Macroeconomics A
Solution to final exam spring 2009

Question 1 (20 points)

Suppose the German government implements a program of fiscal restraints that reduces the level of government spending substantially.

a) Use the closed-economy saving-and-investment model to discuss the effect on the real interest rate, national saving, and investment.

b) Use the small open-economy saving-and-investment model to discuss the effect on the domestic real interest rate, domestic saving, domestic investment, and capital flows. In your answer, assume that initially the current account is balanced.

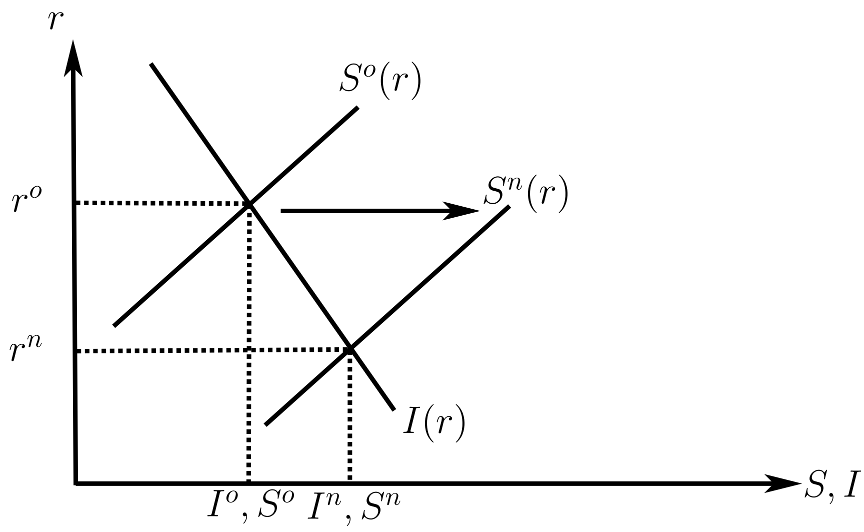
Answers to question 1

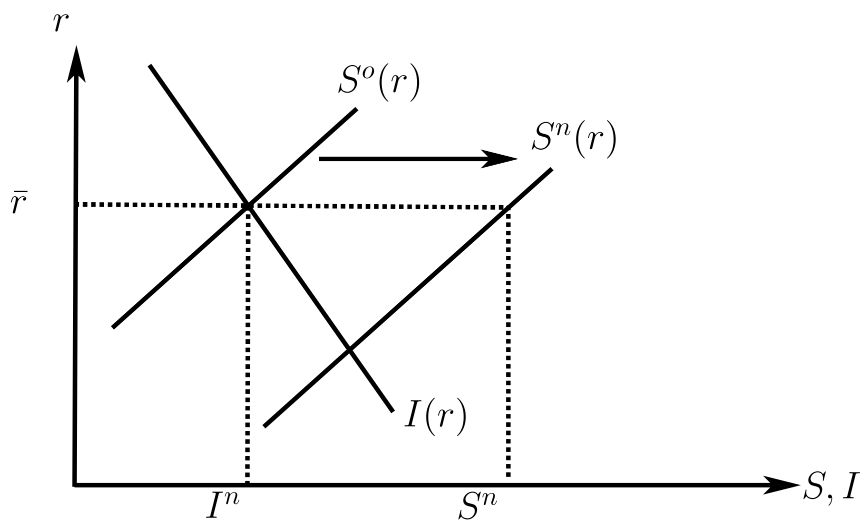
Part a)

government saving: $S^g = T - G$
$\Rightarrow$ if $G \downarrow \rightarrow S^g \uparrow$

national saving: $S = S^g + S^p$
$\Rightarrow$ since S^p remains unaffected, $S \uparrow$

$S(r)$-curve shifts to the right
$\Rightarrow$ for r^o, demand for credit is lower than supply of credit
$\Rightarrow$ the price for credit r decreases, equilibrium S, I increase





$S^n - I^n =$ capital outflow

Part b)

small open economy: $r = \bar{r}$ which is by definition of the small open economy exogenously given
$\Rightarrow$ $S(r)$-curve shifts outwards
$\Rightarrow$ domestic supply of credit is larger than domestic demand
$\Rightarrow$ capital outflow $= S^n - I^n$

Question 2 (20 points)

Use the Solow growth model to answer questions a) and b) below.

