Chapter 5: Inflation: Its Causes, Effects, and Social Costs

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Chapter 5: Inflation

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Introduction

- Inflation: Overall increase in prices
- This chapter: Classical theory: Focus on the long run effects: *Prices are flexible*
- Chapter 10: Short run: Many prices are *sticky*.
- To understand inflation, we have to understand money.

Quantity equation

$$Money \cdot Velocity = Price \cdot Transactions \tag{1}$$

$$M \cdot V = P \cdot T \tag{2}$$

Lolek & Bolek on the campsite

Lolek & Bolek in the supermarket

- Lolek and Bolek make holidays on a campsite.
- Both walk (they don't have a car!) over to the next supermarket (5 km).
- They buy a box of beer with $T = 20$ cans.

Lolek & Bolek on their way back

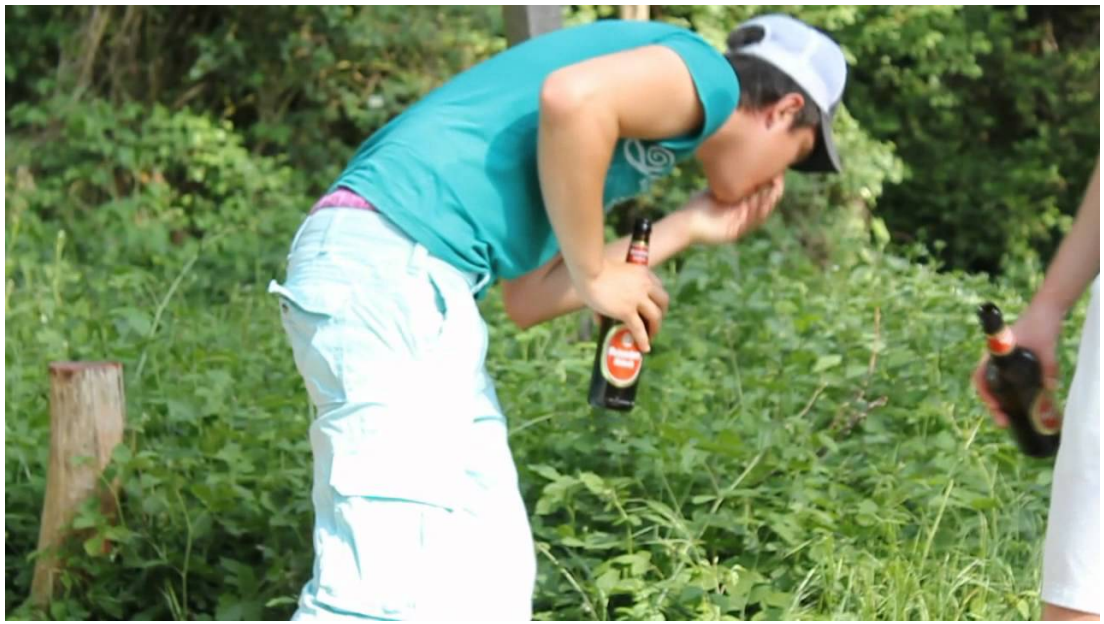
- On their way back, Lolek becomes thirsty.
- He has still $M = 4$ EUR in his pockets.
- Lolek asks Bolek, whether he can buy a beer from him.
- Bolek agrees and fixes the price to $P = 2$ EUR/can.

Lolek & Bolek drink even more

- Lolek drinks the first beer but *"you can not stand on one leg" (Auf einem Bein kann man nicht stehen!)*
- Lolek is still thirsty and decides to buy a second beer...
- A few minutes later Bolek also becomes thirsty.
- Since he has 4 EUR in his pockets now... Bolek decides to buy 2 beers from Lolek!

Lolek & Bolek back on the campsite

- A few hours later, they are back on the campsite.
- The box of beer is empty.
- And Lolek and Bolek are drunk!



Lolek & Bolek: Open questions

- How can money supply of 4 EUR finance transactions with a value of $P \cdot T = 2 \cdot 20 = 40$ EUR?
- How often has money changed the hands?
- In other words: How large is the *velocity* of money?

Quantity equation

$$Money \cdot Velocity = Price \cdot Transactions \tag{3}$$

V: Transactions velocity of money

$$M \cdot V = P \cdot T \tag{4}$$

When it comes to Lolek & Bolek:

$$V = \frac{P \cdot T}{M} = \frac{2 \cdot 20}{4} = 10 \tag{5}$$

Quantity equation

$$M \cdot V = P \cdot T \tag{6}$$

- The quantity equation is an identity.
- It always has to hold!
- When one of the variables changes, one or more of the other variables must also change.

