ECONOMIC POLICY

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Week 8

New keynesian model

Programming excercise

Péter Pete

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1. New keynesian model
2. Solution
3. Impulse response functions
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Monetary policy in the new keynesian framework

Richard Clarida–Jordi Galí–Mark Gertler:
The Science of Monetary Policy: A New Keynesian Perspective.

Journal of Economic Literature,
Vol. XXXVII (December 1999), pp. 1661–1707

• *science and art* – what is science in monetary policy ?

• Unlike in the RBC framework there are frictions and adjustment difficulties in this model, that is why monetary policy makes sense.

What can this model be applied for?

- It can interpret general features of practical economic adjustments.
- Private sector behavior depends on expectations formed about monetary policy. Therefore, policy credibility gets significance.
- In the long run, or in case of flexible prices the model reproduces the RBC results, nominal variables do not matter.

A gap model to interpret cyclical behavior

- *Output gap* – **percentage deviation of measured output from potential, a measure of the business cycle.**

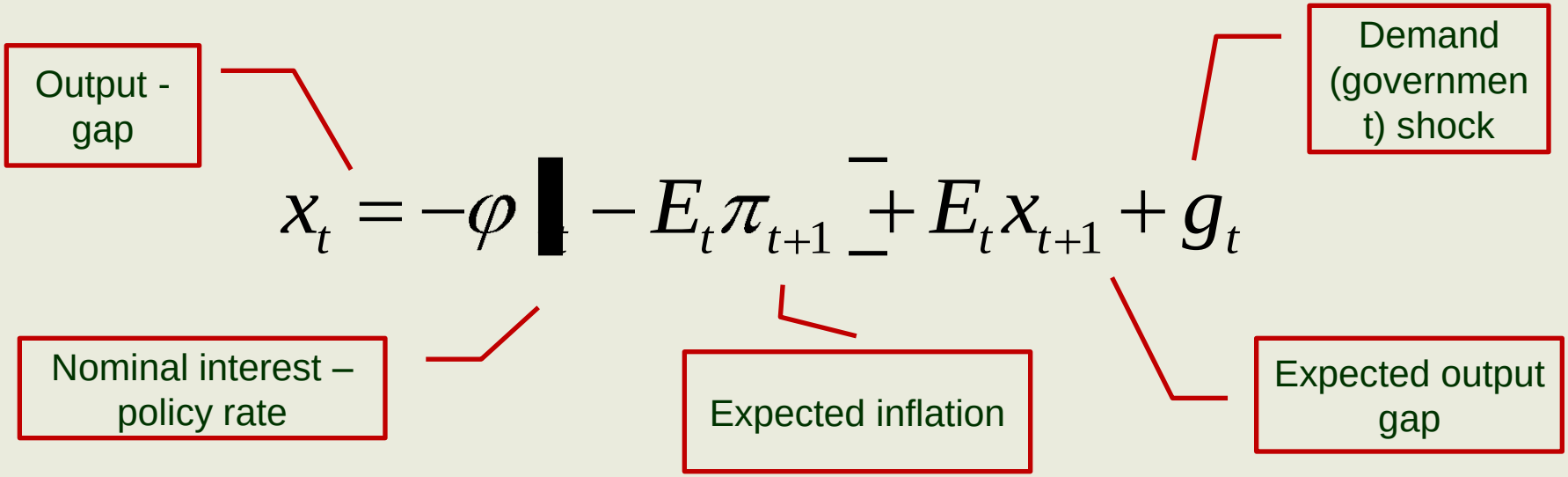
$$x_t = y_t - z_t$$

***x* is output gap, *y* is log of current output,**

***z* is log of potential output**

- **What is potential output**?
- **Output prevailing in case of perfectly flexible prices and nominal wages (quite difficult to measure).**
- **Inflation and nominal interest rate also appear in gap forms in the model.**

New-keynesian IS curve



- IS curve, that connects demand and the real interest rate.
- Real interest is forward looking.
- Forward looking consumers smooth.
- Government expenditure is defined as deviation from the natural rate.

