Answers manual – SØK2011 Spring 2022

Disclaimer: This document is a possible way to answer the questions, in some cases other type answer can be correct.
The points for each question are indications and might be subject to marginal changes.

Task 1 – 40 points

Part A – 20 points

1. 5 points

Before tax, equilibrium:
P*=4

10 – X = 4 ⇔ $X* = 6$
After tax: P*=10 – X = 4 + (4 x 0.2) = 4.8

10 – X = 4.8 ⇔ $X* = 5.2$
Tax revenue: t x quantity = 0.8 x 5.2 = 4.16 where t is tax per unit
Size of deadweight loss = $\frac{t\,\Delta X}{2} = \frac{0.8\,(6-5.2)}{2} = \frac{0.8 \times 0.8}{2} = 0.32$

2. 5 points

After tax of 10% on good X: P*=10 – X = 4 + (4 x 0.1) = 4.4

10 – X = 4.4 ⇔ $X* = 5.6$
Tax revenue from item X: t x quantity of X = 0.4 x 5.6 = 2.24

For item Y, equilibrium before tax:

P*=20 – Y = 4 ⇔ $Y* = 16$
After tax of 10% on good Y: P*=20 –Y = 4 + (4 x 0.1) = 4.4

20 – Y = 4.4 ⇔ $Y* = 15.6$

Tax revenue from item Y: t x quantity of Y= 0.4 x 15.6 = 6.24
Total tax revenue = tax revenue from item X + tax revenue from item Y = 2.24 + 6.24 = 8.48

3. 5 points

Size of deadweight loss for 10% tax on good X = $\frac{t\,\Delta X}{2} = \frac{0.4\,(6-5.6)}{2} = 0.08$

Size of deadweight loss for 10% tax on good Y = $\frac{t\,\Delta Y}{2} = \frac{0.4\,(16-15.6)}{2} = 0.08$
Total deadweight loss = 0.08 + 0.08 = 0.16

4. 5 points

Tax revenues are higher when taxing both goods than when taxing only good X (8.48 > 4.16)
The deadweight loss is higher in the case where tax of 20% on good X than when taxing the two goods at 10% (0.32 > 0.16), so from efficiency point of view, taxation of both goods better.
The question is about efficiency so it is expected that they have a conclusion related to the magnitude of the deadweight loss.

Part B – 20 points

The rule the government can follow to design an optimal taxation of two goods is the Ramsey rule. The optimality of the Ramsey rule must be discussed: it is minimizing the deadweight loss associated to the taxation system. A good answer discusses the inverse elasticity rule.
Possible considerations not taken into account in this rule:

- equity considerations
- opportunities for tax evasion
- high cost of having different tax rates for several goods

Task 2 – 20 points

For i={0,1}, I_i is income in period i; c_i is consumption in period i; S are the savings, r is the interest rate

1. 10 points

Budget constraint:

Period 0: $I_0 = c_0 + S \Leftrightarrow$ 20,000 = $c_0 + S$
$\Rightarrow S = 20{,}000 - c_0$

Period 1: $I_1 + (1+r)S = c_1 \Leftrightarrow$ 15,000 + 1.2S = $c_0 + S$
Combining the two periods by introducing S in period 1 equation:

$15{,}000 + 1.2(20{,}000 - c_0) = C_1 \Leftrightarrow$ 39,000 - 1.2 c_0 = c_1
The problem is:

$$\text{Max } \mathrm{U}(\mathrm{c}_0, \mathrm{c}_1) = \mathrm{c}_0^{0.8}\mathrm{c}_1^{0.2}$$
$$\text{sc } \mathrm{c}_1 = 39{,}000 - 1.2\ \mathrm{c}_0$$

Lagrange function:

$$L = \mathrm{c}_0^{0.8}\mathrm{c}_1^{0.2} - \lambda(\mathrm{c}_1 + 1.2\ \mathrm{c}_0 - 39{,}000)$$

First order conditions of Lagrange function:

$$\frac{\partial L}{\partial c_0} = 0.8\mathrm{c}_0^{-0.2}\mathrm{c}_1^{0.2} - 1.2\lambda = 0 \Rightarrow \lambda = -\frac{0.8\mathrm{c}_0^{-0.2}\mathrm{c}_1^{0.2}}{1.2} \qquad (1)$$

$$\frac{\partial L}{\partial c_1} = 0.2\mathrm{c}_0^{0.8}\mathrm{c}_1^{-0.8} - \lambda = 0 \Rightarrow \lambda = -0.2\mathrm{c}_0^{0.8}\mathrm{c}_1^{-0.8} \qquad (2)$$

$$\frac{\partial L}{\partial \lambda} = 0 \Rightarrow 39{,}000 - 1.2\ \mathrm{c}_0 = \mathrm{c}_1 \qquad (3)$$