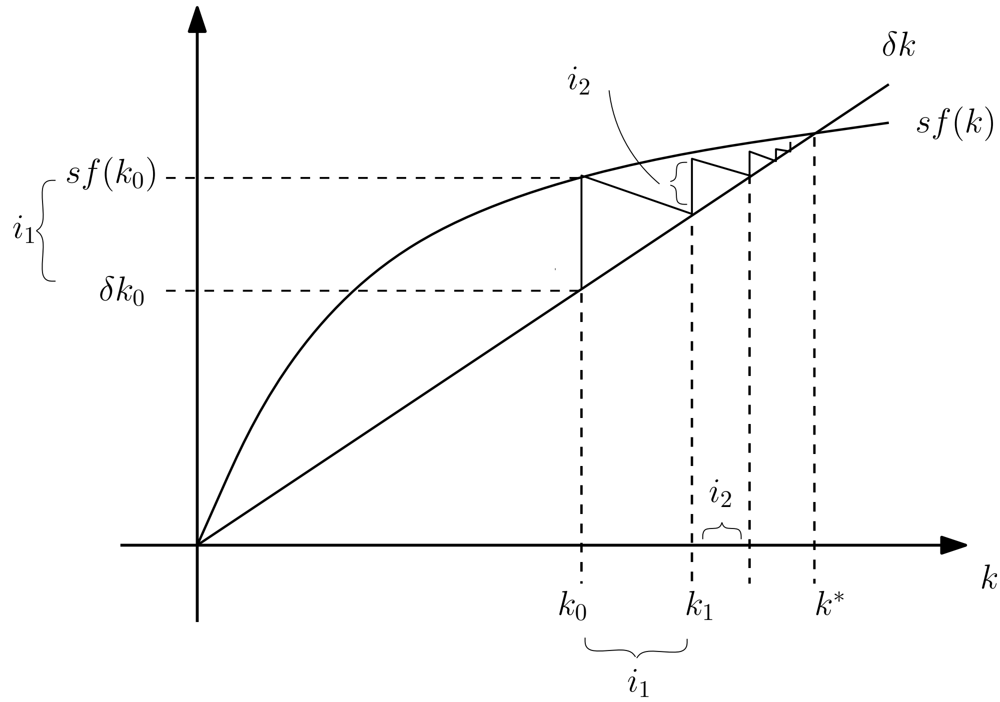
a) *Suppose the current capital stock per worker of a country, k_0, is smaller than its steady state level of capital per worker: $k_0 < k^*$. Assume that the standard assumption of a diminishing marginal product of capital holds. Discuss the evolution of the capital stock per worker and the growth rate of capital per worker over time. Provide as many diagrams as necessary.*

b) *Consider now a country whose production function is linear, that is, the marginal product of capital is constant. Discuss the evolution of the capital stock per worker over time when the country starts with an initial capital stock, k_0 . In your discussion assume that the saving schedule lies above the depreciation schedule.*