New-keynesian Phillips curve

Deviation of inflation from target

$$\pi_t = \lambda x_t + \beta E_t \pi_{t+1} + u_t$$

Output-gap

Expected inflation

Supply shock

- Phillips curve, connects inflation to the real economy.
- Contains the new-keynesian output gap.
- Forward looking expectations.

Closing the model

- Government spending and the supply shocks are stochastic processes.

$$g_t = \mu g_{t-1} + \hat{g}_t$$

$$u_t = \rho u_{t-1} + \hat{u}_t$$

Shocks are iiD with 0 mean.

- Nominal interest is set by the monetary authority: i_t.
- Positive and negative deviations from targets are equally unwelcome.

Solution

- Due to forward looking solution is not trivial.
- Can we calculate it?
- The system is stationary, we know the final values. We move from there backwards, recursively.
- Analytical solutions are too complicated, we use impulse response functions instead.

Impulse response functions

An often used tool for understanding the workings of dynamic systems:

impulse response function (IRF)

It shows the dynamic response exhibited by the system's variables to a particular shock that hits the system.

Impulse response functions

- The result also depends on what they expect to happen in the future.

$$x_t = E_t \sum_{i=0}^{\infty} \left(\varphi \left(r_{t+i} - \pi_{t+1+i} \right) + g_{t+i} \right)$$

$$\pi_t = E_t \sum_{i=0}^{\infty} \beta^i \left(\alpha x_{t+i} + u_{t+i} \right)$$

- We assume the decision makers form expectations consistently.
- We call these expectations rational.

EViews – model

x = – phi * (i – pi_exp(+1)) + x_exp(+1) + g

pi = lambda * x + beta * pi_exp(+1) + u

g = mu * g(–1) + gsokk

u = ro * u(–1) + usokk

How is expectation modeled??

x_exp = – phi * (i_exp – pi_exp(+1)) + x_exp(+1) + g_exp

pi_exp = lambda * x_exp + beta * pi_exp(+1) + u_exp

g_exp = mu * g(–1)

u_exp = ro * u(–1)

What can be expected about the future interest rate?

Alternatives

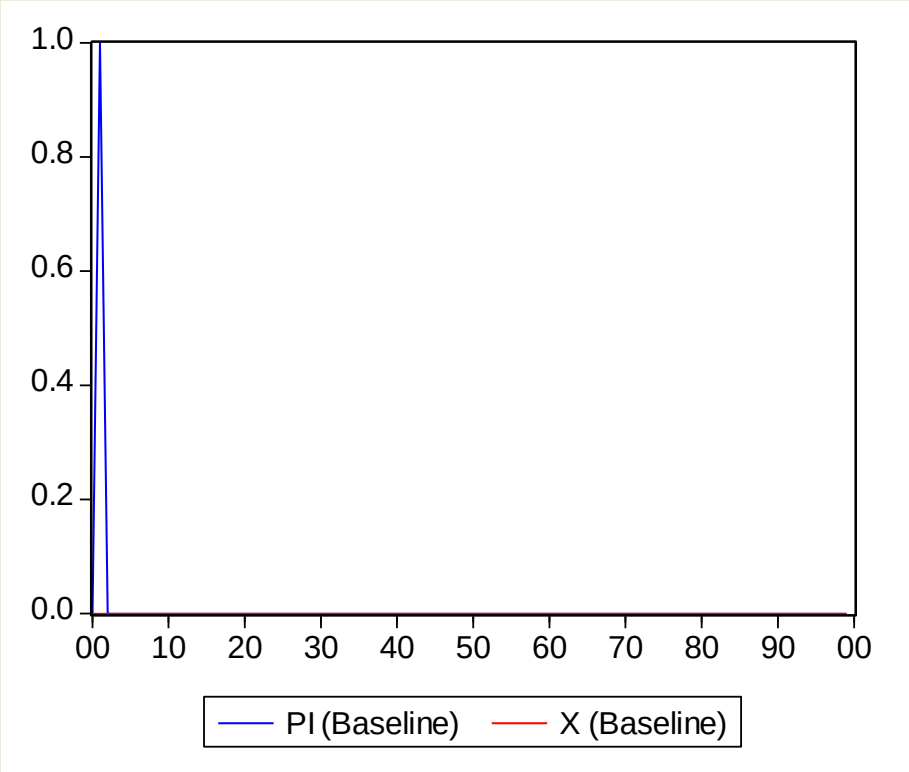
- The monetary policy cannot be forecasted properly, they do not know the future value.
- Path of i is exogenous, and everybody knows that
- Monetary policy follows a known rule

