5. Credit, banks and money

I. Exercise Questions

Readings
Lecture slide set: #7
The Economy: *Policy rate (10.9), consumption smoothing (13.6), Bank money (10.8), money creation & legal tender (10.1), central & commercial banks (10.8), balance sheet (10.10)*
https://policonomics.com: *preferences, utility function*
http://www.ces-munich.de/ifoHome/facts/Survey-Results/Business-Climate.html: *Ifo Business Climate Index*

Problem 1 (*Benefits from borrowing and lending*)

Consider two periods in Christoph's life. In both periods he receives an income I_j and decides on his personal consumption c_j with $j \in \{1; 2\}$. The only way of using his income is consumption. Christoph's preferences regarding his consumption in period 1 and period 2 are represented by the utility function U. In period 1 he has the possibility of either lending a portion of his income to a commercial bank or borrow money from it; both the bank's supply of and demand for money are infinite. In period 1, Christoph is not able to lend more than he has and cannot borrow more than he is able to repay in period 2. The interest rate for lending is r_L, that for borrowing r_B. As Homo economicus, Christoph always seeks to maximize his utility.

Income:	$I_1 > 0;\ I_2 > 0;$
Utility function:	$U = (c_1)^{0.6} \cdot (c_2)^{0.4};$
Interest rates:	$r_L = r_B = r = 0.2;$

(a) Discuss the shape of the utility function with reference to the concepts of impatience and consumption smoothing.

Diminishing marginal returns to consumption lead to a preference for consumption smoothing.
→ Multiplicative utility function
Impatience makes consumption in period 1 more valuable than consumption in period 2.
→ The exponent of c_1 is higher than the one of c_2.

(b) Calculate the amount of money X, Christoph borrows in period 1 subject to his income I_1 and I_2 (Borrowing: $X \geq 0$; Lending: $X < 0$).

$$
\begin{aligned}
Max\ U &= (c_1)^{0.6} \cdot (c_2)^{0.4} \\
s.t.\ c_1 &= I_1 + X \\
c_2 &= I_2 - (1+r) \cdot X \\
\rightarrow\ Max\ U &= (I_1 + X)^{0.6} \cdot (I_2 - (1+r) \cdot X)^{0.4}
\end{aligned}
$$

$$
\begin{aligned}
FOC: \frac{\partial U}{\partial X} &\stackrel{!}{=} 0 \Leftrightarrow 0.6 \cdot (I_1 + X)^{-0.4} \cdot 1 \cdot (I_2 - (1+r) \cdot X)^{0.4} + \\
&+ (I_1 + X)^{0.6} \cdot 0.4 \cdot (I_2 - (1+r) \cdot X)^{-0.6} \cdot (-(1+r)) = 0 \\
0.6 \cdot \frac{(I_2 - (1+r) \cdot X)^{0.4}}{(I_1 + X)^{0.4}} &= 0.4 \cdot (1+r) \cdot \frac{(I_1 + X)^{0.6}}{(I_2 - (1+r) \cdot X)^{0.6}} \\
0.6 \cdot (I_2 - (1+r) \cdot X) &= 0.4 \cdot (1+r) \cdot (I_1 + X) \\
X &= \frac{0.6 I_2 - 0.4 \cdot (1+r) \cdot I_1}{1+r} \\
X &= 0.5 I_2 - 0.4 I_1
\end{aligned}
$$

(c) How does X depend on I_1 and I_2? Give an economic intuition for the dependencies.

$\frac{\partial X}{\partial I_1} = -0.4 < 0$ → The higher C's income in period 1, the less he has to borrow.

$\frac{\partial X}{\partial I_2} = 0.5 > 0$ →The higher C's income in period 2, the more he borrows in period 1 for consumption smoothing.

(d) Assume $I_1 = I_2 = 50$. Give an economic intuition whether Christoph is borrowing or lending money in period 1. Calculate the optimal value of X and Christoph's corresponding utility. Compare the situation to a scenario without the possibility for borrowing and lending.

$I_1 = I_2 = 50$

$\rightarrow$ C is borrowing money due to his higher valuation of consumption in period 1 compared to consumption in period 2 (impatience).

$X = 0.5 \cdot 50 - 0.4 \cdot 50 = 5$

$U = (50 + 5)^{0.6} \cdot (50 - 1.2 \cdot 5)^{0.4} \approx 50.30$

Scenario without borrowing and lending:

$\overline{U} = 50^{0.6} \cdot 50^{0.4} = 50$

$\rightarrow$ $U > \overline{U}$ $\Rightarrow$ Increase in welfare due to the possibility of borrowing and lending.