- In the Lolek & Bolek example:
- When money supply increases: (Most likely) $\Rightarrow$ Velocity will decrease!

Inserting output instead of transactions

$$Money \cdot Velocity = Price \cdot Output \tag{7}$$

$$M \cdot V = P \cdot Y \tag{8}$$

V: Income velocity of money

Inserting output instead of transactions

- Real money balance: $\frac{M}{P}$
- Measures the purchasing power of the stock of money.
- Lolek & Bolek $\frac{M}{P} = \frac{4 \text{ EUR}}{2 \text{ EUR/beer}} = 2$ beers
- Current money balance is large enough to finance 2 beers.
- Money demand function:

$$\frac{M^d}{P} = k \cdot Y \tag{9}$$

Difference & "relationship" between marginal propensity to consume and money demand

Let's assume that

- one household has a monthly income of $Y = 2000$ EUR and
- the marginal propensity to consume is $c_1 = 0.8$.
- The consumption function is given by $C = c_1 \cdot Y$ (autonomous component of consumption is zero).
- The household is spending 1.600 EUR per month.
- The salary is paid on a weekly basis.
- Therefore, the household is walking once a week to the ATM.
- Money demand is only $\frac{M^d}{P} = 400$ EUR.

$$\frac{M^d}{P} = k \cdot Y \quad \Rightarrow \quad 400 = k \cdot 2000 \tag{10}$$

Difference & "relationship" between marginal propensity to consume and money demand

$$\frac{M^d}{P} = k \cdot Y \quad \Rightarrow \quad 400 = k \cdot 2000$$

- The parameter $k = 0.2$.

Difference & "relationship" between marginal propensity to consume and money demand

- There is a relationship between consumption and money demand!
- But most important insight: Payment habits influence money demand
- Assumption of the classical theory: Payment habits are pretty stable in the short run.
- Therefore: Money demand function is pretty stable!

Money demand = money supply

$$\frac{M}{P} = k \cdot Y \tag{11}$$

$$M \cdot \left(\frac{1}{k}\right) = P \cdot Y \tag{12}$$

$$M \cdot V = P \cdot Y \quad with \quad V = \frac{1}{k} \tag{13}$$

- Velocity is influenced by money demand and the payment habits of the economy.
  - When people want to hold only little money (k is small)
  - money changes hands frequently (V is large).
- Hyperinflation

Money demand = money supply

Quantity equation:

$$M \cdot V = P \cdot Y \tag{14}$$

Quantity equation, written in percentage-change form:

$$\Delta M\% + \Delta V\% = \Delta P\% + \Delta Y\% \tag{15}$$

In case that velocity is constant:

$$M \cdot \bar{V} = P \cdot Y \tag{16}$$

$$\Delta M\% + 0 = \Delta P\% + \Delta Y\% \tag{17}$$

Solving for the inflation rate:

$$\Delta P\% = \Delta M\% - \Delta Y\% \tag{18}$$

Money demand = money supply

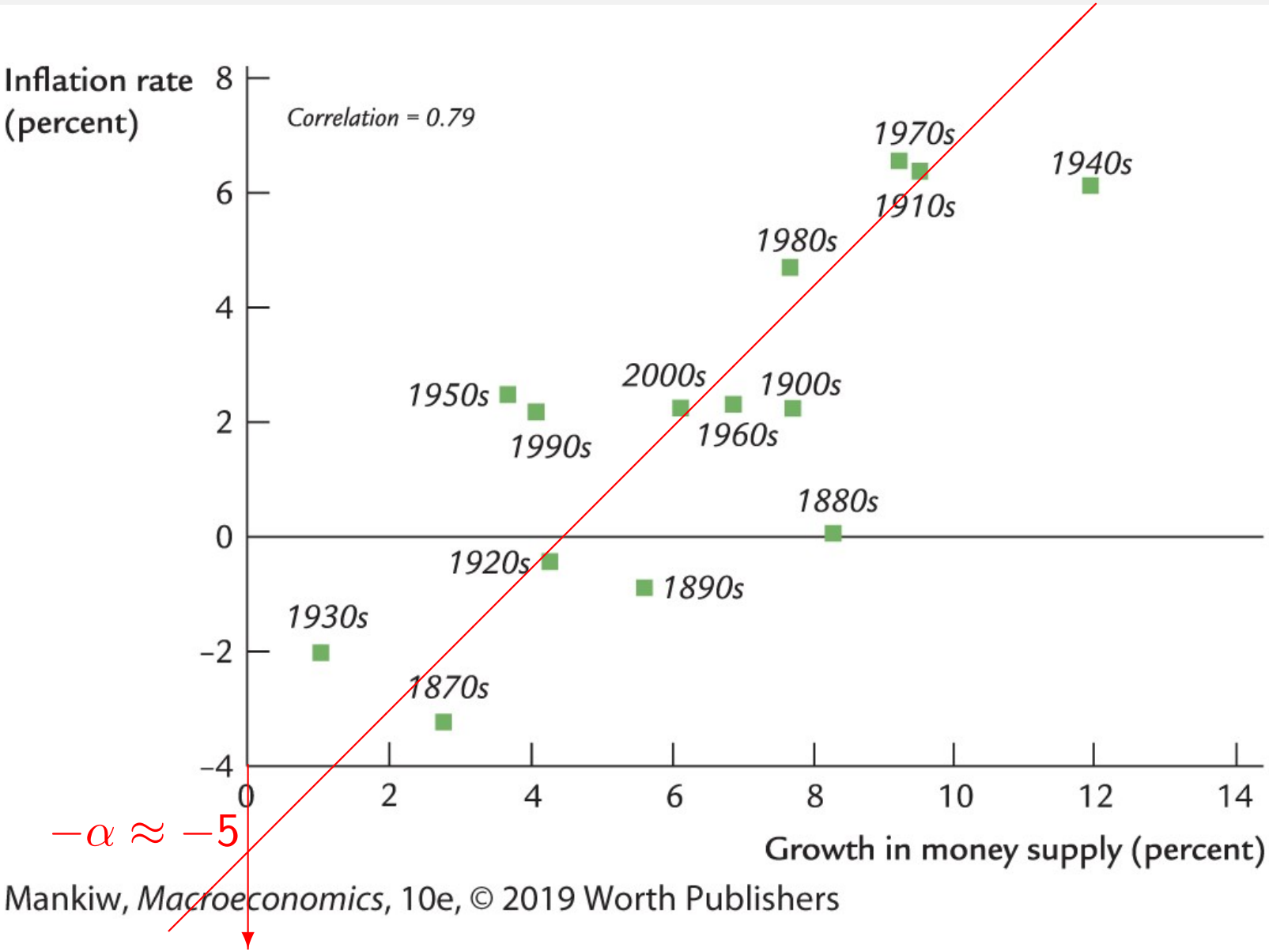
$$\Delta P\% = \Delta M\% - \Delta Y\%$$

- The growth rate of GDP is given by the change in the labor force and the change in capital.
- Let's assume that growth rate of output is a constant:
- $\Delta Y\% = \alpha$

