

6. Inflation and monetary policy

I. Exercise Questions

Readings:

Lecture slide set: #8

The Economy: Nominal and real interest rate (15.1), consumer price index (CPI) (13.8), GDP deflator (13.8), Philips Curve (15.3 ff.), bargaining gap (15.3), wage-price-spiral (15.3), expected inflation rate (15.6), recession (15.1)

<https://www.formelsammlung-mathe.de/zinsrechnung.html>: Finance formulas

Problem 1 (*The Fisher equation*)

The interest rate states how many €(or any other currency) have to be paid in the future in exchange for borrowing €1 today. If you are a lender, it tells you how many € you will receive in the future by giving up the use of €1 today.

The market interest rates quoted on bank websites are nominal interest rates. That is to say that they do not take inflation into account. If you are a borrower, what matters is how many goods you will have to give up in the future to pay the interest, rather than the total interest measured in €. If you are a lender, what you really want to know is how many goods you will get in the future in exchange for the goods you do not consume now.

Households and firms make decisions based on real interest rates. The equation for the real interest rate is known as the Fisher equation:

$$r = i - \pi^e$$

with the real interest rate per annum r , the nominal interest rate p.a. i and the expected inflation π^e . Table 1 shows the nominal interest rate and the inflation rate in % of Japan in the period 1996-2015.

Years	1996-2000 (%)	2001-2005 (%)	2006-2010 (%)	2011-2015 (%)
Interest rate	1.5	1.4	1.3	1.2
Inflation rate	-1.9	-0.9	-0.5	1.6

Table 1

Source: World Bank

- (a) What can you say about the developments of interest rate and inflation rate?

- The (nominal) interest rate was falling over the whole period.
- The inflation rate was increasing over time: in the first three periods, there was deflation, in the last period there was inflation.
- The real interest rate was the following: in the first period 3.4%, in the second period 2.3%, in the third period 1.8%, in the last period -0.4%.
- The real interest rate fell faster than the nominal interest rate. This is due to the rising inflation rate.

- (b) Which period is most profitable for borrowers? Which one for lenders?

The lowest r with -0,4% minimizes debt and is beneficial for borrowers (the inflation point to that as well). The highest r with 3,4% maximizes the return and is beneficial for lenders (the high deflation points to that as well).

- (c) Assume you have €1.000 which you can profitably invest in a business project for four years. The project yields an overall return of €60 afterwards. Alternatively, you could deposit the amount in your bank account during the same period. Comparing nominal values, in which of the periods from Table 1 would it have been sensible to invest in the project and in which to have a bank deposit?

The return of the project together with the start investment is given nominally with 1.060 €. In order to compare nominal values, for the bank deposit, the compound interest (interest on interest) based on the nominal interest rate needs to be calculated for all four periods.

Compound interest in general:

$$K_n = K_0 \left(1 + \frac{i}{100}\right)^n$$

→ Bank account deposit in chronological order after 4 years: €1.061,364 ; €1.057,187 ; €1.053,023 ; €1.048,871.

⇒ In the first period, it is worthwhile using the bank account deposit.

Problem 2 (Inflation)

Consider a closed economy, which produces only three goods: sausages, mustard, and pretzels. Suppose that the ratio of consumption to output is identical for all three goods. The base period for all calculations is 2015.

	Output of sausages (in kg)	Price of sausages (per kg)	Output of mustard (in kg)	Price of mustard (per kg)	Output of pretzels (in kg)	Price of pretzels (per kg)
2015	1000	20	500	10	2000	8
2016	1500	24	200	25	2000	6

Table 2

Calculate the 2016 inflation using the Consumer Price Index (CPI) and the GDP deflator. Discuss the differences between both indicators and highlight advantages and drawbacks.

$$\text{CPI: } p_t^L = \frac{\sum_{i=1}^n p_i^t \cdot q_i^0}{\sum_{i=1}^n p_i^0 \cdot q_i^0} = \frac{24 \cdot 1000 + 25 \cdot 500 + 6 \cdot 2000}{20 \cdot 1000 + 10 \cdot 500 + 8 \cdot 2000} \approx 1.18$$

$$\text{GDP deflator: } p_t^P = \frac{\sum_{i=1}^n p_i^t \cdot q_i^t}{\sum_{i=1}^n p_i^0 \cdot q_i^t} = \frac{24 \cdot 1500 + 25 \cdot 200 + 6 \cdot 2000}{20 \cdot 1500 + 10 \cdot 200 + 8 \cdot 2000} \approx 1.10$$

Advantages of CPI: Reflects changes in cost of living.