$$i_t = \gamma_\pi \pi_t + \gamma_x x_t$$

- i_exp is determined on the basis of one of those.

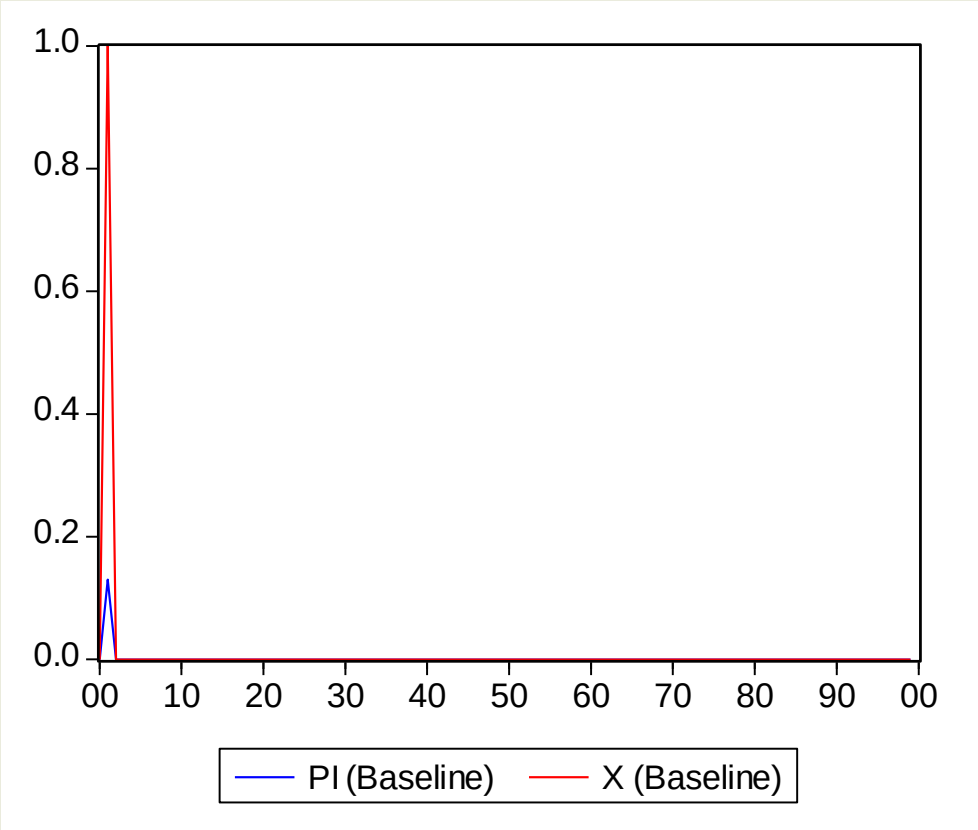
Exogenous monetary policy with shocks that are not autocorrelated

