



# Monetary Policy

(Advanced Monetary Economics)



ECON 4325

## Course Details

- Lectures
  - Fridays 08:15 - 10 am
  - Aud. 6
  - No class: 5/2, 26/2 and 25/3
  - Last class: 29/4
- Seminars
  - Wednesdays 8:15 – 10 am & Fridays 12:15 – 2 pm
  - HH 101 and 301
  - Seminar 1: 27 and 29 Jan
- Material
  - Lecture notes and slides
  - Seminar notes and slides
  - Reading list
- Exam
  - Written (Closed book)
  - 24 May 2016 (2:30 – 5:30 pm)

# Introduction

## Lecture plan

Date	Lecture	Topic	Readings	Lecturer
15.01	Lecture 1	<i>Introduction, current situation and stylized facts</i>	Galí chpt.1, Christiano, Eichenbaum and Evans (2005)	Nina Larsson Midthjell
22.01	Lecture 2	<i>Rules vs Discretion</i>	Handouts	Nina Larsson Midthjell
29.01	Lecture 3	<i>A simple RBC model</i>	Galí chpt. 2	Nina Larsson Midthjell
05.02	No lecture			
12.02	Lecture 4	<i>The basic new Keynesian model</i>	Galí chpt. 3	Nina Larsson Midthjell
19.02	Lecture 5	<i>Guest lecture</i>	Lecture slides only	Kjetil Olsen (Nordea)
26.02	No lecture			
04.03	Lecture 6	<i>The basic new Keynesian model</i>	Galí chpt. 3	Nina Larsson Midthjell
11.03	Lecture 7	<i>Interest rate rules</i>	Galí chpt 4, Clarida, Galí and Gertler (2000)	Nina Larsson Midthjell
18.03	Lecture 8	<i>Optimal Policy in the New Keynesian Model</i>	Clarida, Galí and Gertler (1999)	Nina Larsson Midthjell
25.03	No lecture			
01.04	Lecture 9	<i>Optimal Policy in the New Keynesian Model</i>	Clarida, Galí and Gertler (1999)	Nina Larsson Midthjell
08.04	Lecture 10	<i>Markov Switching in the New Keynesian Model</i>	Davig and Leeper (2007)	Nina Larsson Midthjell
15.04	Lecture 11	<i>Monetary Policy in Norway</i>	The Norges Bank Monetary Policy Report (1/2016), The Norges Bank Watch report (2016)	Nina Larsson Midthjell
22.04	Lecture 12	<i>Financial Stability in Norway</i>	The Norges Bank Financial Stability Report (2015)	Henrik Borchgrevink (Norges Bank)
29.04	Lecture 13	<i>Topical Lecture: Forward Guidance</i>	CEPR ebook on Forward Guidance (2013)	Nina Larsson Midthjell

# Introduction

## Good advice

- **HOW** to do well in this course?
  - Study hard. Prepare in advance for lectures and study slides after lectures.
    - Mark: Teaching is interactive – more comfortable for you to be prepared
  - Follow the monetary policy news – learning the material becomes both easier and more fun!
  - Work with interpretations – don't give up, you will get there 😊
- **WHY** do well in this course?
  - Good investment in general, and it particular if central banking is on your list of future dream jobs

# Introduction

## What is monetary economics?

### MONETARY ECONOMICS ANALYZES THE RELATIONSHIP:

- Between real variables and
  - Real GDP
  - Real interest rate
  - Unemployment
  - Employment
- Between different real variables
  - i.e. real GDP and unemployment
- nominal variables
  - Inflation
  - Nominal interest rate
  - Nominal exchange rate
  - Money supply
- Between different nominal variables
  - i.e. inflation and the nominal interest rate

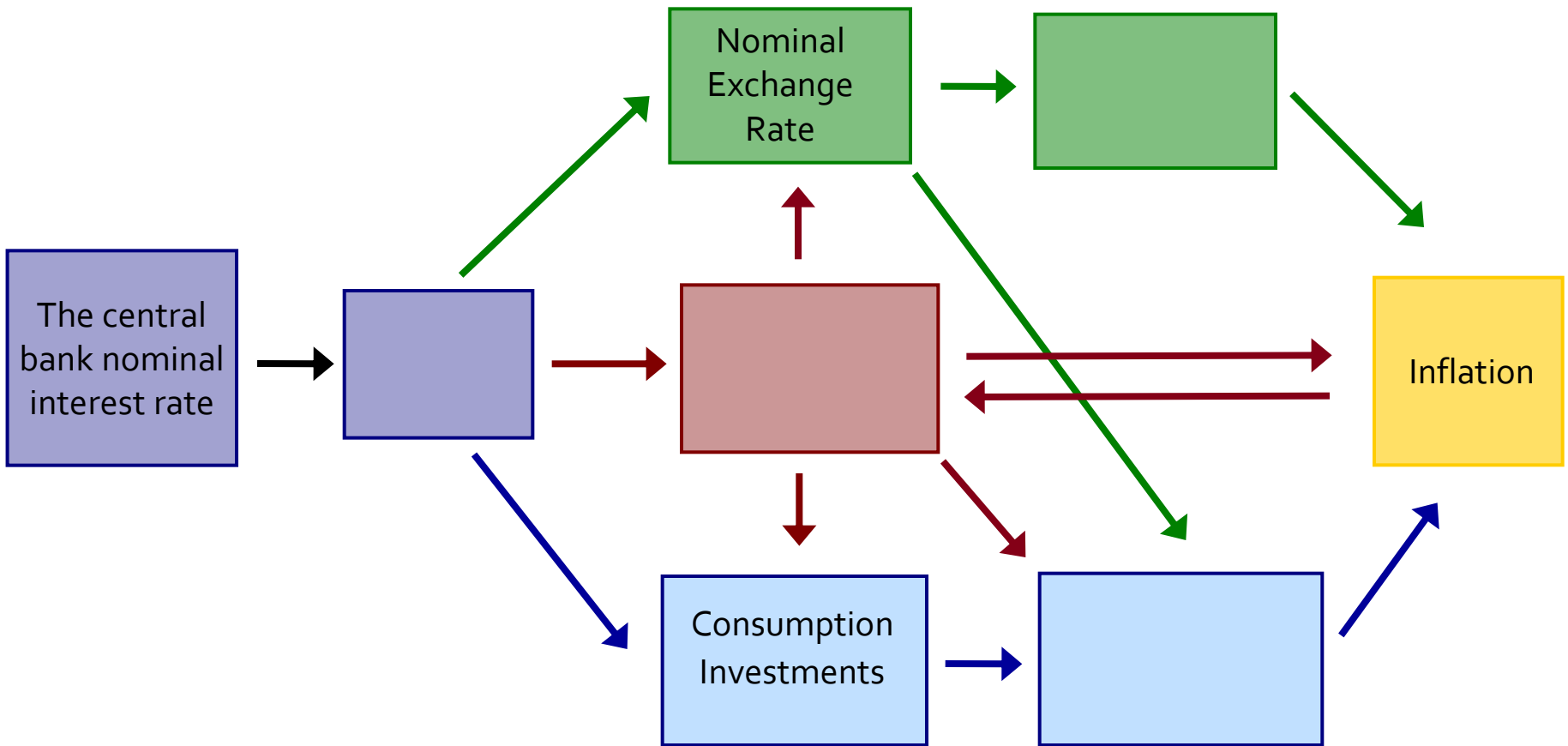
The real interest rate = Nominal interest rate – inflation rate