Disadvantages of CPI: Fixed consumption basket - does not consider substitution effect - overstates inflation.

Advantages of GDP deflator: Dynamic index - considers all goods and services produced in the economy.

Disadvantages of GDP deflator: Also includes goods and services not relevant for an average consumer - may not be the best reflection of change in cost of living. Already includes any change in demand due to change in prices - may understate inflation.

Problem 3

Consider the labour market model from problem 4, exercise sheet 3.

- (a) Suppose that a country imposes protectionist policies which reduce competition from foreign companies in that country. What is the effect on mark-up and real wages?

- Competition $\downarrow \rightarrow$ Elasticity of demand \downarrow : more inelastic
- Because $\frac{1}{\text{elasticity}} = \mu$, the mark-up increases: $\mu \uparrow \rightarrow p^* \uparrow$ to p^{**}
- When the price increases: $p \uparrow \rightarrow \frac{W}{p} \downarrow \rightarrow E \downarrow$
- The real wage/the price-setting curve falls (new intersection with wage curve). In the new equilibrium, the employment is lower.

- (b) Given that firms want to minimize cost per unit of effort, we learned that decreasing wages leads to lower effort. What will be the response of employers to a fall in unemployment?

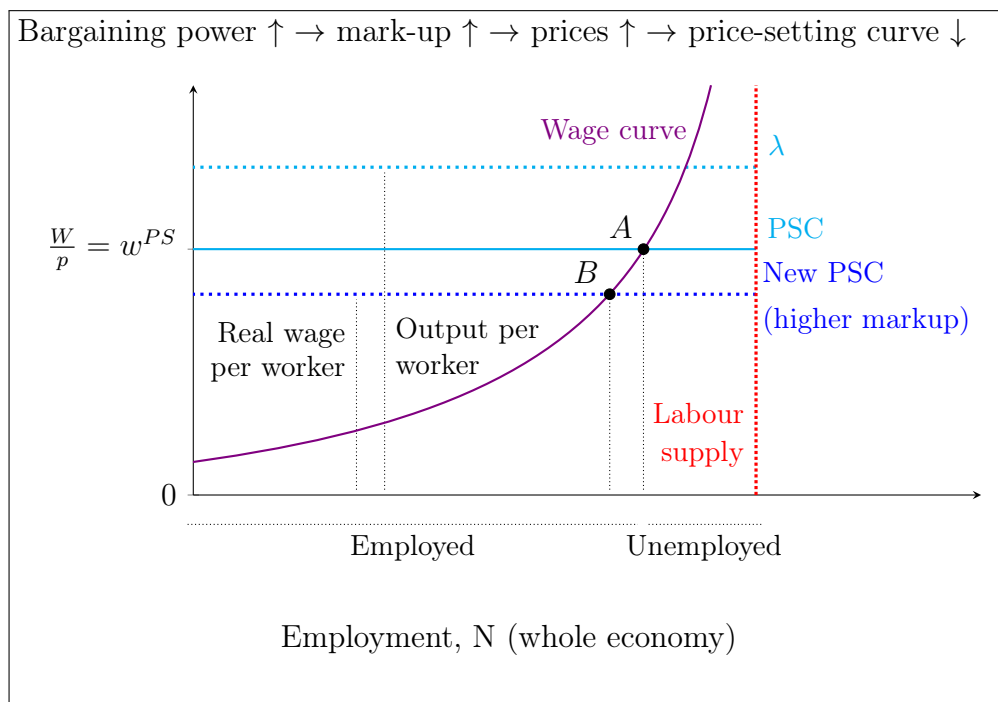
The employment game:
For the employee: The worker's best response curve shifts rightwards (for the previous effort level, a higher nominal wage is necessary.) For the company: The employer will increase the nominal wage in order to reach the efficiency wage ($MRS = MRT$) of the equilibrium.
 \rightarrow For all companies: Nominal wages of the whole economy increase: $W \uparrow \rightarrow p \uparrow \rightarrow$ Inflation \uparrow

- (c) What is a company's response to higher nominal wages in this model?

Firms want to keep the original mark-up. To restore the mark-up, they will increase prices.
There are two options, to reduce mark-ups:

- The markup is high, when the elasticity of demand is low. The firm's markup is inversely proportional to the elasticity of demand. By increasing competition, i.e. allowing more firms to enter the market, the elasticity of demand rises and the mark-up falls.
- Workers at the given unemployment rate possess enough bargaining power (e.g. through labour unions) to ask for the initial real wage.

- (d) How does an increase in the bargaining power of firms over consumers affect the labour market model?