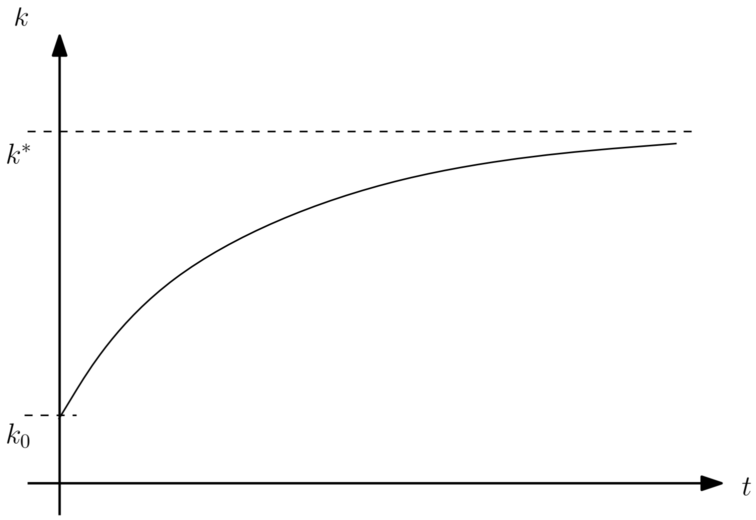
Answers to question 2

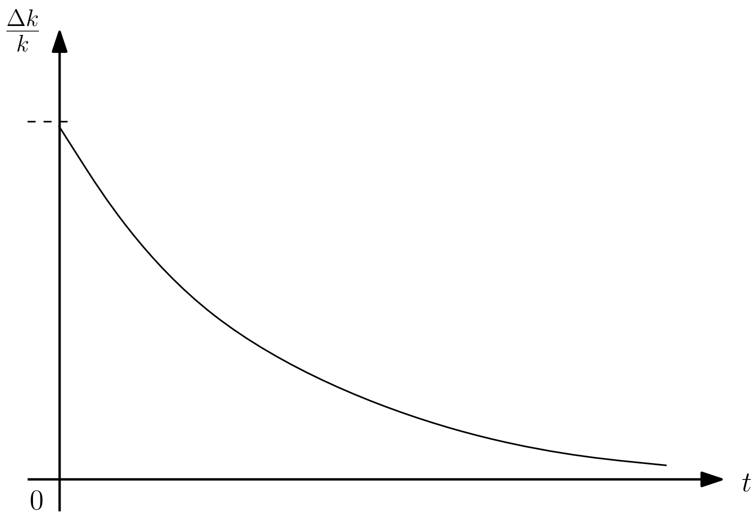
Part a)

- Definition of variables:
  - k: capital per worker
  - $f(k)$: production function
  - δ: depreciation rate
  - s: savings rate
  - i: investment per worker
  - $\frac{\Delta k}{k}$: growth rate of k
- In steady state: $sf(k^*) = \delta k^*$
- Initial situation: $sf(k_0) > \delta k_0$, because diminishing MPK



- k increases by $i = sf(k) - \delta k$
- k increases at a diminishing rate because of diminishing MPK
- k converges to k^*

