

i Candidate instructions**ECON3620/4620 - Public Economics I**

This is some important information about the written exam in ECON3620/4620. Please read this carefully before you start answering the exam.

Date of exam: May 6

Time for exam: 9:00 AM

The problem set: The problem set consists of 3 problems. The weights are 25%, 35% and 40% for problem 1, 2 and 3, respectively.

Sketches: You may use sketches on all questions. You are to use the sketching sheets handed to you. You can use more than one sketching sheet per question. See instructions for filling in sketching sheets below. It is very important that you make sure to allocate time to fill in the headings (the code for each problem, candidate number, course code, date etc.) on the sheets that you will use to add to your answer. You will find the code for each problem under the problem text. You will NOT be given extra time to fill out the "general information" on the sketching.

Access: You will not have access to your exam right after submission. The reason is that the sketches with equations and graphs must be scanned in to your exam. You will get access to your exam within 2-3 days.

Resources allowed: No written or printed resources - or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences).

Grading: The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

Grades are given: Monday, May 27

1 Problem 1 - 25%

1a. Explain two economic distortions from a standard corporate income tax, such as the one in place in Norway.

1b. Some argue that countries should implement an allowance for corporate equity (ACE) system, where the idea is to make equity investment costs deductible. What would you argue are the main benefits and drawbacks with that proposal?

Fill in your answer here and/or on sketching paper

The Standard Corporate Income tax typically allows for the deductions of interest costs on debt for the corporate tax base, but not on equity invested in the business. This causes two main distortions: investments and in financing decisions. For financing, it favours debt as the inclusion of interest costs of debts can be deducted from the tax base, thus reducing the total corporate tax base. This means that using debt instead of equity is cheaper as the costs associated with debt is deducted. The cost associated with investing equity in a business is the alternative cost for investing equity in some other assets, for instance risk-free government bonds. This would have paid a guaranteed interest i to the investor. Investing in a business means he won't get this interest rate on his capital from another asset. This alternative cost is, however, not deductible under the CIT system.

For investments, not being able to deduct an interest rate on equity, makes the rental cost of capital go up compared to other places the investor could invest their equity, as already mentioned. Allowing for the deduction of interest on equity is similar to allowing for the alternative cost on capital. If this is allowed to be deducted, the required return on capital goes down (same as capital cost), and the investor investing her capital will be indifferent between investing in the business or in other assets. Since the business can't deduct this, they have to raise a higher amount of investments, and if this is done through capital, the amount they have to raise is then higher than what it would have been without the tax. More shares needed to be issued means lower marginal profit per share. The pay-off from the equity investor is then lowered. In sum this means that the investor would invest less in a business and more in another asset because the return to equity is lower in the business.

b.

Benefits: There would be increased equity investments in business as the cost of capital is now equal to the alternative cost of putting it elsewhere. It would ideally also make the business indifferent between debt and equity financing, whereas the incentives for debt financing were strong earlier.

Drawbacks: This would at the same time make the tax base for corporate income smaller. If the government revenue requirement is set, this would mean that they either would have to increase the corporate tax rate to reach the same tax revenue as before, or increase taxes in other parts of the economy, such as consumption taxes.

Another drawback is that it could lead to debt shifting if the implementation of ACE is not international. A Multinational corporation would have incentives to move their equity to the country that has the ACE, since the price of capital is lower there, while they would move their debt to the countries that still have the CIT.

Besvart.

Knytte håndtegninger til denne oppgaven?

Bruk følgende kode:

0 5 5 4 3 5 5

Problem 2 - 35%

Suppose individuals work l hours to generate income wl and are then taxed according to a flat income tax t . Individuals shift part of their income e to tax havens. The budget constraint for the individual is $c = wl - t(wl - e)$. Both work and tax evasion are costly for the individuals (the latter in terms of money they pay for lawyers). The evasion cost is a convex function $k(e)$ in income evaded. Tax revenue to the government is equal to $t(wl - e)$.

2a. How much does an individual receive from working one hour more (holding tax evasion constant)? How much does society in total receive when an individual works one hour more?

2b. When the individual has set the optimal hours of work and amount of tax evasion, what is the utility change for the individual for a small increase in tax evasion? What individual *gain* must the increase in the evasion cost ($k(e)$) be equal to for this to be the case?

2c. Show, by setting up the change in social efficiency, that the change in *tax revenue* provides a monetary measure of the *marginal social efficiency effect* of a small increase in tax evasion.

Fill in your answer here and/or on sketching paper

2a) In this model the consumer does not receive a direct transfer from the tax he has paid. He spends all his income on consumption such that $c=z$. A change in working one more hour is usually seen by setting up the income function and then differentiating with regards to l , but here it is sufficient to differentiating the cost function directly. The derivation is on the paper.