# Introduction

## What is monetary economics? Con't

- A key goal of monetary theory is to understand **the transmission mechanisms of monetary policy**.
- What happens first when there is a change in monetary policy?
  - The central bank changes the nominal interest rate
- Why does the central bank change the nominal interest rate?
  - To affect inflation with respect to the bank's inflation target?
  - To affect the unemployment rate and the output gap?
  - To affect the exchange rate ?
- What are the transmission mechanisms of monetary policy?

# What are the transmission mechanisms of monetary policy?



# Introduction

## What is monetary economics? Con't

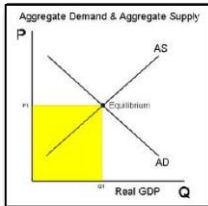
What did the previous slide tell us?

- That  $\Delta$  Key policy interest rate has a **direct effect on market interest rates** and therefore on the valuation of financial assets and their expected returns.
- That  $\Delta$  market rates  $\longrightarrow$   $\Delta$  inflation,  $\Delta$  unemployment and  $\Delta$  inflation expectations through **the demand channel**
- That  $\Delta$  Key policy interest rate  $\longrightarrow$   $\Delta$  **exchange rate**.
  - For small open economies, like Norway, the exchange rate effect must always be taken into account
- **Inflation expectations are given massive weight** in monetary economics and central bank decision making because:
  - They are affected by present changes in interest rates and by present inflation
  - They affect exchange rates, consumption and investment decisions, wage bargaining powers and unemployment
- **It takes time** for interest rate changes to affect inflation, how strongly inflation is affected will depend on the development in the different channels.
  - 1-3 years time horizon



# Introduction

## Development of Monetary Economics from the 1960s till today



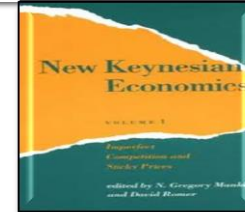
### 1960-70's: IS-LM and AD-AS models

- Completely fixed prices
- Monetary economics concerned with inflation
- Central banks control money supply



### 1980-90's: Flexible Price Models

- **The RBC theory**
  - DSGE models as a central tool (micro foundation)
  - Fully flexible prices and wages
  - Business cycles seen as efficient
  - Technology shocks important (Supply side driven economy)
  - Limited role of monetary policy
  - Rational Expectations – The Lucas Critique
- **The Classical Monetary Model**
  - Introduces a monetary sector
  - Still fully flexible  $p$  and  $w$
  - Neutrality of monetary policy wrt real variables
  - Not a very popular belief among central bankers (obviously)
  - A conflict between theoretical prediction and empirical evidence and normative implication and policy practice: Changes in monetary policy seem to influence output and employment in the short run



### 1990-2000's: New Keynesian Models

- Motivated by the shortcomings of the flexible price models
- Still intertemporal utility maximization in a DSGE framework (microfoundation)
- Introduces monopolistic competition in product and factor markets to make it more realistic (In contrast to a social planner who seeks to clear all markets at all times)
- Introduces nominal rigidities, which leads to non-neutrality of monetary policy in the short run.
- Classical long run properties
  - Prices and wages adjust and economy goes back to natural equilibrium

# Introduction

## Development of Monetary Economics from the 1960s till today. Con't

- What have been gained from introducing Keynesian assumptions to the RBC framework?
  - The economy's response to a shock is now generally inefficient – room for fiscal and monetary stabilization policies
  - Non-neutrality of monetary policy in the short run – room for welfare enhancing interventions
  - Suited for analysis and comparison of different regimes without being subject to the Lucas critique

# Introduction

## Current situation

### WHAT ARE THE CURRENT STANCE OF MONETARY POLICY?

	2015	2014	2013
Norges Bank:		1.25 %	1.5 %
ECB:		0.15 %	0.5 %
Fed:		0 – 0.25%	0 – 0.25 %
BoE:		0.5 %	0.5 %