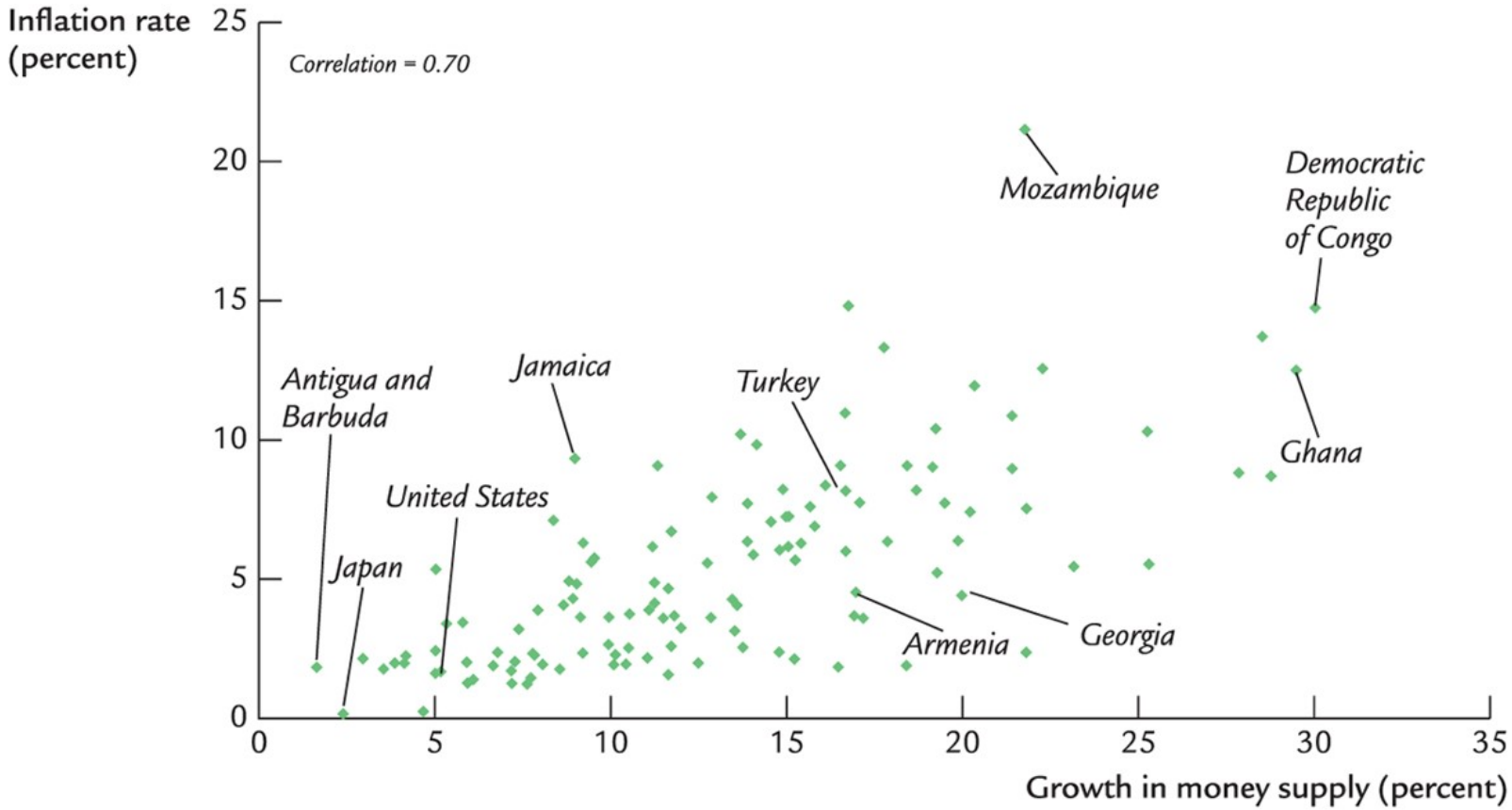
$$\Delta P\% = -\alpha + 1 \cdot \Delta M\% \tag{19}$$

- The quantity theory of money states that the central bank, which controls the money supply, has ultimate control over the rate of inflation.