Result for individual is $= w(1-t)$

Result for the society is $= w$

The gain for society is value of the individuals working one hour more.

2b) Calculations on paper. The consumer gets to consume the extra amount which equals the amount of tax reduction from evading one krone. The reason he doesn't get to consume the whole krone evaded is because the evasion comes with a cost. If the evasion cost equals the tax, the individuals would be indifferent between evasion and taxation and the change in utility is zero.

This is possible because of the use of the envelope theorem, which says that when we are in the optimum, a marginal change in one of the variables (evasion) only changes the direct effects, our behaviour towards the other variables, such as consumption, is not effected because the change is so small.

However, the cost of evasion is convex in income evaded, meaning that there is diminishing rate of costs to increased evasion, the more you evade, the less cost per evaded krone. If we hadn't been in optimum and the individuals had started to evade more, we might have it so $t > k'(e)$ and that would mean they would evade more, maybe everything.

2c)

Calculations on paper.

It shows that for a marginal change, the change in social efficiency is equal to the change in tax revenue. This is possible because of the use of the envelope theorem, which says that when we are in the optimum, a marginal change in one of the variables only changes the direct effect, our behaviour towards the other variables doesn't need to be re-optimized because we already have optimized and the change is so small.

Result for tax revenue change $= -t$

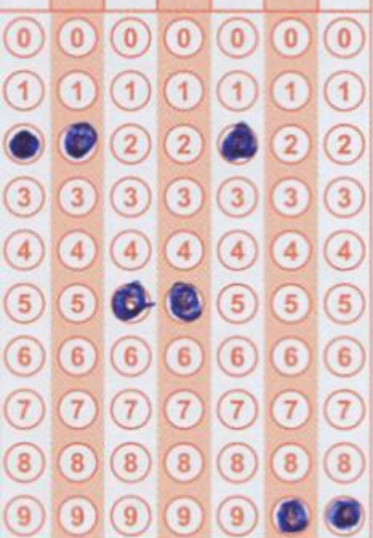
Besvart.

Knytte håndtegninger til denne oppgaven?

2 2 5 5 2 9 9

Bruk følgende kode:

| Oppgavekode Question code | Dato Date | Emnekode Subject code | Kandidatnummer Candidate number | Oppgavenummer Question number | Sidetail Page number |
|------------------------------|--------------|--------------------------|------------------------------------|----------------------------------|-------------------------|
| 2255299 | 6.05.19 | ECON4620 | 17171 | 2 | 1 |



2a)

Tegneområde Drawing area

$C = z$ for the individual

$$\frac{\partial z}{\partial l} = w - tw \Rightarrow \frac{1}{2} w(1-t)$$

$$\frac{\partial g_w}{\partial l} = tw$$

for society the society receives $R - c$. Since now we're taking from an individual giving it to society, but the individual is also part of the society.

$$\Delta S = \Delta g_w + \Delta C \Rightarrow tw + w - tw = w$$

2b) the maximization problem =

$$U(c, l, e) = \lambda (w - t(w - e) - c) + \mu (k(e) \leq 0)$$

where $U'(c) > 0$ $U'(l) < 0$ $U'(e) < 0$ and

$$\cancel{U'(l)} \quad k'(e) > 0 \quad k''(e) > 0$$

$$2b \text{ cont.}) \quad \frac{\partial U}{\partial e} = t > 0 \Leftrightarrow \text{not important}$$

if he is in optimum = $U(c^*, l^*, e^*)$

$$\frac{\partial U}{\partial e^*} = -\lambda t + \mu k'(e) \Rightarrow \lambda t = \mu k'(e)$$

Assume that $\lambda = \mu$ in optimum.

This means that $t = k'(e)$

which means that $\frac{\partial U}{\partial e^*} = 0$

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| 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 | 9 | 9 | 9 |

Tegneområde Drawing area

2c)

$$\Delta \text{Social marginal efficiency} = \Delta \text{gov} - \Delta \text{consumers.}$$

I have just shown that the change to consumers in optimum = 0.

Thus the $\Delta \text{SME} = \Delta \text{gov}$

$$\text{gov} = t(wl - e)$$

$$\frac{\delta \text{gov}}{\delta e} = -t$$

$$\Delta \text{SME} = -t$$

Problem 3 - 40%

Consider an economy with one representative individual with wage w . The individual works l number of hours and consumes h units of holiday travel and x units of all other goods. Total pre-tax income is wl .

The individual maximizes the utility function $U(h, x, l)$ subject to the budget constraint $(1 + \tau_h)p_h h + (1 + \tau_x)p_x x = wl - T(\cdot)$, where p_h, τ_h and p_x, τ_x are prices and commodity taxes for holiday travel and other goods, respectively. $T(\cdot)$ is a non-linear tax.