# Introduction

## Current situation

### WHAT ARE THE DIFFERENT INFLATION TARGETS?

- Norges Bank:
- ECB:
- Fed:
- BoE:

# Introduction

## Current situation

### WE WILL FOLLOW THE NEXT MONETARY POLICY MEETINGS CLOSELY

▪ Norges Bank:  
[www.norges-bank.no](http://www.norges-bank.no)

▪ 17/3

▪ ECB:  
[www.ecb.eu](http://www.ecb.eu)

▪ 21/1    10/3    21/4

▪ Fed:  
[www.federalreserve.gov](http://www.federalreserve.gov)

▪ 16/12\*    27/1    16/3\*    27/4

▪ BoE:  
[www.bankofengland.co.uk](http://www.bankofengland.co.uk)

▪ 14/1    4/2\*    17/3    14/4

# Introduction

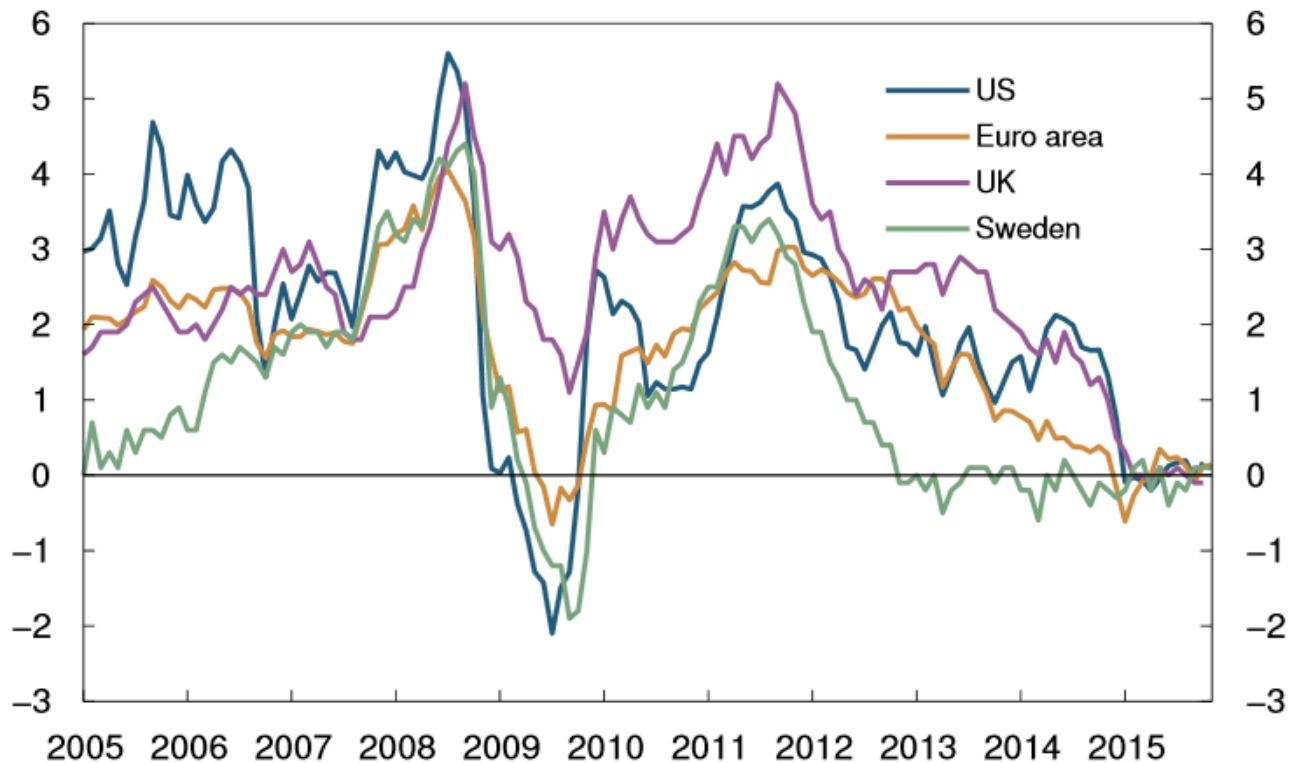
## Stylized Facts – Nominal rigidities

- Average frequency of **price rigidity** is 8-11 months
- Taylor (1999): Little evidence of synchronization of price adjustments
- Most studies:
  - A large amount of heterogeneity in price durations across sectors/types of goods
  - Largest degree of rigidity: Services
  - Smallest degree of rigidity: Energy, unprocessed food.
- Also **wage rigidity**
  - Upward, as for prices
  - DNWR present in most countries

# Introduction

## Stylized Facts – Inflation in recent years

Chart 1.10 Consumer price inflation among trading partners.  
Twelve-month change. Percent. January 2005 – November 2015<sup>1)</sup>