- If the central bank keeps the growth rate of money supply stable, inflation will be stable.

Money supply & Inflation (USA)



Money supply & Inflation (Cross section)



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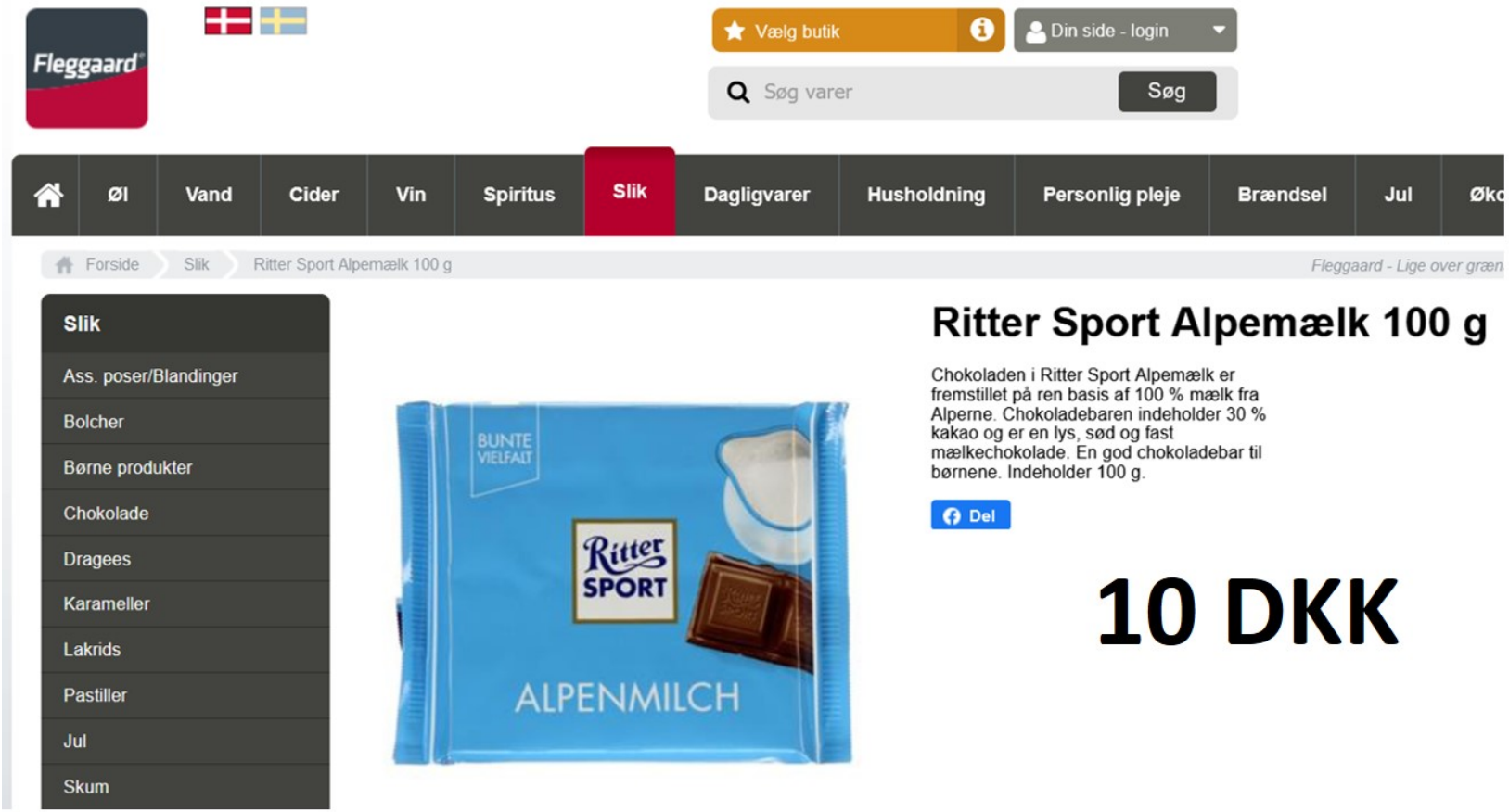
Why does a central bank print too much money?