Problem 4 (*The Phillips curve and expected inflation*)

In Figure 1, the labour market model is combined with the Phillips curve. The Phillips curve plots the inflation rate against the employment level. As illustrated, a recession leads to higher unemployment at 9%. What will happen to the expected inflation, the bargaining gap and the inflation rate if employment cannot be raised?

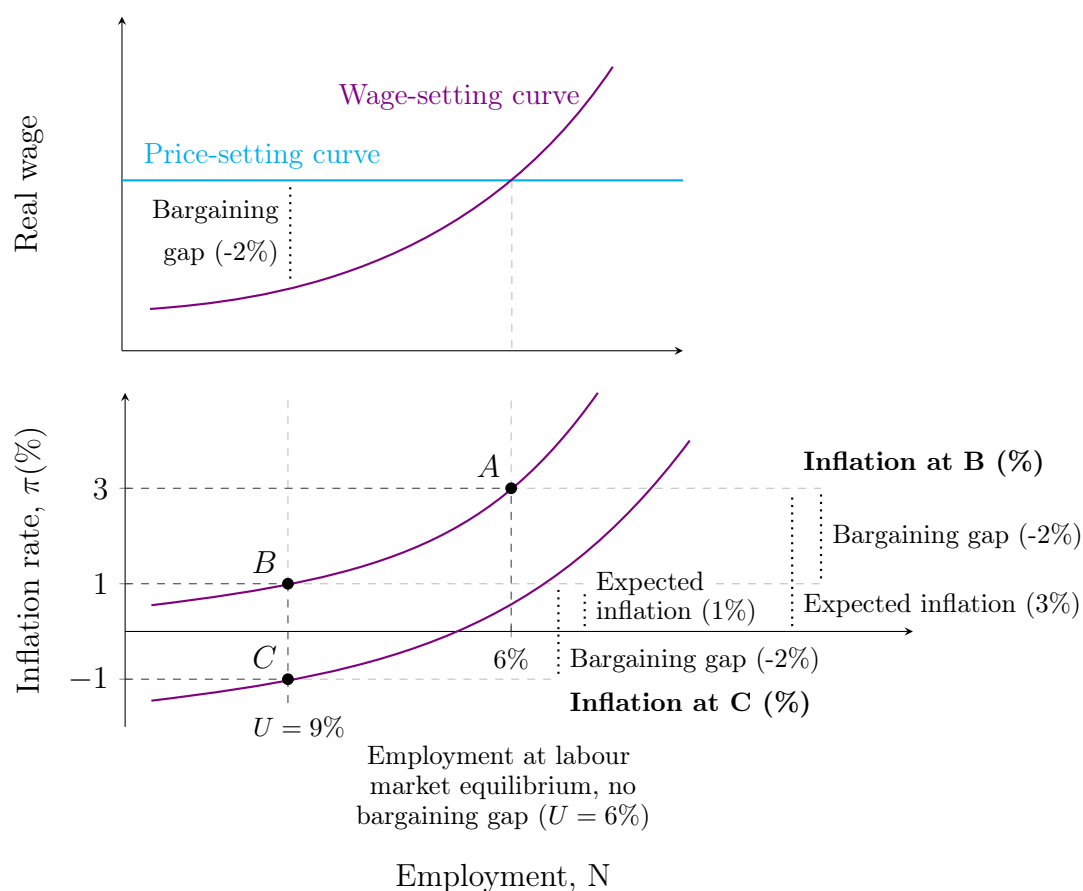


Figure 1

The labour market and inflation are closely tied together, and business cycles will affect both. The bargaining gap is relevant for the inflation: With recessionally higher unemployment (than the long-term/natural rate of 6% in this case), there is a negative bargaining gap for employees.