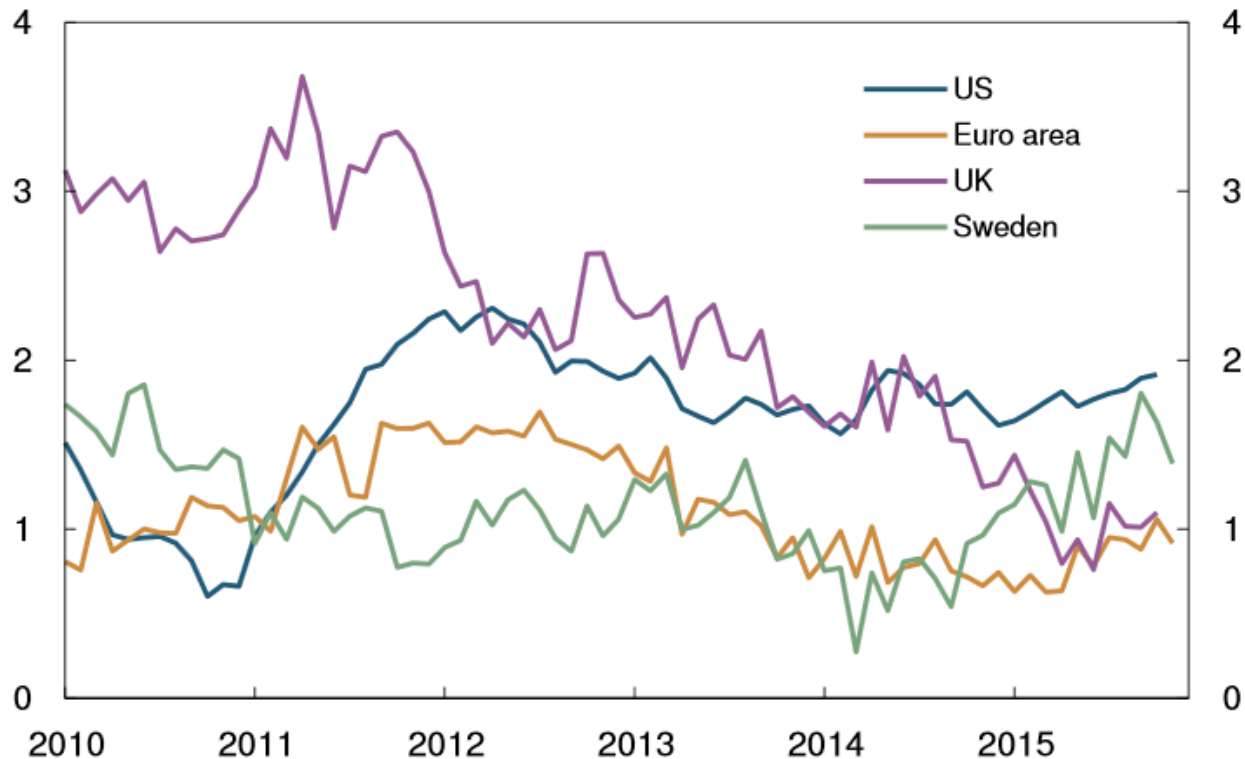
1) Latest observation October 2015 for the US and the UK.  
Source: Thomson Reuters

Source: Norges Bank MPR 4/15

# Introduction

## Stylized Facts – Inflation in recent years

Chart 1.11 Consumer prices excluding food and energy.<sup>1)</sup>  
Twelve-month change. Percent. January 2010 – November 2015<sup>2)</sup>



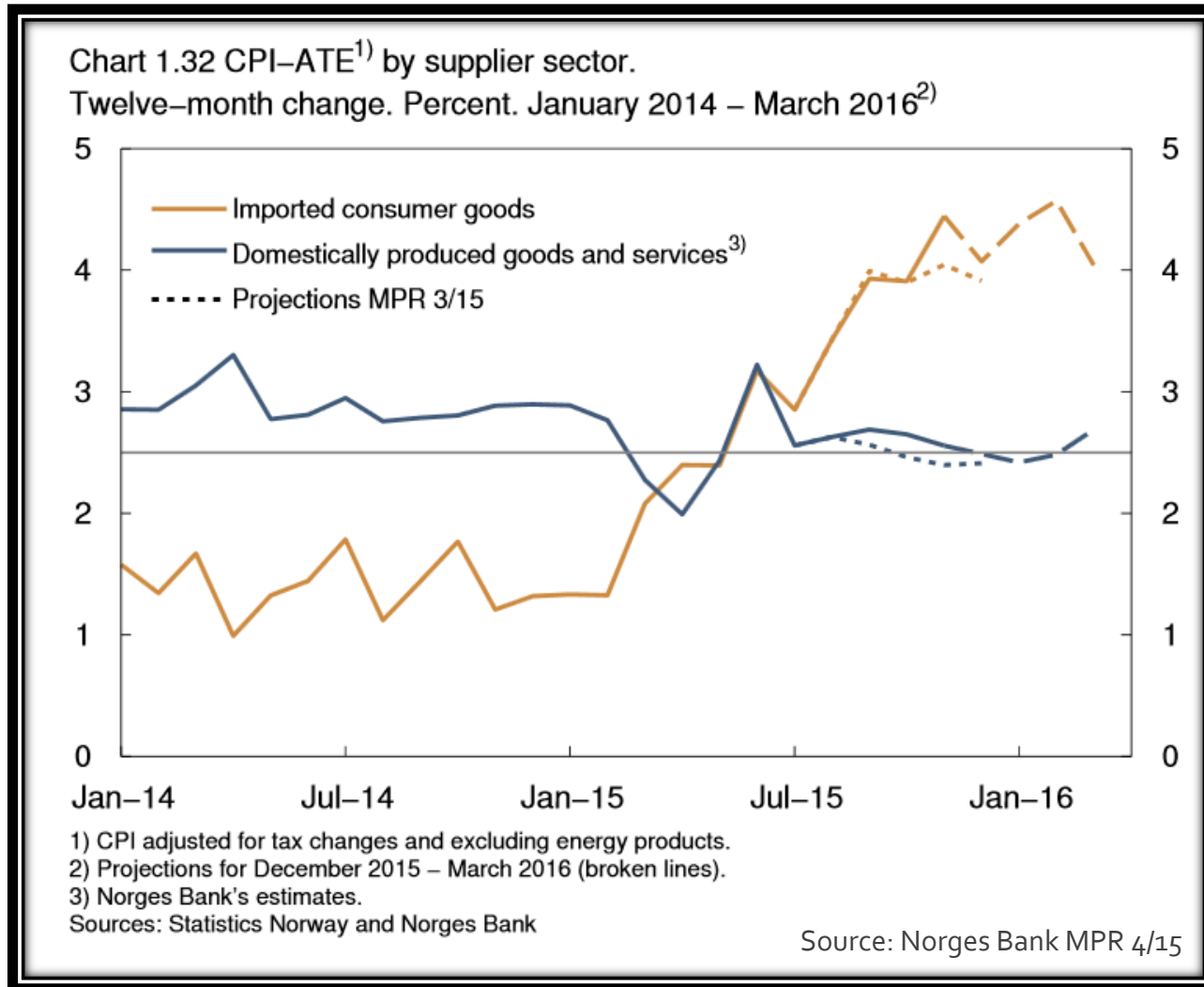
1) Time series for Sweden show consumer prices excluding energy, at a constant mortgage interest rate. Time series for the euro area and the UK show consumer prices excluding food, energy, alcohol and tobacco.  
2) Latest observation October 2015 for the US and the UK.  
Source: Thomson Reuters.