How can government finance its spending?

1. Taxes
2. Borrowing by issuing bonds
3. Print money (= Print bonds and 'sell' them to the central bank)

Inflation tax

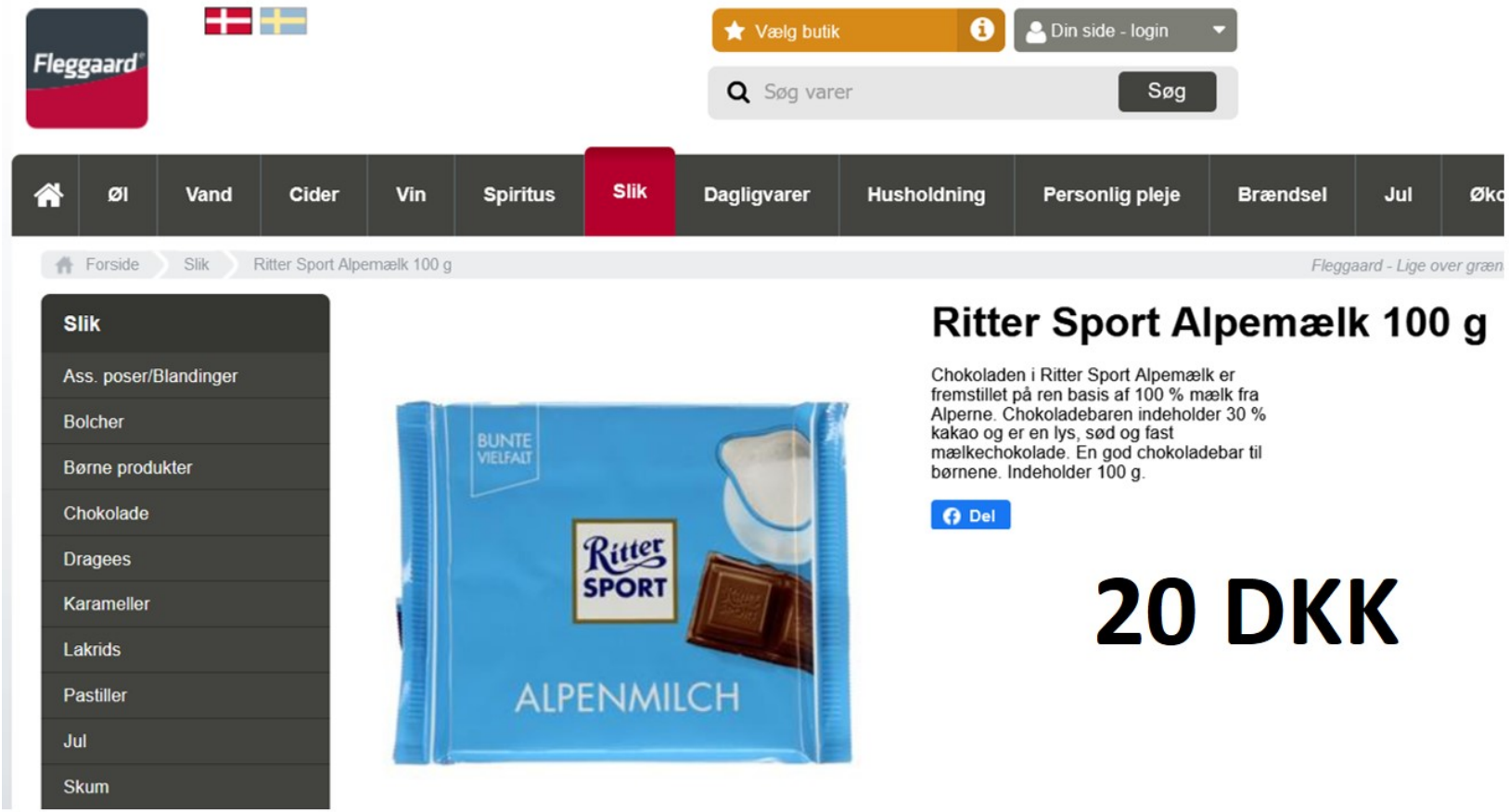
Inflation tax



Inflation tax

Inflation tax

Inflation tax



Inflation tax

Inflation tax

- When government prints money: Inflation!
- Why inflation tax? Who is taxed?
- The holders of money are taxed, because the purchasing power decreases.
- The real value of money decreases.

Fisher equation

- Relationship between nominal interest rate (i) and real interest rate (r):

