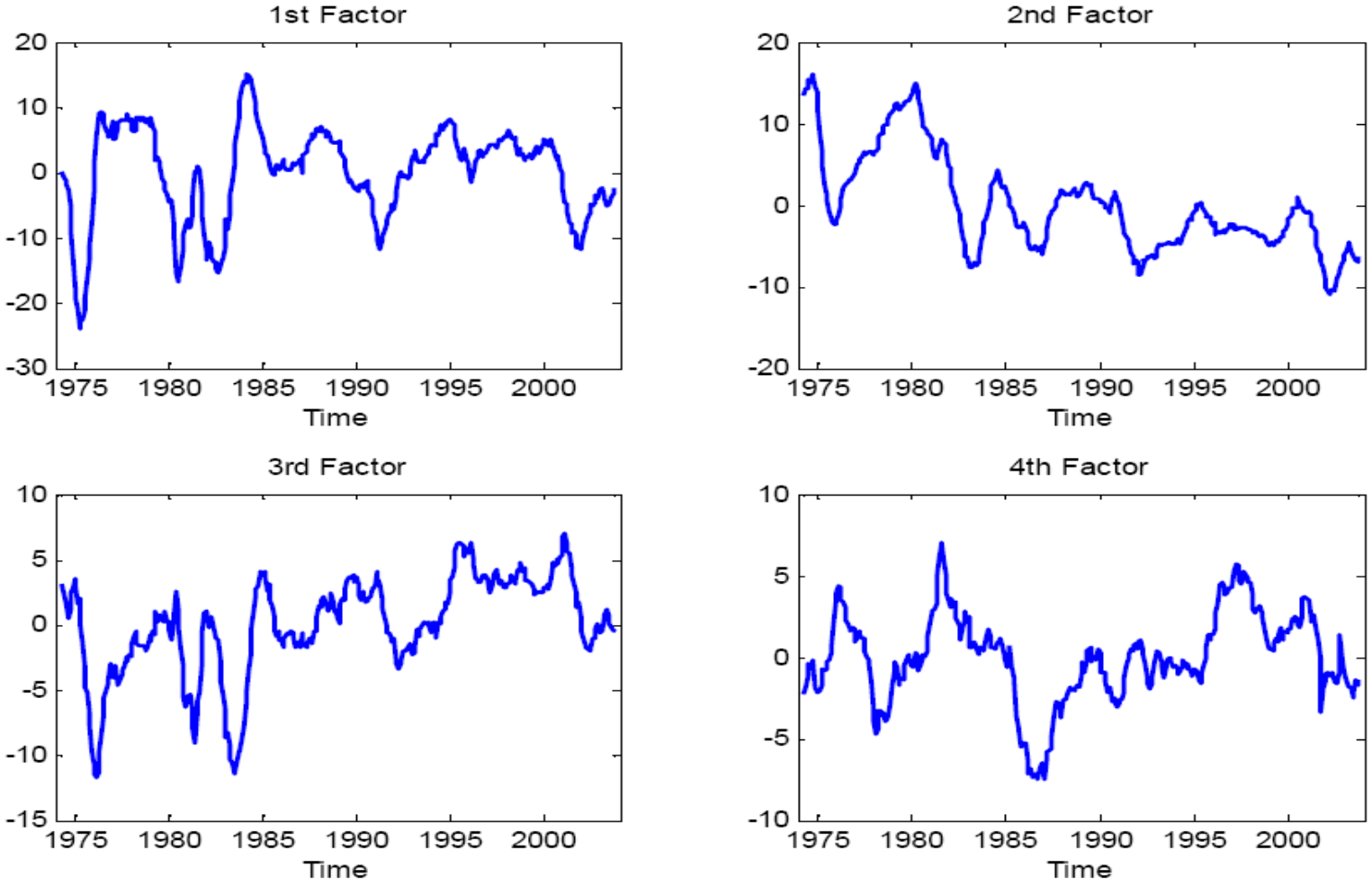
Decomposition of the output (1948:Q1 – 2014:Q4)



Timing and scales of the HP-filtered gaps (1948:Q1 – 2014:Q4)



Comovement of macro variables (1974:4 – 2003:9)



Key driving forces?