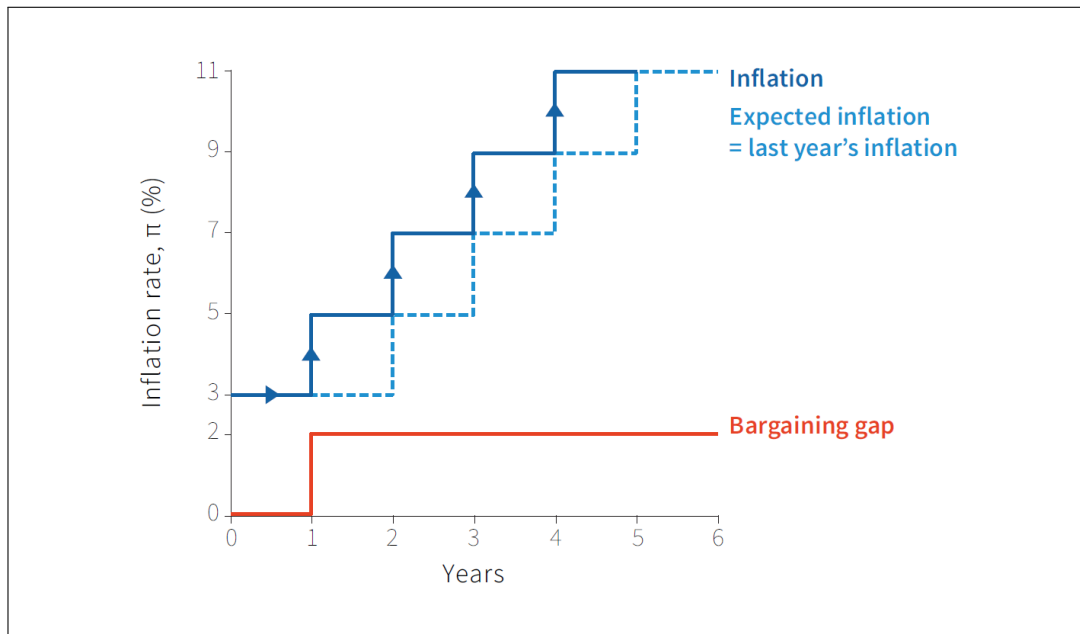
The bargaining gap added together with the expected inflation equals the actual inflation. With higher unemployment, the employees expect the same rise in price as before: 3%. For this reason, they would need additional 3% in their nominal wages to keep their real wages unchanged. Because a negative bargaining gap of 2% (that is -2%) opened up, the total inflation and the wage growth aggregates to 1%.

Inflation rate (%) = Price increase (%)
= increase in costs per unit of output (%)
= increase in wages (%) (if wages are the only costs)
= expected inflation + bargaining gap (%)
= last period's inflation + bargaining gap (%)

In the first year of the recession with a higher unemployment of 9%, there is lower inflation of 1%. In the illustration, there would be a movement along the Phillips curve to the left to point B (at 9% UR and 1% IR).

If employment cannot be lifted, the following years would suffer from rising deflation: In the second year, the inflation expectation would adjust to 1%, while the bargaining gap of -2% still holds. This aggregates to an inflation rate of -1%. For the second year, the Phillips curve would be shifted downward such that UR is 9% and IR is -1%. For the third year, the curve would be lowered further such that UR is 9% and IR is -3% and so forth.

Deflation (and thus the wage-price-spiral) stops to aggravate in case unemployment can be lifted to the natural level of 6% and the bargaining gap closes.



II. Multiple Choice

Readings:

The Economy: *Exchange rate and monetary policy* (15.8, 15.9)

Select one answer.

1. Inflation and business cycles

Table 3 shows the annual inflation rate in % of Japan, the UK, China and South Sudan in the period 1996-2015.

Years	1996-2000 (%)	2001-2005 (%)	2006-2010 (%)	2011-2015 (%)
Japan	-1.9	-0.9	-0.5	1.6
UK	2.1	1.7	1.8	1.8
China	8.1	2.4	2.1	0.8
South Sudan	54.1	6.5	0.6	-18.7

Source: World Bank

Table 3

Which of the following statements is correct?

- (A) Japan experienced a rising deflationary pressure from 1996 until 2010.
- (B) China was confronted with deflation throughout the whole period.
- (C) Due to disinflation and deflation through the period in South Sudan, the price level in 2015 is approximately the same as in 1996.
- (D) The UK's price level rose at a relatively stable rate between 1996 and 2015.

2. The exchange rate and monetary policy

Table 4 shows the British pound exchange rates against USD and €.

	24 Nov 2014	23 Nov 2015
USD/GBP	1.5698	1.5131
EUR/GBP	1.2622	1.4256

Table 4

Source: World Bank

In this table, the exchange rate is defined as the number of USD and € that buy £1. Which of the following statements is correct?

- (A) The USD has depreciated against the GBP.
 - (B) The € has appreciated against the GBP.
 - (C) The USD has depreciated against the €.
 - (D) For the US, importing from GB has become cheaper.
3. Consider a scenario where the Bank of England views the UK economy to be overheating and is attempting to slow the economy down using monetary policy. Which of the following statements is correct regarding the effects of an interest rate rise?
- (A) It leads to higher bond prices, which result in higher demand for UK bonds.
 - (B) It leads to higher demand for GBP, which results in an appreciation of GBP.
 - (C) It leads directly to UK exports becoming cheaper and imports becoming more expensive.
 - (D) It has opposing effects to the UK's aggregate demand (AD) of discouraging investment, which lowers AD, and cheaper imports, which boosts AD.