Source: Norges Bank MPR 4/15



# Introduction

## Stylized Facts – Inflation in recent years



# Introduction

How to read the media – Financial Times 7 January 2014

Typical article in FT prior to a monetary policy meeting  
(ECB meeting was coming up two days later)

Last updated: January 7, 2014 11:47 am

Gift

## Core eurozone inflation falls to low stoking fears of deflation

By Claire Jones in London

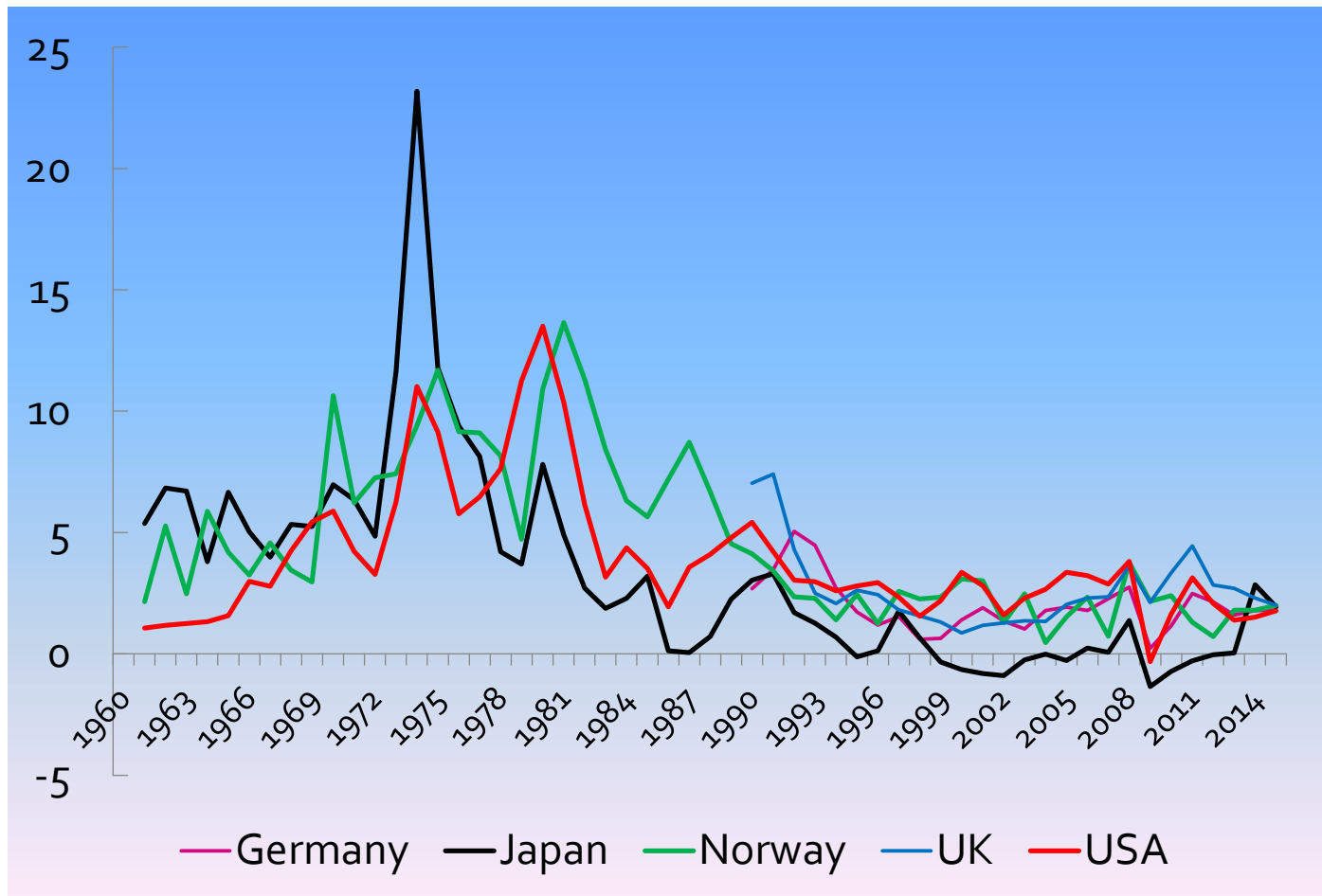
The core measure of eurozone inflation has fallen to a record low, stoking fears of deflation in the currency bloc and raising pressure on the [European Central Bank](#) to take action at its rate-setting [meeting this week](#).