Factors are extracted from a panel with 162 macro variables (1974:4-2003:9) after transformation to control for stationarity. The first five factors are shown with the five variables with which they are most highly correlated. The first five factors together explain 72.21% of the total variation in the transformed macro panel. The series used are the same as in Giannone, Reichlin and Sala (2004), except that we exclude 9 interest rate

Factor 1	**Total variance explained: 32.26%**	R^2
	Index of IP: Non-energy, total	0.93
	Index of IP: Mfg	0.93
	Index of IP: Non-energy excl CCS	0.92
	Index of IP: Total	0.92
	Index of IP: Non-energy excl CCS and MVP	0.91
Factor 2	**Total variance explained: 22.25%**	
	PPI: crude materials	0.80
	CPI: housing	0.79
	CPI: services	0.79
	Loans and Securities @ all commercial banks: commercial and Individual loans (in mil of current $)	0.78
	CPI: food and beverages	0.77

1. Introduction: growth and cycles

Long run movement: trend, growth

Medium run: business cycles

Short run: seasonal, weekly, daily noise

Time series: macro, finance data

Classical	**vs.**	**Keynesian**
Equilibrium	**vs.**	**Disequilibrium**
Laissez-faire	**vs.**	**Intervention**
Long run	**vs.**	**Short/Medium run**

Recent Synthesis:

Dynamic stochastic general equilibrium (DSGE), applied + theory

2. Approximating and Solving DSGE Models

$$\max_{c_t, n_t, k_t} E_0 \left\{ \sum_{t=0}^{\infty} \beta^t \left[\ln (c_t) + \gamma (N - n_t) \right] \right\} \tag{1}$$

s.t.

$$c_t + k_t = k_{t-1}^{\theta} (a_t n_t)^{1-\theta} + (1-\delta) k_{t-1} \tag{2}$$

$$\ln a_t = (1-\phi) \ln \bar{a} + \phi \ln a_{t-1} + \varepsilon_t \tag{3}$$

with $E_{t-1}[\varepsilon_t] = 0$ and $Var[\varepsilon_t] = \sigma^2$. c_t, n_t, k_t denote consumption, labor and capital. β, γ, N, θ, δ and ϕ are parameters. Note that $0 \leq n_t \leq N$, a_t is a stochastic process. It might be useful to define the expressions for output and gross return on capital as:

$$y_t = k_{t-1}^{\theta} (a_t n_t)^{1-\theta} \tag{4}$$

$$R_t = \theta \frac{y_t}{k_{t-1}} + 1 - \delta \tag{5}$$

(a) *Preferences:* The *representative agent* has a utility function $\ln c_t + \gamma(N - n_t)$, where c_t is the consumption, β is the discount factor.

(b) *Technology:* This is a Cobb-Douglas production function $k_{t-1}^{\theta} (a_t n_t)^{1-\theta}$, ρ is the *capital share* and δ is the *depreciation rate*.

(c) *Endowment:* Each period, the representative agent is endowed with N units of time.

(d) *Information:* The variables need to be chosen based on all information $\mathcal{I}_t$ up to time t.