The government maximizes a social welfare function $W = U(h, x, l)$ such that it raises the required revenue $R = \tau_h h + \tau_x x + T(\cdot)$.

3a. Assume first that the government can only tax goods (τ_h and τ_x) and nothing else ($T(\cdot) = 0$). Explain how the government *implicitly* taxes income (wl) by using commodity taxes.

3b. What is the one key piece of information you need to decide whether commodity taxation should be uniform or differentiated when the non-linear tax is unavailable?

Instead of one representative individual, assume now that there are 10 individuals in the economy with different types/wages w_i , and thereby allocations h_i, x_i, l_i . They all maximize the same utility function subject to their budget constraints. The government maximizes a utilitarian social welfare function

$$W = \sum_{i=1}^{10} U(h_i, x_i, l_i).$$

3c. Assume first that the government can *observe* each individual's type w and set type-specific taxes $T(w)$. What is now the optimal level of commodity taxes (τ_h and τ_x) when $T(w)$ is set optimally?

In the following, the government cannot observe types, so the non-linear tax can only be a function of income, wl (and not w directly): $T(wl)$.

3d. Explain why taxation may be distortionary when types are unobservable to the government.

3e. What is the one key piece of information you need to decide the level of commodity taxes (τ_h and τ_x) when the non-linear income tax ($T(wl)$) is set optimally? Explain.

Fill in your answer here and/or on sketching paper

a) An implicit tax, such as the taxation of goods that we have here, is defined by being an anonymous tax on behaviour, not on personal characteristics. Your total tax burden when there is no income taxes, is then decided by the goods you consume. However, in a situation in the Ramsey framework, a uniform tax on commodity is the same as taxing income, which is only possible to say since we assume that the agent spends all her disposable income on consumption of the goods, and that all goods are taxed. If not, the agent would have incentives to shift her consumption towards the good that is untaxed, in a C

b) the key piece of information is to know the cross elasticity towards an untaxed good, often assumed to be leisure. In a Corlett-Hague model, the good that is to be highest taxed is the good that is complementary with leisure, because otherwise the agent would have incentives to shift her behaviour towards the untaxed good.

Also, if the agents are heterogenous, you would tax the good that were more preferred by the high type.

c) If you can set non-linear taxes that are optimized for all different types, the taxes on goods are not needed, since these are creating distortions in the market. A tax will create a wedge between the MRS and the MRT, meaning that there are trade deals that will not go through, and both the seller and buyer could have been better off without the tax.

d) I assume that the question is asking why income taxes may be distortary.

Earlier, we are given information that all of the types have the same utility function. In a Mirrless model, we would ideally like to set non-linear income taxes. The main challenge for the government, however, is that they can't observe the different types' abilities. This is the main assumption for the Mirrless model: there is asymmetric information because of this non-visible ability.

I choose to explain this through the two-type example of the Mirrless model.

The high type is bounded by the self-selection constraint. This means that he can self select into the low type group, where he consumes the low-type amount and works the low-type amount of hours, or he can choose his own high type bundle, where he consumes more and works more. Given that the utility functions are the same for the high and low type, the high type can consume the same as the low type, but he needs to work a smaller amount of hours due to his higher ability, meaning he is more efficient. He thus have the same consumption as the low type, but more leisure. This is not optimal for the government, considering they ideally want the efficient to work more so they can also tax them more. For the low type amount of income, they than have to put a tax on the marginal income so that the consumption level for that amount of income goes slightly down.

This is the main result in the Mirrlees. By having a marginal tax of $T(L) > 0$, the government distorts the labour supply of the low type, so that the low type can afford less consumption. For the high type, the marginal tax is $T(H) = 0$. If the high type was mimicking, he then sees that he can work more and then reach a higher consumption. The non-taxation of the last income krone for the high type increases his utility.

The conclusion is this: If the marginal tax on the high type is above 0, he will have incentives to mimick the low type, which is the same as distorting the labour supply for the high type. His labour supply is now distorted towards leisure, which in the traditional Mirrless model is untaxed. This results in both an efficiency loss for the economy in total since the efficient type doesn't work as much as he could, and it also leads to less tax revenue on goods since both the types now consume the low type amount.

e)

the key piece of information needed is to know what the utility function for the types look like. We have already assumed that it is equal for all types. If the utility function is separable in the two goods, here consumption and leisure, the use of commodity taxes is redundant since it won't give any information to the government of the abilities of the types. This is the Atkinson-Stiglitz result.

If the separable utility assumption does not hold, the result would be to tax the good that is complementary with leisure since this is the only thing in which the two types differ. Taxing the leisure will make the marginal utility of labour compared to marginal disutility of leisure go down, meaning he will work more.

Besvart.

Knytte håndtegninger til denne oppgaven?

4 1 0 7 5 4 7