From (1) and (2):

$$-\frac{0.8c_0^{-0.2}c_1^{0.2}}{1.2} = -0.2c_0^{0.8}c_1^{-0.8}$$

$$\Rightarrow\ c_1 = \frac{3}{10}c_0$$

We replace in (3):

$$\Rightarrow 39{,}000 - 1.2\,c_0 = \frac{3}{10}c_0$$

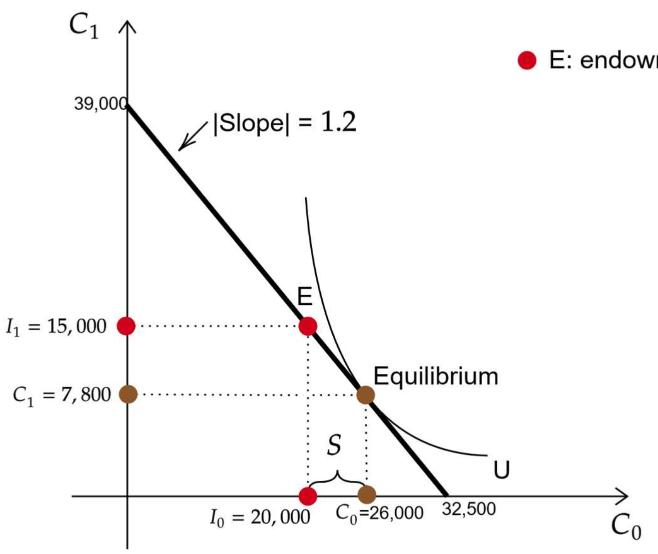
$$\Rightarrow c_0 = 26{,}000$$

Then we get $c_1 = 7{,}800$

S = 20,000 – 26,000 = - 6,000

The individual is borrowing in the first period.

Graphically:



2. 7 points

The consumption does not change as the interest rate for the National insurance scheme is the same as the bank's one.

Given that the forced saving is 200 and previous overall saving was -6,000, the private saving is now -6,000-200=-6,200.

3. 6 points

Possible reasons mentioned in lecture:

- Adverse selection
- Moral hazard

- Limited rationality
- Administrative costs
- Income redistribution

The reason needs to be explained.

Task 3 – 30 points

1. 4 points

B = 800 – 0.5E where B: benefit and E: earnings

2. 2 points

For earnings equal to $1,000, applying the above formula:

$B_{E=1000}$ = 800 – 0.5x1,000 = 300

3. 4 points

B > 0 ⇔ 800 – 0.5E > 0

⇔ 1,600 > E

An individual can earn up to $1,600.

4. 20 points

The question is to be answered using the model presented in chapter 13 of the textbook. The model consists of four equations:

Benefit: B=G−tE

Total revenue: EB=E+B

Income before benefits: E=w(T−F) where w is the wage rate, T the total amount of time available and F the amount of time for leisure

Individual preferences: U=U(EB,F)

The equations of the model must be presented and explained. The individual's trade-off between income and leisure time must be explained. Equilibrium without social assistance is to be explained first. It is important to explain how the budget condition changes with the introduction of social assistance. Equilibrium with social assistance should then distinguish between two cases: i) Equilibrium in the part of the budget condition that changes when benefits are introduced: the benefits reduced labor supply and increases leisure; ii) Equilibrium in the part of the budget condition that does not change when benefits are introduced.

Good answers can also discuss the special case where benefits are reduced one-on-one with an increase in income.

Task 4 – 10 points

1. 4 points

Maximize function: $\sqrt{I_J} + 2 \times \sqrt{I_L}$

We have: $I_J = 10{,}000 - I_L$. We replace and obtain:

Maximize: $\sqrt{10{,}000 - I_L} + 2 \times \sqrt{I_L}$

The maximum is obtained when the derivate of this function is equal to zero, i.e.:

$$-\frac{1}{2\sqrt{10{,}000 - I_L}} + \frac{1}{\sqrt{I_J}} = 0$$

$$\Leftrightarrow 10{,}000 - I_L = \frac{1}{4} I_L$$

$$\Leftrightarrow 8{,}000 = I_{\mathrm{L}}$$

Then we get $I_J = 10{,}000 - 8{,}000 = 2{,}000$

2. 6 points

See definitions of the functions in the slides of the lectures.

Implicitly the additive welfare function is giving the same weight to the utility of all the individuals, not the case for maximin criterion: giving more weight to the one with the least.