A flash estimate from [Eurostat](#), the commission's statistics bureau, showed overall inflation slowed to 0.8 per cent in December from 0.9 per cent the previous month. Core inflation, which excludes the most volatile prices such as food and energy, slowed to 0.7 per cent – the lowest level since the series began in 1996.

In class, we will look at some January 2016 articles

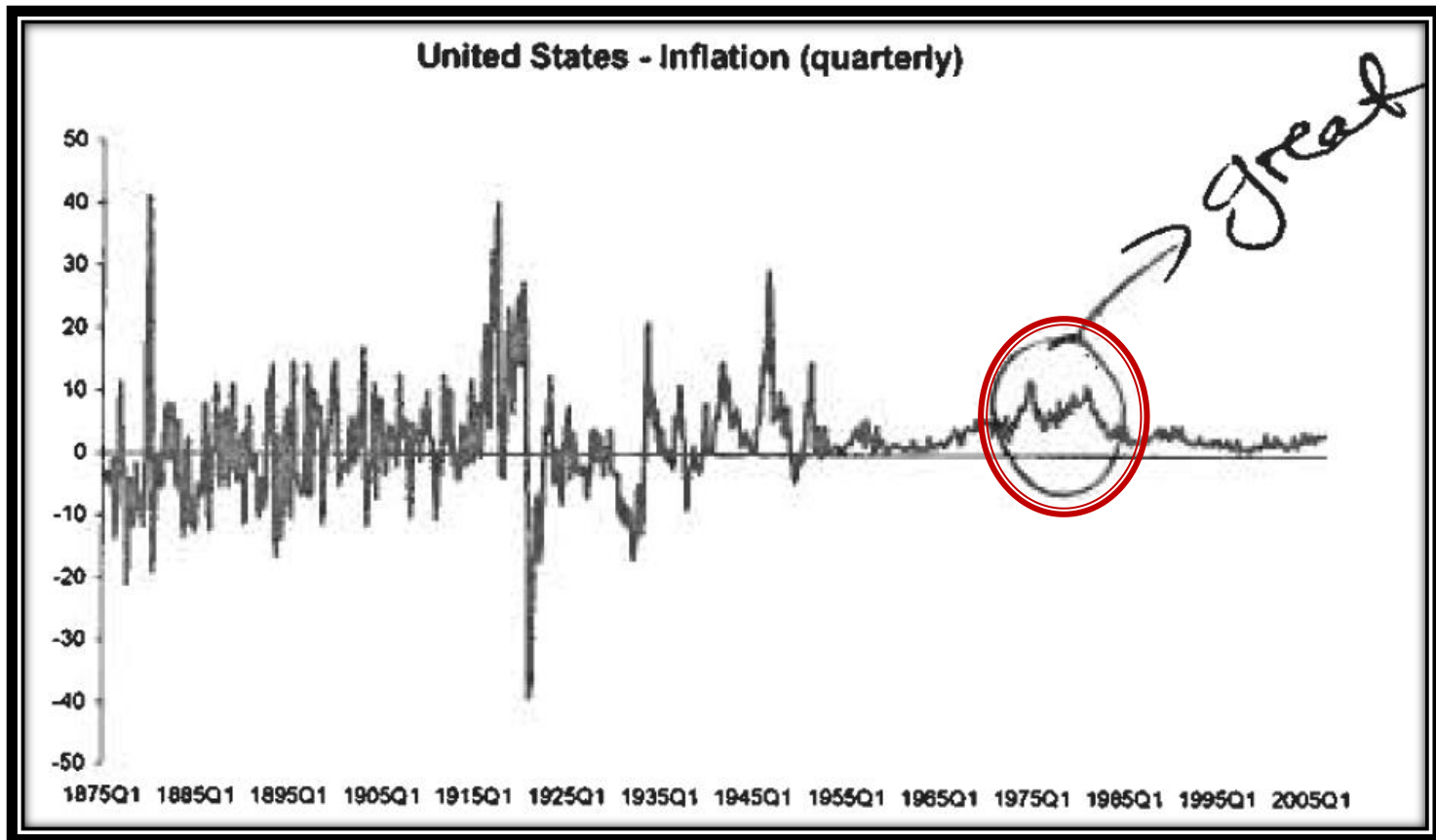
# Introduction

Some inflation history: What is the historical perspective?



# Introduction

Some inflation history: Inflation less volatile over time



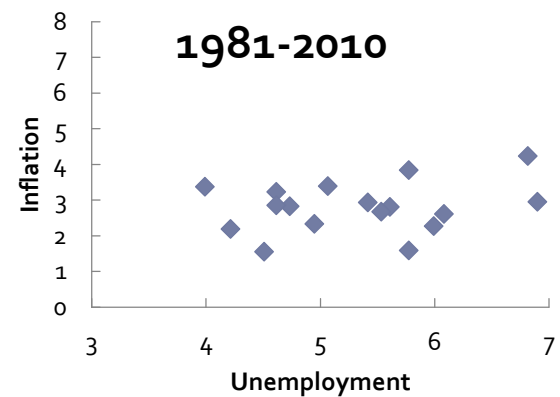
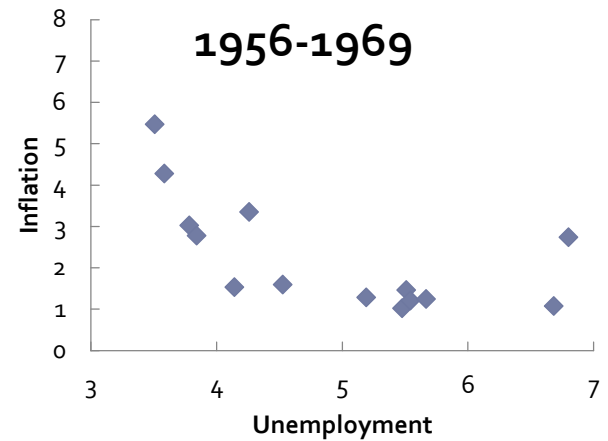
# Introduction

Some inflation history: Inflation less volatile over time. Con't.