Supply shock



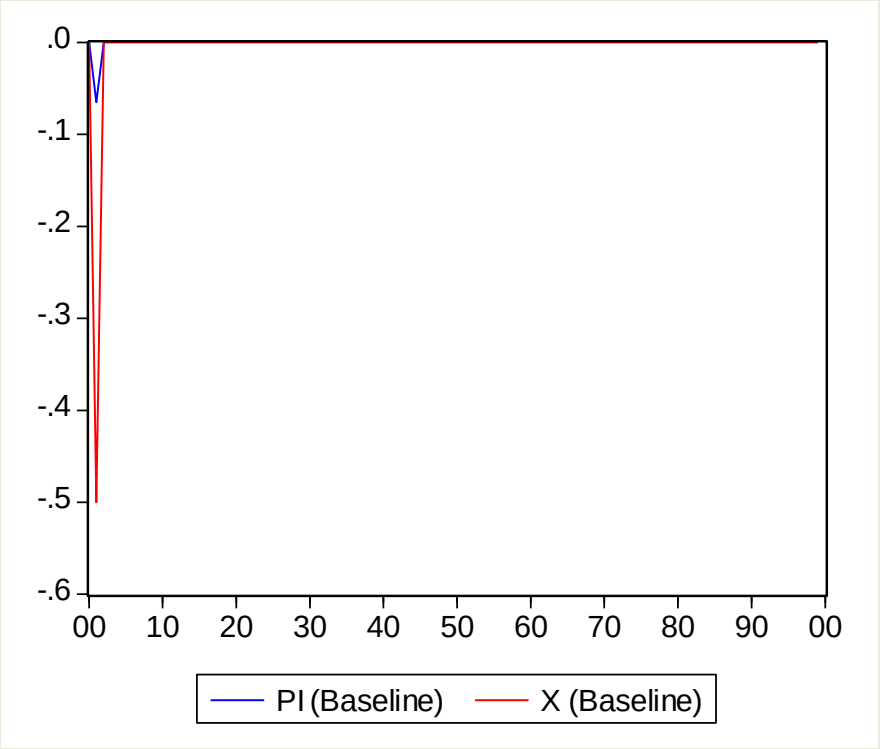
Inflation increases temporarily. The shock is not expected to last, therefore output is not affected.

Demand shock



The output gap increases and it also raises the rate of inflation.

If the bank raises



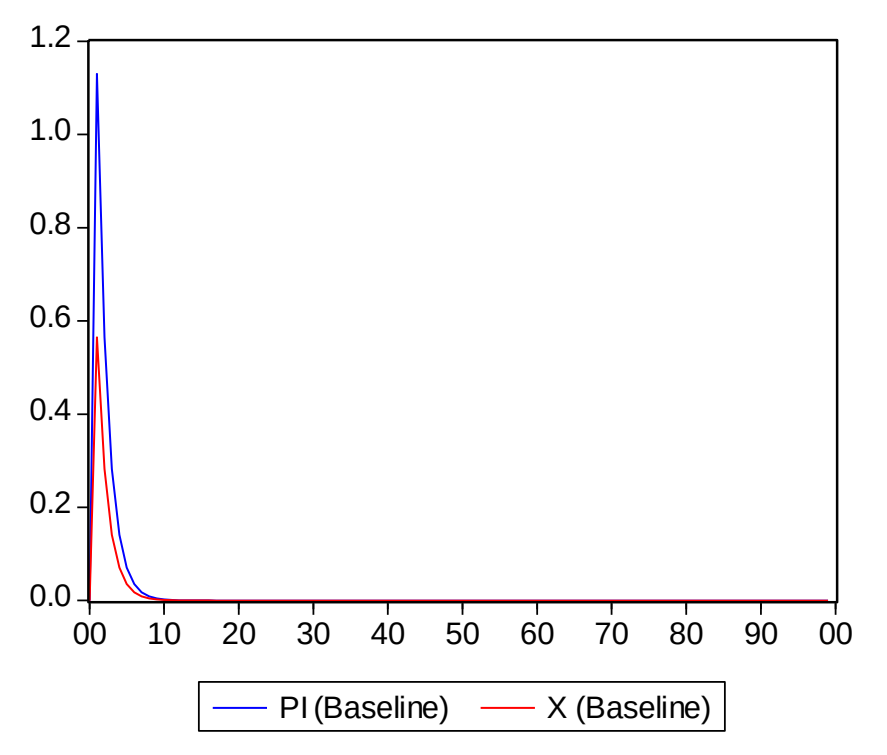
A rise in the policy (nominal) rate results in an increase of the real interest. It depresses output and reduces inflation.