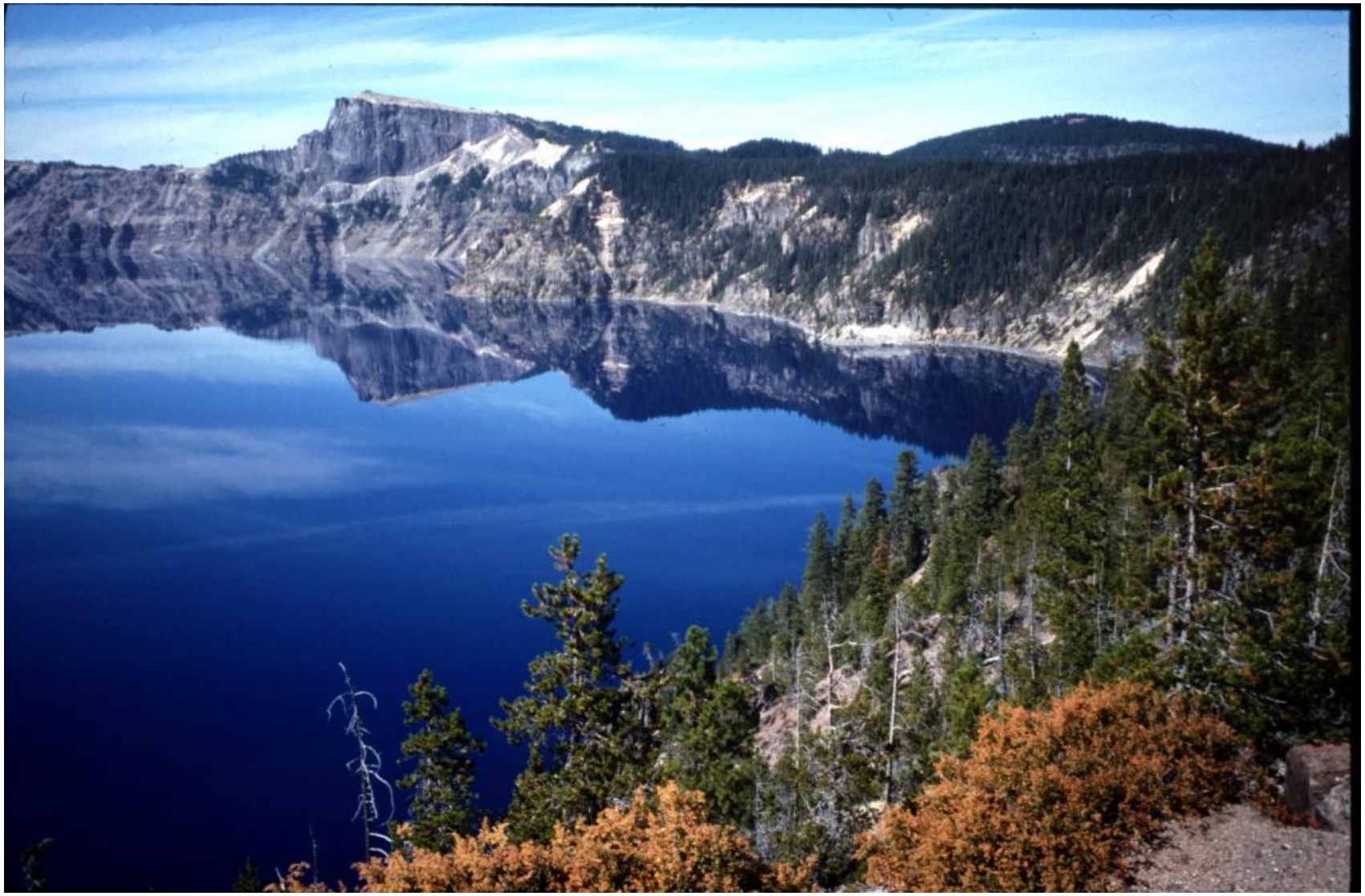
Dynamic optimization

$$\max_{c_t,n_t,k_t} E_0 \sum_{t=0}^{\infty} \beta^{\,t} \left[\ln(c_t) + \gamma(N - n_t)\right] - \lambda_t \left[c_t + k_t - k_{t-1}^{\theta} (a_t n_t)^{1-\theta} - (1-\delta)k_{t-1}\right]$$

$$\begin{aligned} f.o.c. \quad \frac{\beta^t}{c_t} &= \lambda_t \\ \beta^t \gamma &= \lambda_t k_{t-1}^{\theta} (1-\theta)(a_t n_t)^{-\theta} a_t \\ \lambda_t &= E_t \left\{ \lambda_{t+1} \left[(a_t n_t)^{1-\theta} \theta k_t^{(\theta-1)} + (1-\delta) \right] \right\} \end{aligned}$$

Steady states

$$
\begin{aligned}
\bar{c}\gamma &= (1-\theta)\bar{a}^{(1-\theta)}\bar{k}^{\theta}\bar{n}^{-\theta} \\
\frac{1}{\beta} &= \theta\left(\frac{\bar{a}\bar{n}}{\bar{k}}\right)^{1-\theta} + 1 - \delta \\
\bar{c} &= \bar{k}^{\theta}\bar{a}^{(1-\theta)}\bar{n}^{(1-\theta)} - \delta\bar{k} \\
\bar{a}
\end{aligned}
$$



Loglinearize around the steady states

$$\tilde{c}_t \approx (1-\theta)\tilde{a}_t + \theta\tilde{k}_{t-1} + \theta\tilde{n}_t$$

$$\tilde{c}_{t+1} - \tilde{c}_t = \beta\theta\left(\frac{\bar{a}\bar{n}}{\bar{k}}\right)^{1-\theta}(1-\theta)\left(\tilde{a}_t + \tilde{n}_t - \tilde{k}_t\right)$$