US Inflation		
	Mean	Stdev
<b>Gold Standard</b> 1878-1913	0.27	8.31
<b>Interwar</b> 1919-1938	-0.79	10.65
<b>Bretton Woods</b> 1946-1972	3.41	4.29
<b>High Inflation</b> 1973 – 1982	7.34	1.95
<b>Low Inflation</b> 1983-2006	2.51	0.98

# Introduction

## Some inflation history: The evolution of the US Phillips curve



# Vector Auto Regression (VAR)

- **Reduced forms**
  - Simple correlations
  - Friedman and Schwartz (1963): Money Growth is positively correlated with output - Faster money growth tends to be followed by increases in output above trend - slower money growth by declines in output.
  - Causality problem – is it a causal relation between M and Y?
  - Endogeneity problem
    - Simple correlations between nominal interest rates and real variables cannot be used as evidence of non-neutrality!
    - Must use Vector Auto Regression (VAR)

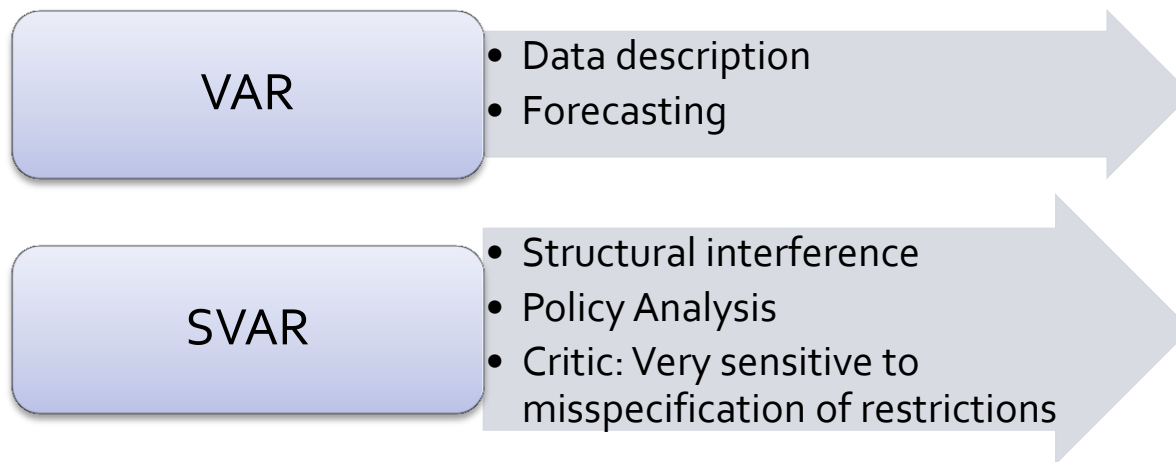
# Vector Auto Regression (VAR) con't

- Proposed by Christopher Sims in 1970s, 1980s
- Useful way to organize data.
- Used when all variables you want to study are endogenous
- The VAR not only includes endogenous variables with each written as a linear fn of its lags, but also lags of all the other variables in the system!
- We want to answer the following question: "How does the economy respond to a particular shock?"
- The answer can be very useful for discriminating between models, and for estimating the parameters of a given model.
- VARs cannot actually address such a question! We need **Structural VARs**.



# Vector Auto Regression (VAR) con't

- In a **VAR**, impulse responses cannot be given meaningful interpretation - shocks cannot be uniquely identified with a particular variable
  - Must introduce restrictions!
- **Structural VAR (SVAR)**: Introduce enough restrictions to identify the shocks.
  - Now we can identify how the different variables react to a shock in one of the other variables



# Vector Auto Regression (VAR) con't

## *The Basic Set-Up*

- Let  $Y_t$  be a  $N \times 1$  vector of macroeconomic variables. A vector autoregression (VAR) is:

$$Y_t = B_1 Y_{t-1} + B_2 Y_{t-2} + \dots + B_p Y_{t-p} + u_t,$$

where the  $B$ 's are parameters and  $u_t$  is a vector of shocks. Moreover we have  $E u_t u_t' = \Sigma_u$ .

- It is easy to get estimates for the  $B$ 's, the  $u$ 's, and  $\Sigma_u$ , but we are interested in impulse response functions to *fundamental* shocks:

$$\begin{aligned} u_t &= C e_t, \\ E e_t e_t' &= \Sigma_e = I, \\ C C' &= \Sigma_u. \end{aligned}$$

# Structural VAR

- The structural VAR:

$$Y_t = B_1 Y_{t-1} + B_2 Y_{t-2} + \dots + B_p Y_{t-p} + C e_t.$$

- The impulse response to the  $i^{\text{th}}$  shock:

$$\begin{aligned} Y_t - E_{t-1} Y_t &= C_i e_{i,t}, \\ E_t Y_{t+1} - E_{t-1} Y_{t+1} &= B_1 C_i e_{i,t}, \\ &\dots \end{aligned}$$

- To compute impulse responses we need  $B_1, \dots, B_p$ , and  $C$ .

# Identification Problem

- Not enough restrictions to pin down all the parameters in C.
- How to solve the identification problem?

3 different approaches:

## 1. Contemporaneous restrictions:

- No short-run effects from policy shocks to some variable(s).
  - E.g. monetary policy shocks do not affect output within the same period.
- No short-run effect from shocks to the policy instrument.
- Monetary policy does not react within the period to certain shocks or variables.