What can monetary policy do?

- Which shock can be eliminated by monetary policy??
- It is the demand shock. The bank can raise just as much on the rate that neutralizes the effect of the shock.
- In case of a supply shock it has to choose. There is a trade off. In case of an increase of the policy rate the inflation is eliminated, but it creates a negative output gap.

Exogenous interest rate policy if the shock is autocorrelated

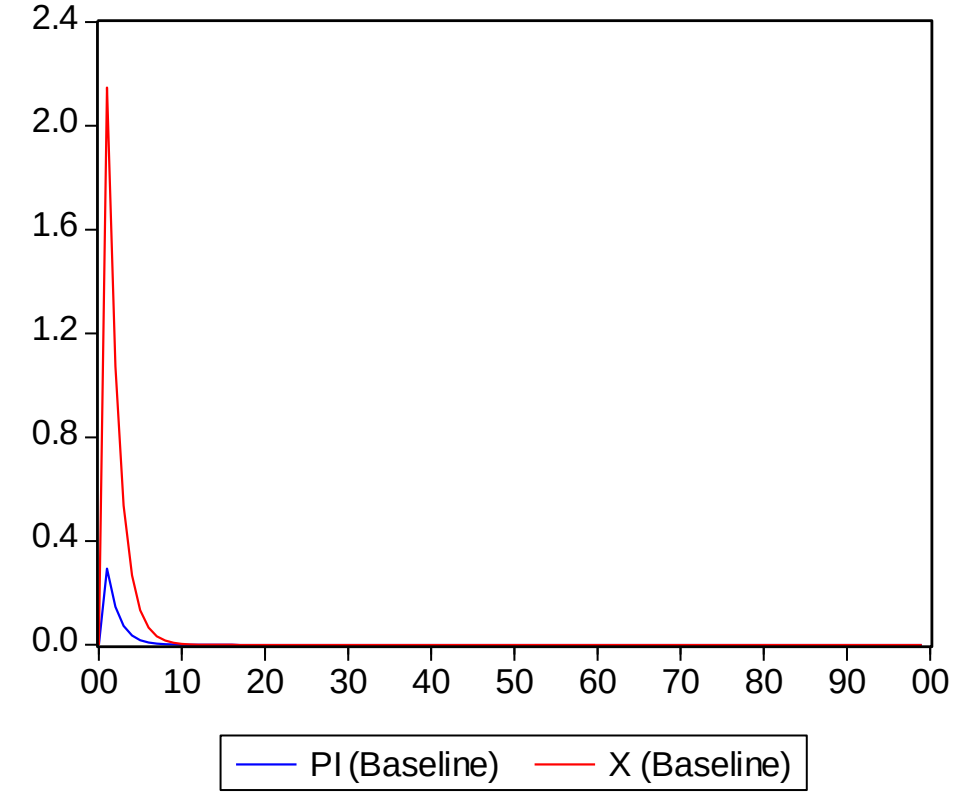
Supply shock



A supply shock raises inflation and expected inflation as well.

Real interest rate shrinks that creates an output gap.

Demand shock



Forward looking expectations strengthen the effect both on the output gap and on the inflation.

What can monetary policy do?