……

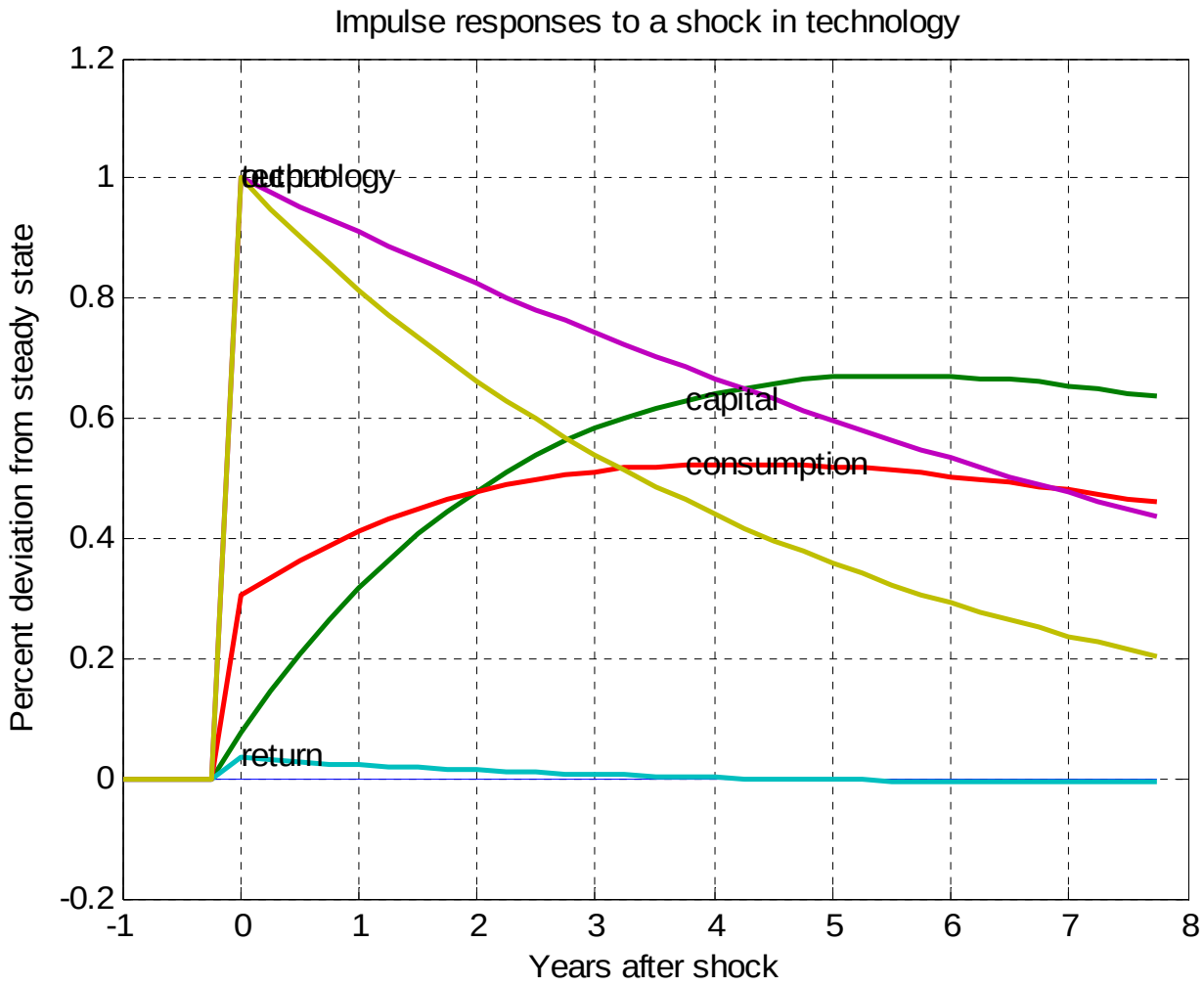
- **To solve the linear system:**
  - **Undetermined coefficient methods**
  - **Recursive law of motion**