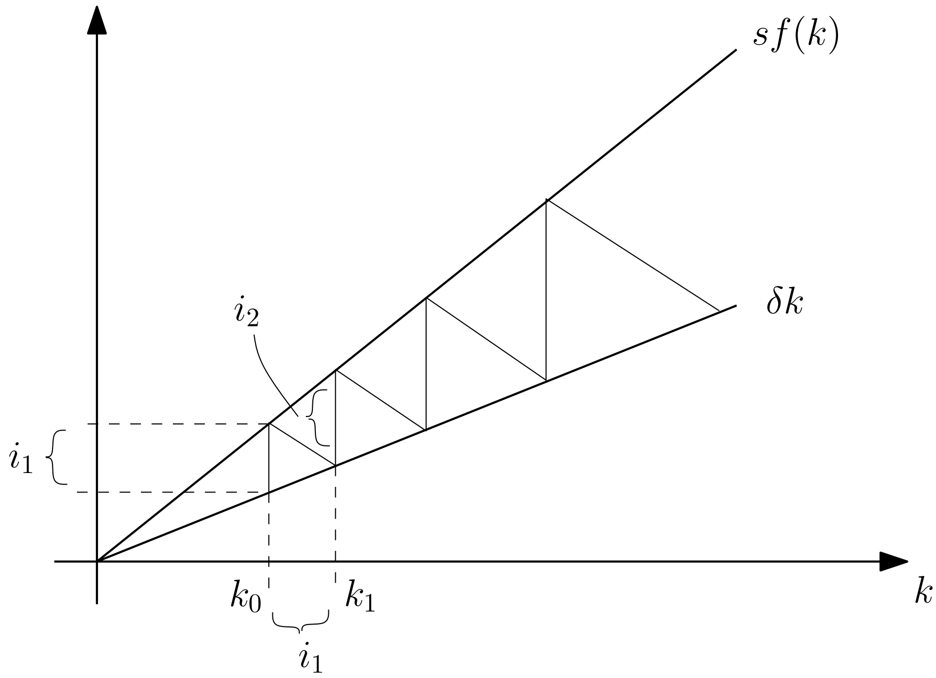




- $\frac{\Delta k}{k}$ approaches zero, in steady state equal to zero

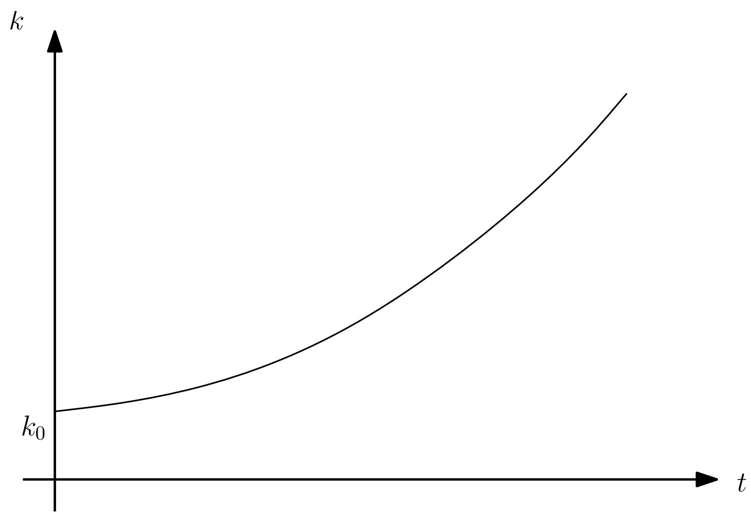
Part b)

- $sf(k) > \delta k$ for all k
- $sf(k)$ is a line going through the origin



- i increases over time, because MPK constant and $sf(k) > \delta k$

  $\Rightarrow$ k increases at a constant rate, does not converge to a steady state



Question 3 (20 points)

a) *State the two intermediate targets and the three final targets of monetary policy. Which of the three final targets is the main target for most central banks?*

b) *Use the quantity theory of money and the quantity equation to derive analytically the effect of increasing the money growth rate from 2 percent to 3 percent.*

c) *Use the AD-AS framework to discuss the short-run and long-run effects of a contraction in money supply on output and the price level.*

Answers to question 3

Part a)

intermediate targets:

1. money supply
2. interest rates

long-run targets:

1. inflation
2. output
3. employment

Most central banks focus on inflation (*inflation-targeting*)

Part b)

definition of variables:

- M money supply
- V velocity
- P price level

- Y real output

quantity equation:

- in levels: $M\ V = P\ Y$
- in growth rates: $\frac{\Delta M}{M} + \frac{\Delta V}{V} = \frac{\Delta P}{P} + \frac{\Delta Y}{Y}$

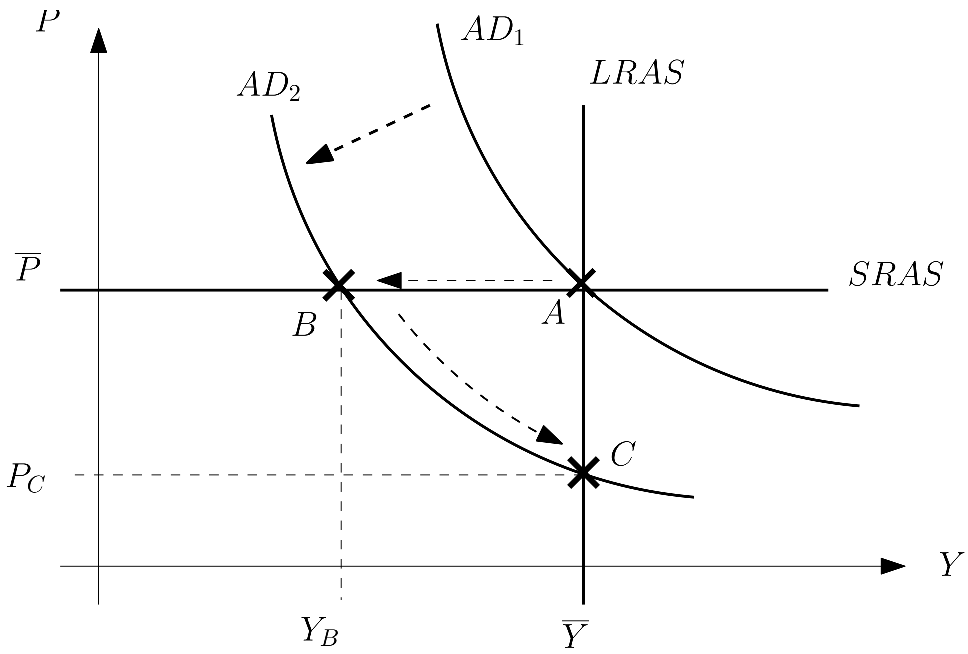
quantity theory: quantity equation + two assumptions