Problem 2 (*Bank money creation and the central bank's influence*)

Consider a commercial bank with the following balance sheet in Table 1:

Assets	Liabilities
Cash reserve €5,500	Deposits €1200,000
Central bank money €6,500	Dept €340,000
Loans €1348,000	Equity €20,000
Bonds €200,000	

Table 1

(a) Illustrate the process of money creation (assume an additional loan of €$5,000$) by the commercial bank. Point out the difference between a cash payment of the money and a bank transfer to an account of another bank.

Granting of the credit: Deposits + €$5,000$ & Loans + €$5,000$
Cash payment: Deposits − €$5,000$ & Cash reserve − €$5,000$
Bank transfer: Deposit − €$5,000$ & Central bank money − €$5,000$).

(b) Explain the central bank's role in the process of money creation and its potential to control it. Which actions must the commercial bank take to comply with regulations after the emission of the loan and its complete payment in cash (assume a minimum reserve of 1% and a policy interest rate of 0.00%)?

The central bank decides on policy interest rate and minimum reserve.
Minimum reserve: 1% of deposits = $0.01 \cdot 1200,000 = 12,000$
Bank's reaction: Central bank money + €$5,000$ & Bonds − €$5,000$

(c) In January 2012 the ECB decreased the minimum reserve from 2% to 1% and in March 2016 the policy interest rate was reduced from 0.05% to 0.00%. Discuss the likely effects of both policies on the money supply in the economy.

A reduction of the minimum reserve decreases the amount of base money a commercial bank needs to hold. Furthermore a reduction of the policy interest rate decreases the price for base money, the commercial bank has to pay. Both actions decrease the commercial bank's cost of lending money to their clients.

(d) Discuss likely macroeconomic effects of increased borrowing if the borrowed money is

(i) invested in production capital, such as machines and factories,

(ii) spent for private consumption,

(iii) spent for assets, such as real estate or bonds.

(i) Investment in production capital increases the output of an economy and in the long run leads to economic growth.

(ii) An increased demand for consumption goods increases their prices and thus causes inflation.

(iii) An increased demand for assets increases their prices and might result in speculative bubbles.

II. Multiple Choice

Readings
The Economy: *Feasible frontier (3.4)*

Select one answer.

1. Which of the following statements is true?

(A) Bank money includes the money created by commercial banks when they extend credit to firms and households.

(B) A principal-agent problem occurs in every case in which principal and agent are not the same person.

(C) The policy rate is determined by supply and demand on the money market.

(D) The bank lending rate is the average interest rate charged by the central bank on base money.

2. Annette has an income of €100 in period 1 and no income in period 2. Her only possibility of smoothing consumption is lending money to a bank from period 1 to 2, for which she receives an interest rate r. Which of the following statements is true?

(A) When the interest rate is $r = 12\%$, the marginal rate of transformation of goods from period 1 to period 2 is 0.12.

(B) When the interest rate is $r = 25\%$, Annette can consume 40% of her income in period 1 and still buy new sunglasses for €70 in period 2.

(C) When the interest rate is $r = 25\%$, the maximum that Annette can lend in period 1 is €80.

(D) When the interest rate is $r = 12\%$, Annette's consumption in period 2 is €120 at most.

3. Christoph and Julian both earn an income in period 2 but none in period 1. To smooth their consumption, they can borrow money from a bank. The bank can charge an individual interest rate.
Their feasible frontiers are given in Figure 1.

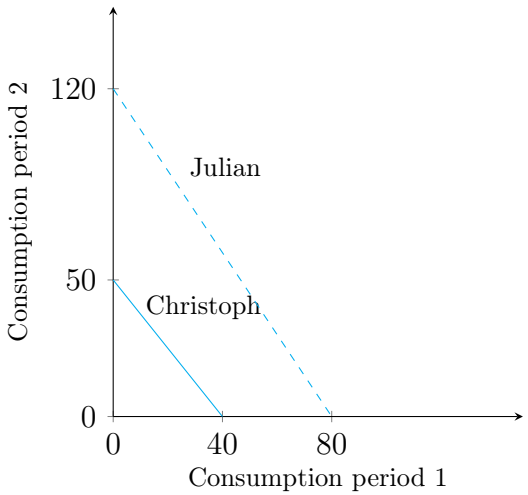

Figure 1

Which of the following statements is true?

(A) Christoph pays a lower interest rate for borrowing money.

(B) Julian has to pay an interest rate of $r_J = 0.25$.

(C) Christoph is definitely more impatient than Julian.

(D) Julian's income in period 2 is exactly twice as high as Christoph's income.