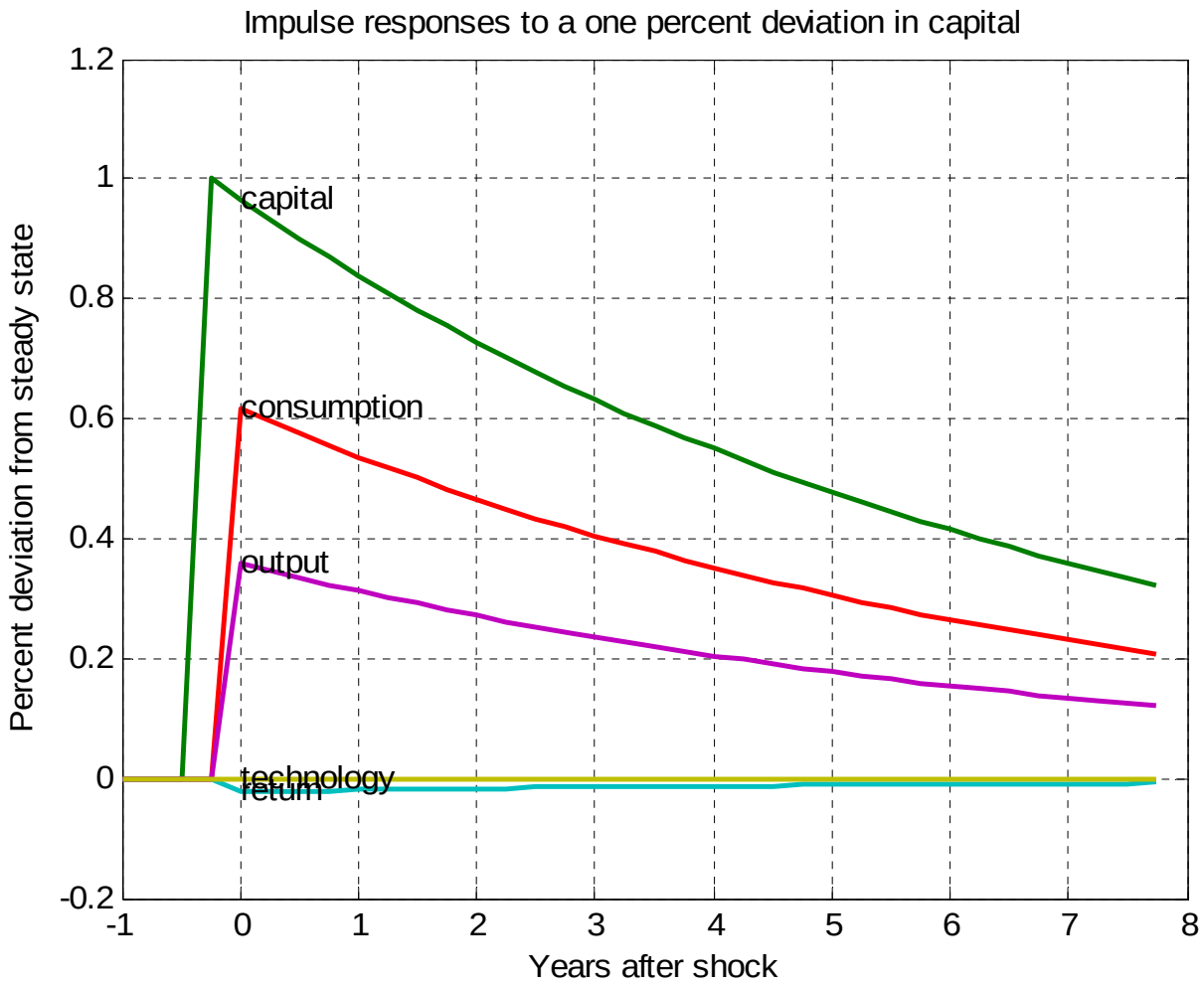
- **State variable: capital(*t-1*), technology shock (*t*)**