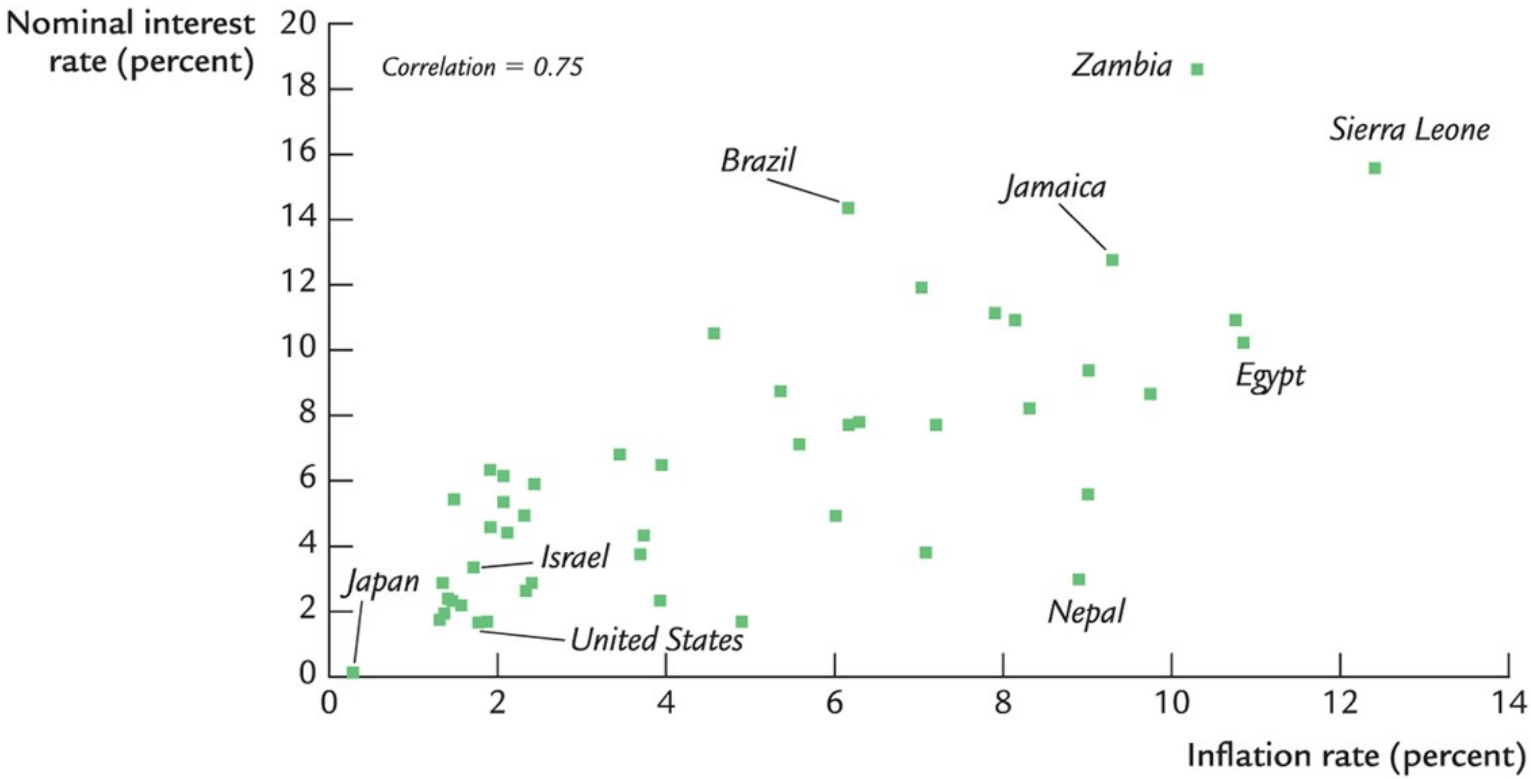
$$r = i - \pi \tag{20}$$

- Fisher equation:

$$i = r + \pi \tag{21}$$

- Countries which have higher inflation rates also have higher nominal interest rates.

Relationship between inflation and nominal interest rates



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Fisher equation

- The real interest rate that the borrower and lender *expect* when the loan is made: Ex ante real interest rate.
- Ex ante: $i - E\pi$
- The real interest rate that is actually *realized* is called: Ex post real interest rate.
- Ex post: $i - \pi$
- The two real rates differ, in case that realized inflation differs from expected inflation $\pi \neq E\pi$

Fisher equation: Ex post

- Relationship between nominal interest rate (i) and real interest rate (r):

$$r = i - \pi \tag{22}$$

- Fisher equation:

$$i = r + \pi \tag{23}$$

- Countries which have higher inflation rates also have higher nominal interest rates.

Fisher equation: Ex ante

- Relationship between nominal interest rate (i) and the expected real interest rate (Er):

$$Er = i - E\pi \tag{24}$$

- Fisher equation:

$$i = Er + E\pi \tag{25}$$

- Unfortunately: The textbook does not differentiate between the expected and realized real interest rate.
- Textbook uses the very same symbol: r