1. $\frac{\Delta V}{V} = 0$
2. $\frac{\Delta Y}{Y}$ exogenously determined (by the real economy)

$\Rightarrow$ increasing $\frac{\Delta M}{M}$ from 2 to 3 percent implies $\frac{\Delta P}{P}$ increases by 1 percentage point (note: $\frac{\Delta Y}{Y}$ can be different from 0)

Part c)

- Definition of variables
  - $\Delta M < 0$: contraction in money supply
  - Y: aggregate output
  - P: aggregate price level
  - AD: aggregate demand
  - $LRAS$, $SRAS$: long- / short-run aggregate supply
- $\Delta M < 0 \Rightarrow$ consumers have less money to spend, because prices fixed at $\bar{P}$ in the short-run $\Rightarrow$ will demand less $\Rightarrow$ AD shifts to the left



- output adjusts to demand: $Y \downarrow$ from $\bar{Y}$ to Y_B
- In point B: downward pressure on wages, because higher unemployment
- Lower wages $\rightarrow$ lower P $\rightarrow$ agents can spend more than expected $\rightarrow$ $Y \uparrow$
- wage-price spiral until Y reaches $\bar{Y}$ and P reaches P_C
- Point C: new long-run and short-run equilibrium (no more pressure on prices)

Question 4 (20 points)

Consider the classical model of the labor market and assume that workers have to pay a labor income tax that is proportional to their labor income.

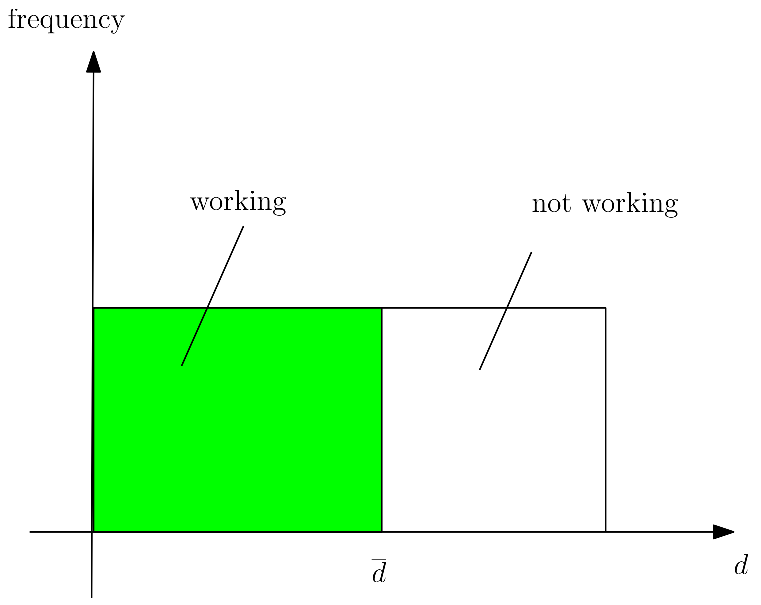
a) Discuss formally how a reduction in the labor income tax affects the individual and aggregate labor supply. Provide a diagram supporting your answer.

b) Use your result derived in a) to discuss how a reduction in the labor income tax affects the real wage and employment according to the classical model of the labor market.