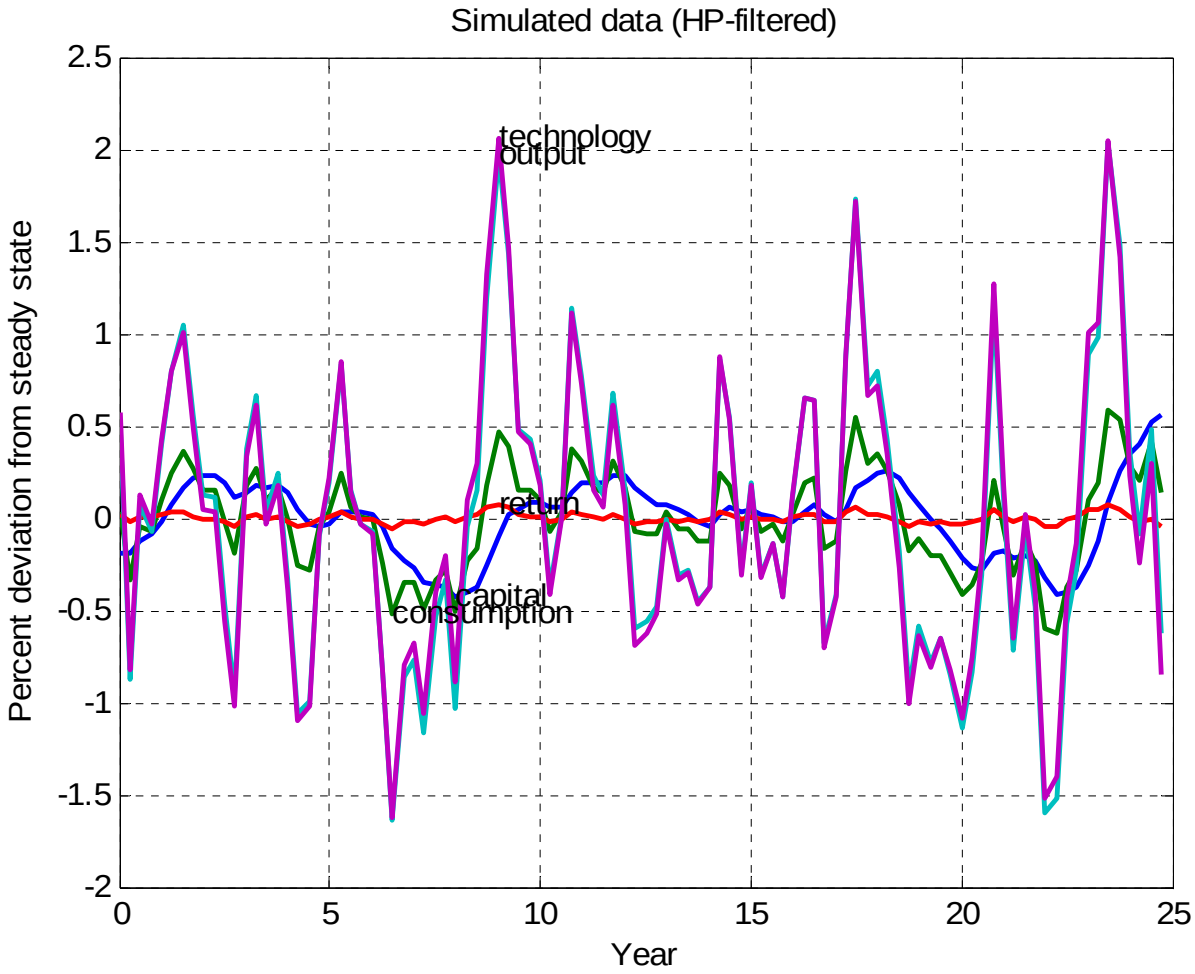
- **After solving, the dynamics of the system can be expressed by the state variables alone.**

- **Given parameters (calibration, estimation), we can study the system numerically.**

- **We can also estimate the model with sufficient data.**


Impulse responses to a shock in technology
Percent deviation from steady state
Years after shock
technology
output
capital
consumption
return
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-1
0
1
2
3
4
5
6
7
8


Impulse responses to a one percent deviation in capital
Percent deviation from steady state
Years after shock
capital
consumption
output
technology
return
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-1
0
1
2
3
4
5
6
7
8


Simulated data (HP-filtered)
Percent deviation from steady state
Year
technology
output
return
capital
consumption
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
5
10
15
20
25