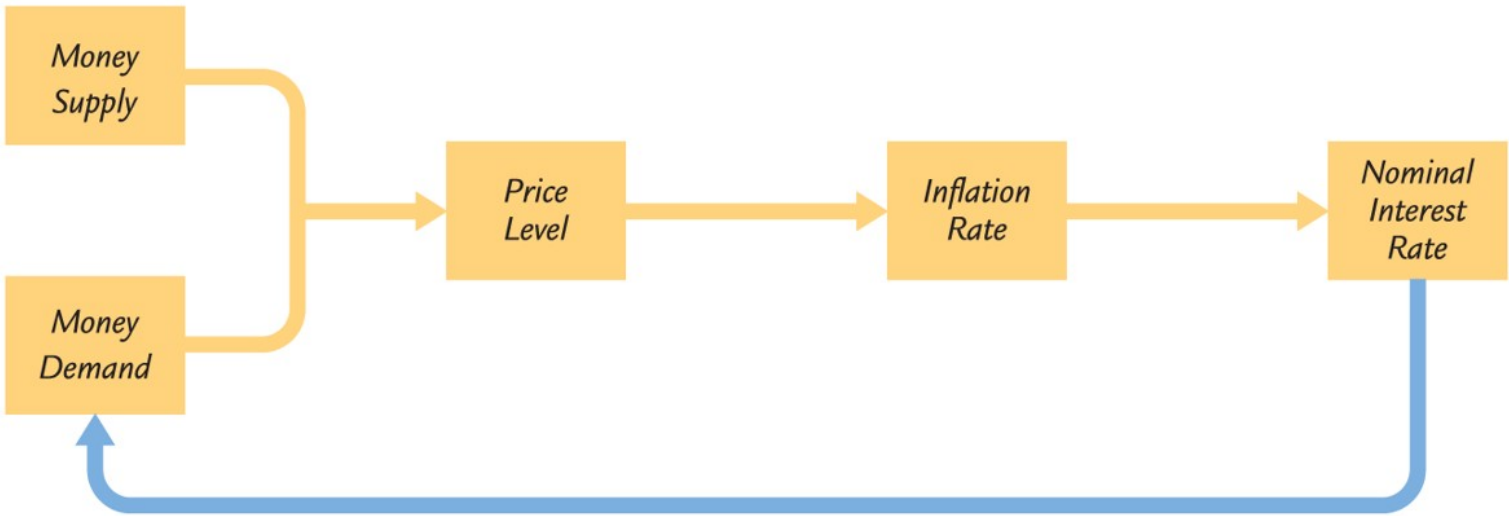
$$i = r + E\pi \tag{26}$$

Money demand depends *also* on the interest rate

- When people hold money, they are NOT earning the nominal interest rate (i).
- The nominal interest rate is the opportunity cost of holding money.
- The larger the interest rate, the lower the demand for money (=liquidity L).

$$\frac{M^d}{P} = L(i, Y) \tag{27}$$

Linkages: A new loop



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Expectations for tomorrow drive prices already today

$$\frac{M}{P} = L(i, Y) \tag{28}$$

- Today's nominal interest rate depends on the inflation expectations for the future.
- Textbook: $i = r + E\pi$

$$\frac{M}{P} = L(r + E\pi, Y) \tag{29}$$

- Price level today depends on inflation expectations.
- What influences inflation expectations?
- The expected monetary policy in the future.
- *"Expectations of higher money growth in the future lead to a higher price level today."*

Expectations drive prices already today

- The price level depends on a weighted average of the *current* money supply AND the money supply to prevail in the *future*.
- Inflation is driven by both: Current growth in the money supply and its expected future growth.

Layman's view

- Layman's judge that the cost of inflation is higher compared to economists.

Stable inflation rates: $\pi_t = \pi_{t+1} = \pi_{t+2} = 6\%$

- Shoeleather cost: Lower levels of money holdings $\Rightarrow$ more visits at the ATM.
- Menu costs
- Larger variability of relative prices, in case that nominal prices are adjusted at different points in time.
- Tax laws: 100 USD $\Rightarrow$ 106 USD

The cost of high and unstable inflation rates

- High inflation = higher variability in inflation
- Redistribution between debtor and creditor
- Fixed pensions

Adjustments of the real wage

- Due to a negative shock, the demand in one sector decreases.
- The real wage (W/P) in this sector has to decrease be 2 %.
- Three options:
  1. $\frac{W\downarrow\downarrow}{\bar{P}}$
  2. $\frac{\bar{W}}{P\uparrow\uparrow}$
  3. $\frac{W\uparrow\uparrow\uparrow}{P\uparrow\uparrow\uparrow\uparrow\uparrow}$
- Without inflation, real wage will be stuck on a level which is too high $\Rightarrow$ higher unemployment.
- Inflation *"greases the wheels"* of labor markets.

Hyperinflation

- Hyperinflation: When the *monthly* inflation rate exceeds 50 % (more than 1 % a day!).
- Menu costs: German hyperinflation 1920's: In a restaurant, a waiter was standing up on a table very 30 minutes to call out the new prices

Hyperinflation

Even paper money has *some* intrinsic value

Carrying money to the grocery store is as burdensome as carrying the groceries back home Mankiw (p. 125)


5 Pfd. Mehl
120000
1 Brot
50000
Weißkohl
30000
4 Eier
40000
40000
Tomaten
40000
Wurst
1 Pfd
180000
2 Pfd
Schmalz
340000
60000

The velocity of money increases tremendously

- Money is not counted anymore, but weighted!
- Money is loosing the function of account!

Hyperinflation: It all starts with the government, *not* the central bank

- Government has three options to finance its spending
  - Taxes
  - Borrow via issuing bonds
  - Printing money
- When inflation picks up: Real value of tax revenues decreases $\Rightarrow$ Print more money

$$\Delta M\% \uparrow + \Delta V\% = \Delta P\% + \Delta Y\%$$

Velocity of money

- *"Buy two pitchers of beer even when the second one looses its freshness"*
- Velocity increases!

$$\Delta M\% + \Delta V\% \uparrow = \Delta P\% + \Delta Y\%$$

Production decreases

- Production decreases

$$\Delta M\% + \Delta V\% = \Delta P\% + \Delta Y\% \downarrow$$

How can hyperinflation be stopped?

- Introduce new currency maybe even dollarization.
- Fiscal reforms: Without fiscal reforms, underlying problem not solved.
- Decrease government spending, increase taxes.
- Government budget has to be balanced without printing money.