# Identification problem con't

## 2. Long-run restrictions:

- Monetary neutrality.
- Monetary policy disturbances have no long-run effect on real variables (output, unemployment, real exchange rate, etc).
- Demand shocks have no long-run effects on output and unemployment.

## 3. Sign restrictions:

- Positive demand shocks increase inflation, while positive supply shocks decrease inflation.

# One example

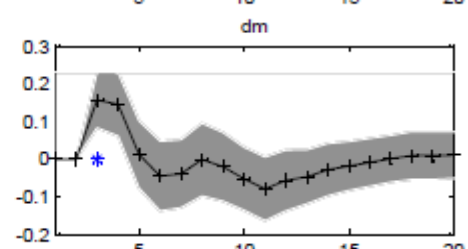
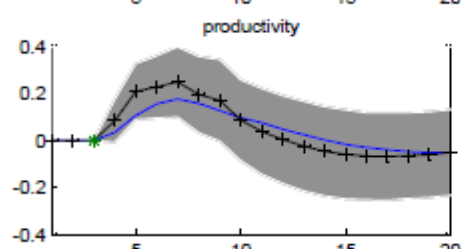
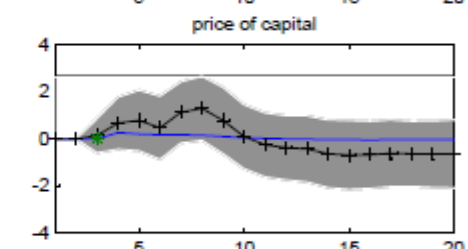
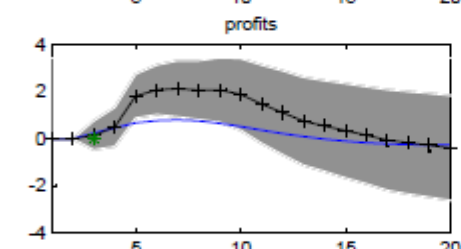
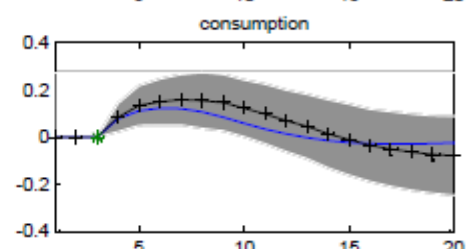
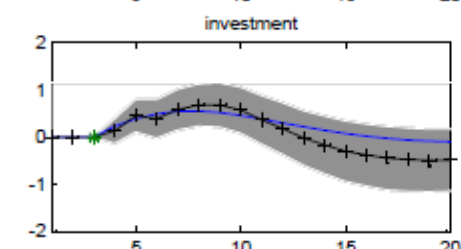
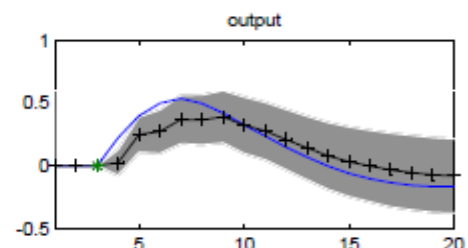
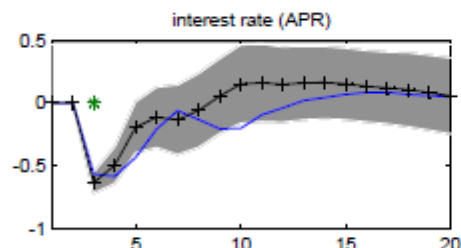
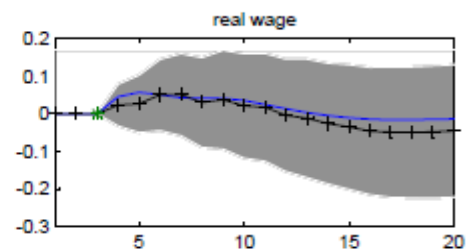
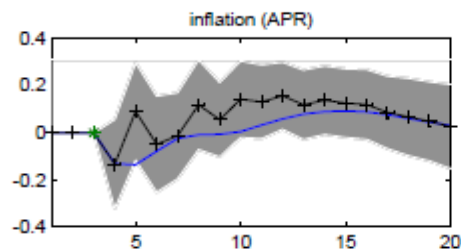
*Christiano, Eichenbaum and Evans (2005)*

- Use short-run restrictions to identify a monetary policy rule and the corresponding shock to policy:

$$R_t = f(\Omega_t) + \epsilon_t,$$

where  $R_t$  is the federal funds rate,  $f$  is a linear function of the information set  $\Omega_t$ , and  $\epsilon_t$  is the monetary policy shock.

- Let the vector of variables be  $Y_t = [Y_{1,t}, R_t, Y_{2,t}]'$ .
  - Variables in  $Y_{1,t}$  (GDP, consumption, GDP deflator, investments, real wage, labor productivity) do not react to monetary policy shocks.
  - Variables in  $Y_{2,t}$  (real profits and growth in M2) do not belong to  $\Omega_t$ .



# One example con't

## Main Results:

- Persistent effects on real variables.
- Inflation is slow to react, peaks after 2 years.
- Hump-shaped responses of real variables.
  - Output, consumption and investment peak after 1,5 years and return to pre-shock levels after about 3 years.
- The interest rate falls for about 1 year
- Real profit, real wages and labor productivity rise
- Money growth rises immediately
- Walsh (2003): "*We cannot design policy without a theory of how money or monetary policy in general affects the economy*"



# Next week

- Readings: Handouts sent by email so make sure to sign up on the list!
- Discuss Rules Versus Discretion
  - The Barro Gordon model
  - Solutions to the time-inconsistency problem



# Monetary Policy

(Advanced Monetary Economics)



ECON 4325