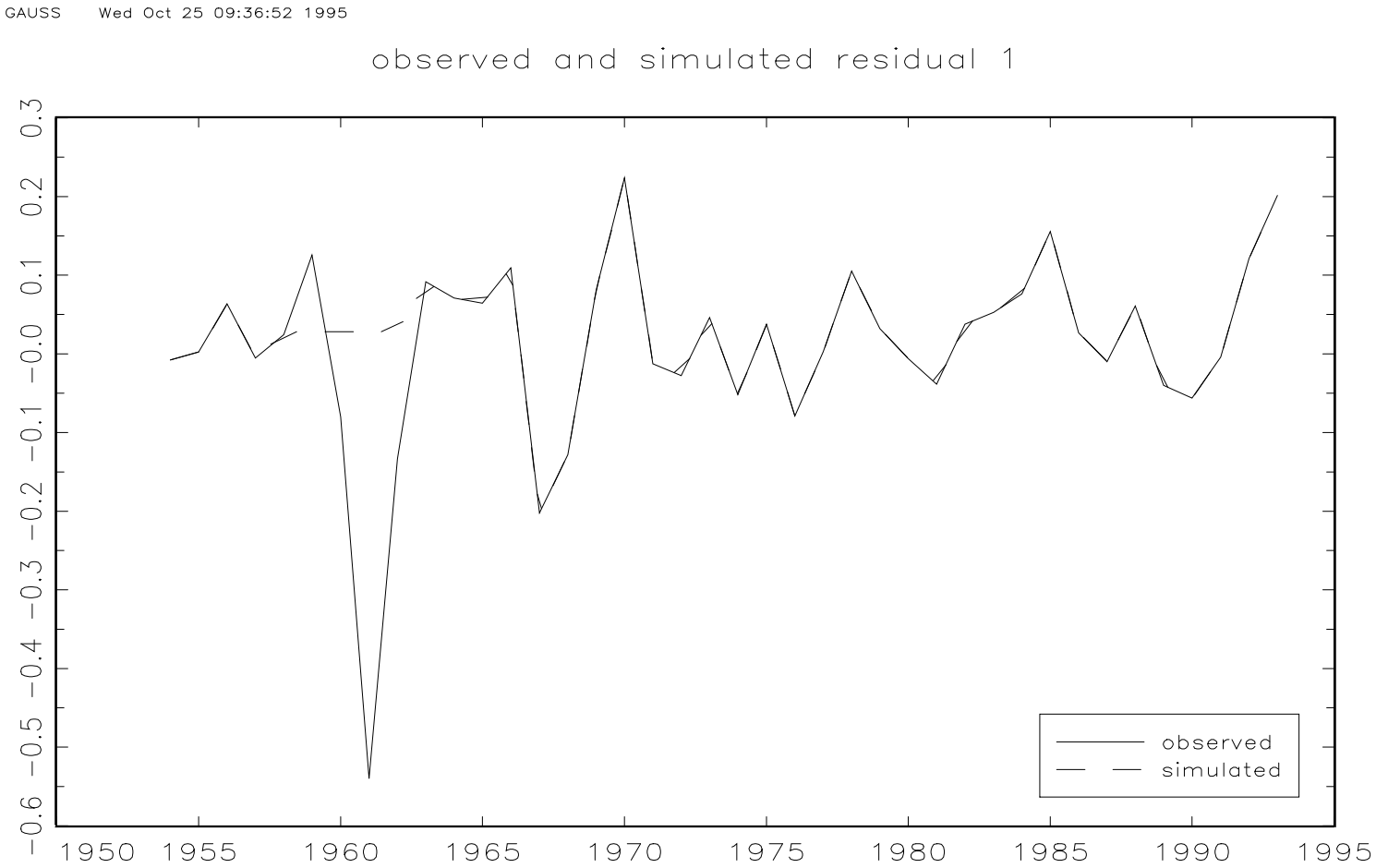
3. Examples of DSGE Models in the RBC framework