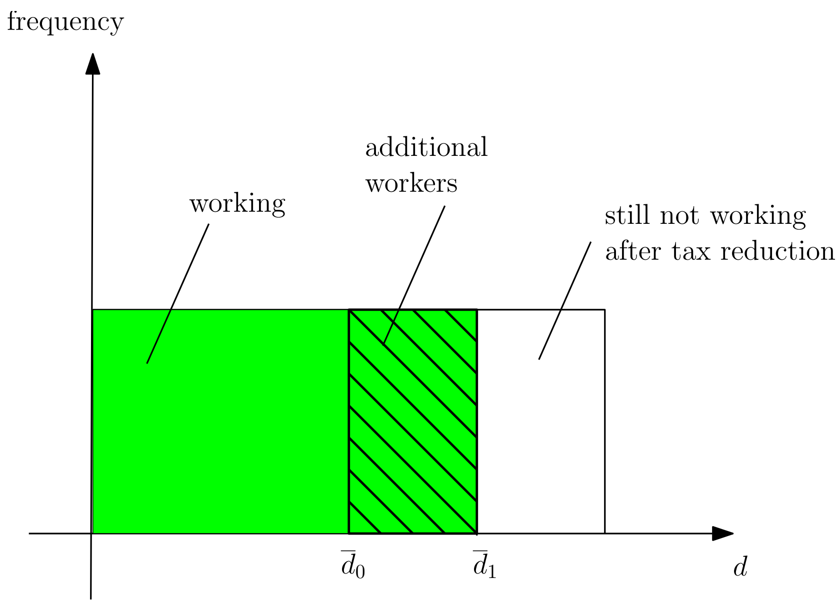
Answers to question 4

Part a)

- Definition of variables
  - $u(\cdot)$: utility
  - n: hours worked, fix at $n = 1$
  - w: wage
  - d: disutility from working
  - τ: tax rate
  - b: benefits when not working
  - indeces 0 and 1 refer to before and after tax reduction
- if $u\left(nw(1-\tau)\right) - d > u(b)$ worker chooses to work,
  if $u\left(nw(1-\tau)\right) - d \leq u(b)$ he chooses not to work
- Assume a uniform distribution over d



- workers with $\bar{d}$ are indifferent $\quad\Leftrightarrow\quad \bar{d} = u\left(w(1-\tau)\right) - u(b)$
- if $\tau \downarrow$ then $u\left(w(1-\tau)\right) \uparrow \quad\Rightarrow\quad \bar{d}\uparrow$, because all else remains constant (c.p.)



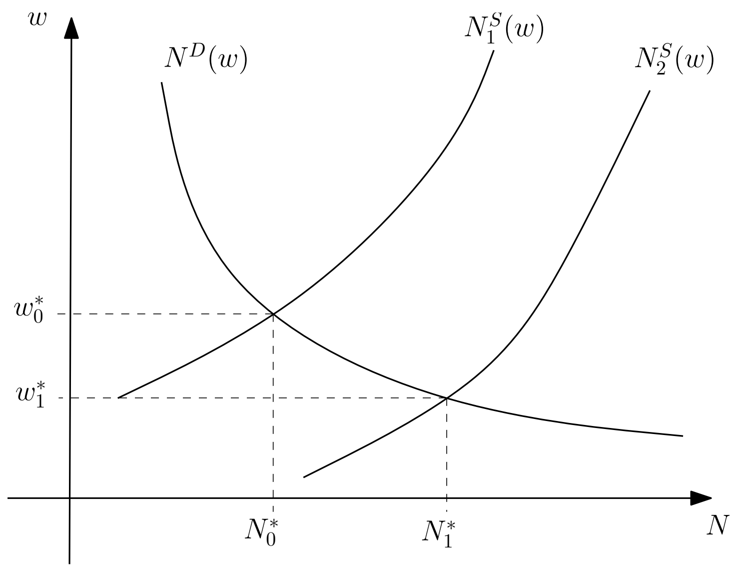
- Results: $\bar{d}_0$ increases to $\bar{d}_1 \;\Rightarrow\;$ more workers decide to work $\;\Rightarrow\;$ aggregate labor supply $\uparrow$

Part b)

- Definition of variables

- $N^S(w)$: aggregate labor supply
- $N^D(w)$: aggregate labor demand
- N^* , w^*: equilibrium employment / wage

- From a) we have that for every given w, $N^S \uparrow$ if $\tau \downarrow \;\; \Rightarrow \; N^S(w)$ shifts to the right
- Profits of the firm are unaffected by $\tau \; \Rightarrow \; N^D$ unchanged



- Results: When $\tau \downarrow$ then $N^* \uparrow$ and $w^* \downarrow$

Question 5 (20 points)