- Effect of the demand shock can completely be eliminated:

$$i = g/phi$$

- The rate is to be increased significantly.
- The supply shock cannot be eliminated completely. pi increases more than x, therefore there is a sacrifice to be paid for eliminating inflation (sacrifice ratio).

Monetary policy

- Decision makers do not know the type of the shock immediately, they react to the state of the economy

$$i_t = \gamma_\pi \pi_t + \gamma_x x_t$$

- How large the coefficient on inflation is to be?
- To have an effect on the real rate it has to be larger than one.

Change of the monetary regime in the US

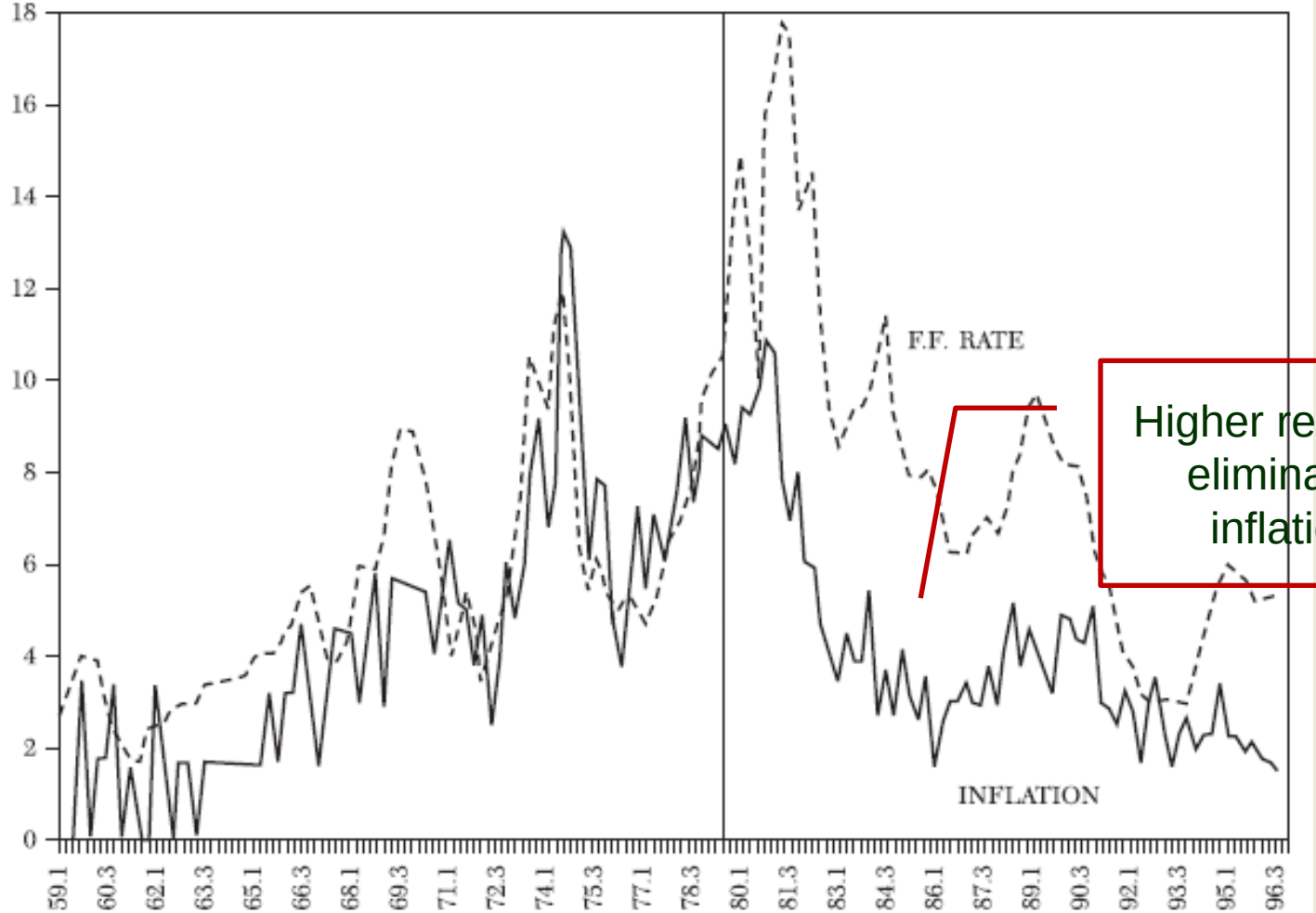
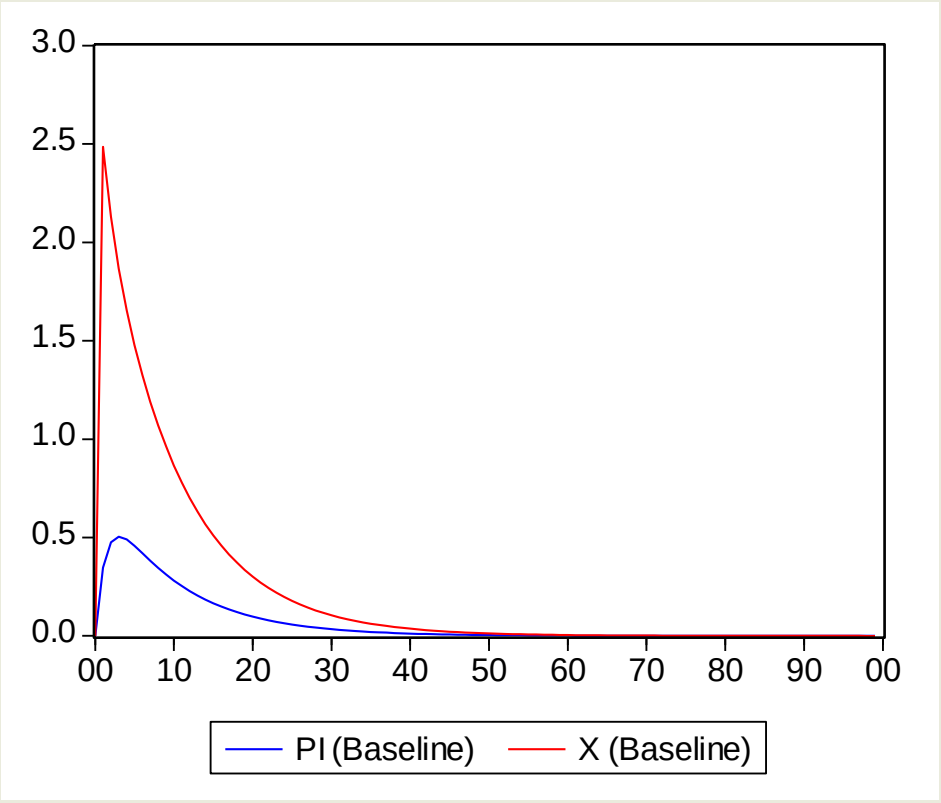


Figure 4. The Federal Funds Rate and the Inflation Rate

Higher real rate eliminates inflation

Inflation persistency (backward looking)

$$\pi_t = \lambda x_t + \phi \pi_{t-1} + (1 - \phi)\beta E_t \pi_{t+1} + u_t$$



With backward looking expectations inflation becomes more persistent.

Persistency

- If inflation is more persistent, the monetary authority has to be more aggressive
- Intuition: if the bank reduces current inflation, it also reduces future inflation due to influencing expectations. It is a double win.

Interest rate smoothing

- Empirical evidence shows central banks adjusting the policy rate in small steps.
- Formally:

$$i_t = (1-\omega)\left[\alpha + \gamma_\pi \pi_t + \gamma_x x_t\right] + \omega i_{t-1}$$

- Exact reason is not known. There can be hesitation due to uncertainty, learning or caring for stability of the financial sector