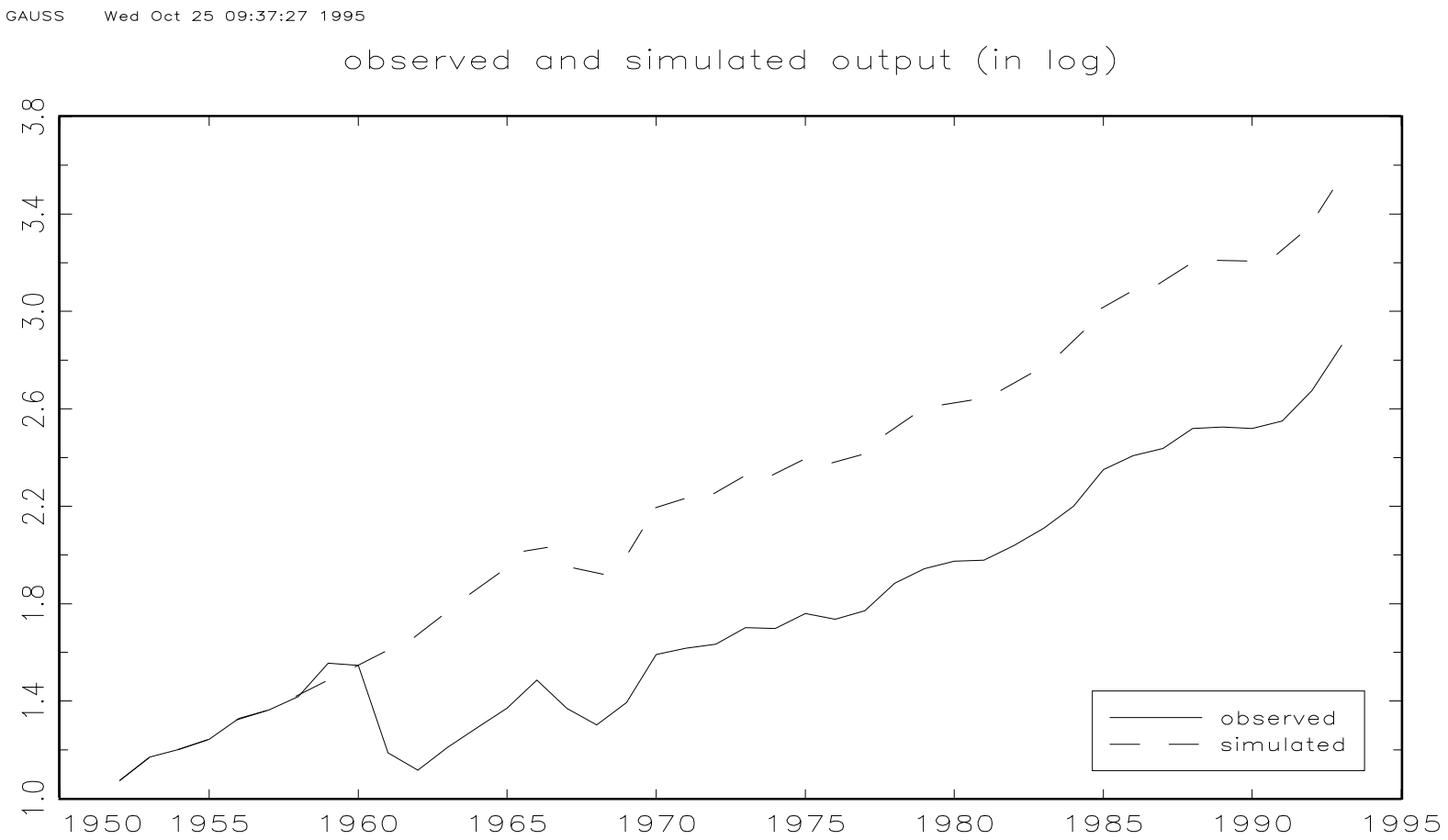
Simple RBC models

- **Labor supply**
- **Adjustment cost of investment**

You can conduct other research on

- **monetary policy**
- **fiscal policy,**
- **trade,**
- **asset pricing,**
- **exchange rate**
- **…… with the set of tools and techniques learnt here**


GAUSS Wed Oct 25 09:36:52 1995
observed and simulated residual 1
0.3
0.2
0.1
−0.0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
observed
simulated


GAUSS Wed Oct 25 09:37:27 1995
observed and simulated output (in log)
3.8
3.4
3.0
2.6
2.2
1.8
1.4
1.0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
observed
simulated

4. New Keynesian DSGE framework

- **Monopolistic competition**
- **Nominal rigidities**
- **Short run non-neutrality of monetary policy**

With application to examine economic problems: e.g. Kwan and Chow (1996) "*Estimating Economic Effects of Political Movements in China*".

Topics

1) A classical monetary model
2) New Keynesian model with monopolistic competition and nominal rigidity
3) Taylor rule: Empirical evidence of monetary policy with interest rate as the instrument
4) Monetary policy design in the basic New Keynesian model
5) Monetary policy tradeoff: discretion vs. commitment
6) Monetary policy and the open economy
7) Quantitative easing and the zero bound on nominal interest rates

5. Empirical methods that bring models to the data

- **Removing Trends and Isolating Cycles**
- **Spectral analysis**
- **Calibration**

6. Preparation

Basic skills

Dynamic optimization with Lagrange Multiplier

Loglinearization

Basic math (high school)

Software: Matlab

Simple programming skills: matrix operation, plot, …

***Toolkit* by Uhlig: to solve for medium to large scale models**

Exercise sessions

To discuss problem sets and mid-term exam, and report your results.