Consider the two-period Fisher-Model of inter-temporal consumption. Assume that there are no taxes. Second-period labor income is zero (retirement), but the government provides the household with a retirement benefit, B, in the second period. The utility function is $U(c_1, c_2) = u(c_1) + \beta u(c_2)$, where $\beta < 1$ is the discount factor of the individual household.

a) *Derive formally a condition that ensures perfect consumption smoothing, that is, a condition that implies that first-period consumption equals second-period consumption. Provide a diagram supporting your answer.*

b) *Discuss how an increase in retirement benefits affects private saving.*

c) *Use your result derived in b) and the closed-economy saving-and-investment model to discuss the effect of an increase in retirement benefits on the real interest rate and investment.*

Answers to question 5

Part a)

definition of variables:

- C_1, C_2 consumption in period 1 and 2
- Y_1 income in period 1
- B retirement benefit
- r real interest rate

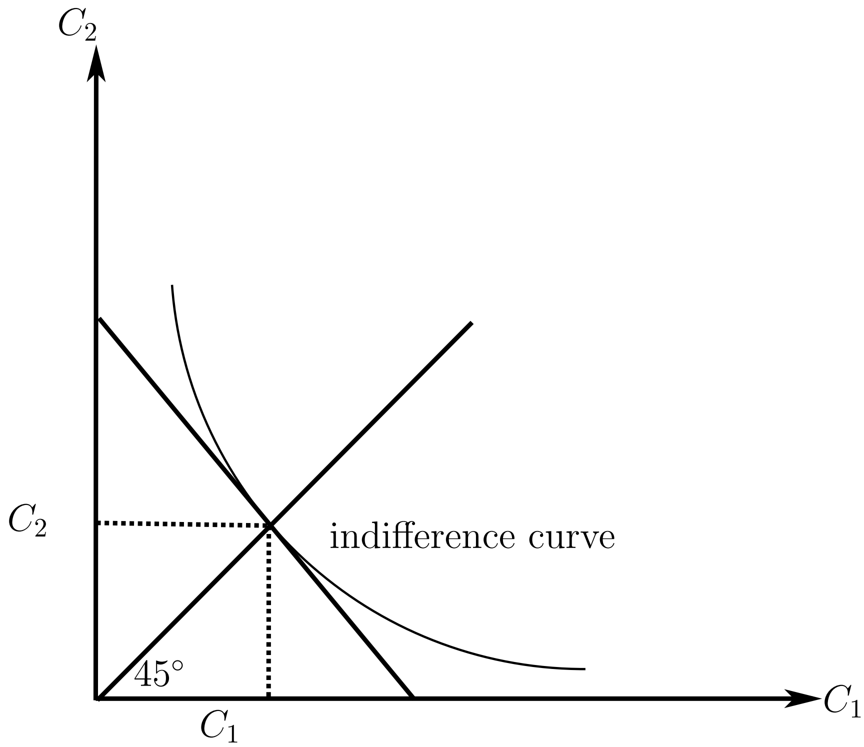
optimization problem:

$$\max_{\{C_1,C2\}} \{u(C_1) + \beta\ u(C_2)\}$$

$$\text{subject to} \qquad C_1 + \frac{C_2}{1+r} = Y_1 + \frac{B}{1+r}$$

solve budget constraint for C_2 and substitute into objective function

$$\max_{\{C_1\}} \{u(C_1) + \beta\ u((1+r)\ (Y_1 - C_1) + B)\}$$



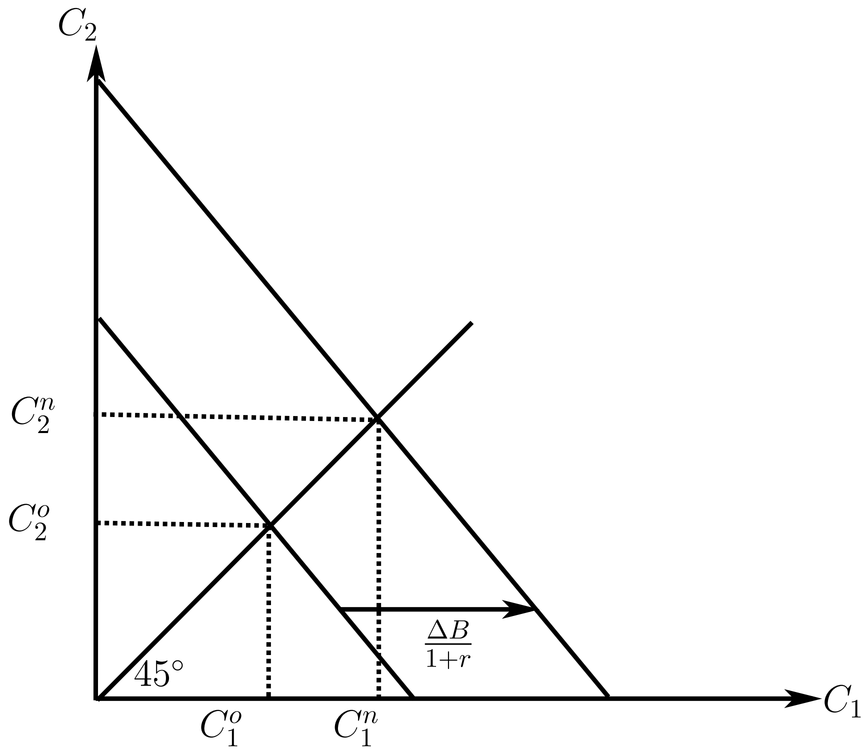
$\Rightarrow$ the first-order condition of this optimization problem is

$$\frac{\partial u(C_1)}{\partial C_1} - \beta\ (1+r)\ \frac{\partial u(C_2)}{\partial C_2} = 0$$

$\Rightarrow$ consumption smoothing means $C_1 = C_2 \Leftrightarrow \frac{\partial u(C_1)}{\partial C_1} = \frac{\partial u(C_2)}{\partial C_2}$
$\Rightarrow$ perfect consumption smoothing thus requires $\beta\ (1+r) = 1$

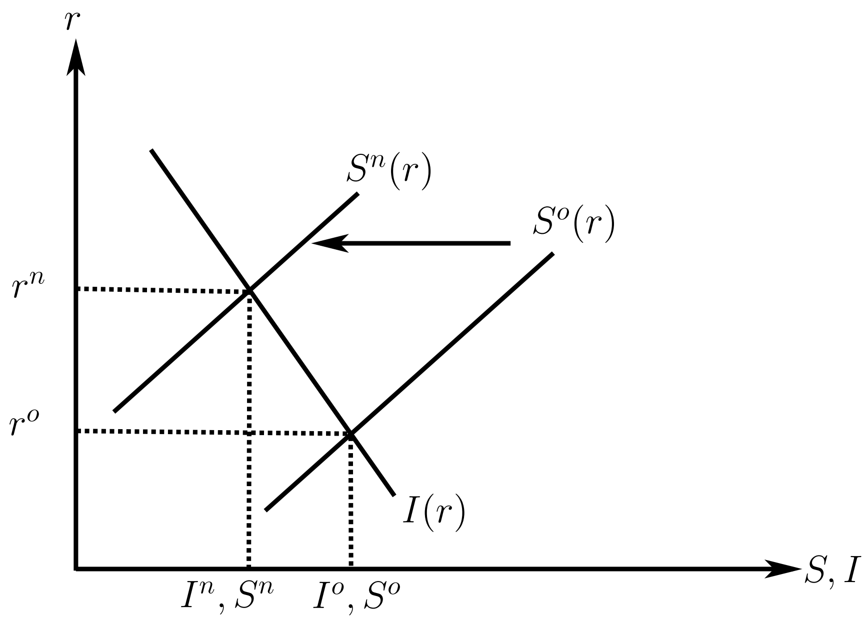
Part b)

if $B \uparrow$, the budget constraint moves outwards
$\Rightarrow$ C_1 and C_2 increase
$\Rightarrow$ since $S = Y_1 - C_1$, private saving decreases



Part c)

private saving decreases
⇒ national saving decreases and $S(r)$-curve shifts to the left
⇒ for r^o, demand for credit is higher than supply of credit
⇒ the price for credit r increases
⇒ equilibrium $S,\ I$ decrease


r
$S^n(r)$
$S^o(r)$
r^n
r^o
$I(r)$
S, I
I^n, S^n
I^o, S^o