University of Freiburg
Institut für Finanzwissenschaft II
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Exam in International Taxation and Tax Competition

Date:	2 August 2010
Room:	1199
Permitted Aids:	English Dictionary
Examiner:	Prof. Dr. Wolfgang Eggert

Please answer completely **two** out of the following three questions. If you answer more than two questions, only your first two answers are evaluated. Read all the questions carefully and completely before beginning the exam. Please write clearly and legibly.

Each question is worth a maximum of 24 points; point values to the questions are shown. There are a total of 48 points possible. The exam is passed when at minimum 48/2=24 points are obtained.

There is space for your answers on pages 5-12. Please do not open the staple of this exam!

Question 1: The Basic Tax Competition Model

Consider a static model of a small open economy which is linked to a market for internationally mobile capital. The economy is characterized by a continuum of immobile households and firms. Households are endowed with s units of capital and l units of labor. Capital is invested on the international market. Denote the international return to capital by r. Profit-maximizing firms produce a homogeneous good using a constant returns to scale technology. Assume the government chooses the rate of a *unit* tax on wages t^w and the rate of a *unit* source-based capital tax on the firm level t^s to cover the costs for a public good. With these taxes the public budget constraint is $g = t^w l + t^s k$, where g is the provision level of a public good. Let $f(k, l)$ be the constant returns to scale production function. Denote preferences by $U(c, g)$. All markets are perfectly competitive.

a) Set up the problem of the firms and derive the first-order condition for profit maximizing capital demand. Explain this condition verbally. Use a simple raph to illustrate rents in this economy. (Hint: $wl = f(k, l) - (R + t^s)k$.) **4 Points**

b) Assume that the government chooses tax rates to maximize the utility of the representative individual. Write down the government problem and first-oder conditions. (Hint: use the private and the public budget constraint to substitute out for c and g in the direct utility function.) **6 Points**

c) Characterize government choice of taxes in the case where wage taxation suffices to cover the costs for public good provision. **4 Points**

d) Characterize government choice of taxes in the case where the yield from wage taxation does not cover the costs of public good provision. Discuss the economic mechanisms behind your results both verbally and by use of a simple graph. **6 Points**

e) Consider the following model extension. Assume capital investment of firms causes (crowding) costs given by the function $p(k)$ where $p'(k), p''(k) > 0$. Let $U(c, g) - p(k)$ denote utility. Determine the welfare maximizing level of t^w and t^s. Give a verbal explanation for your results. **4 Points**

Question 2: Optimal Taxation in an Open Economy

Consider the *two-period* model of a small open economy. Households obtain a capital good at the beginning of the first period and choose how much they consume. The remainder is then invested on the international capital market using banks as financial intermediaries. The international return to capital is R. In the second period, households supply labor and profit-maximizing firms produce a homogeneous good. Assume the government chooses tax rates on wages t^w, a source-based tax on the firm level t^s and a residence-based tax on savings t^r to cover the costs for a public good. With *unit* taxes the public budget constraint is $g = t^w l + t^s k + t^r s$, where g is the provision level of a public good, s is savings and k, l is capital and labor demand, respectively. Let $f(k,l)$ be the constant returns to scale production function. Denote by r the gross return to capital, preferences by $U(c_1, c_2, l) + \tilde{U}(g)$, indirect utility by v, the net wage by ω, the gross wage by w and the net interest rate by ϱ. All markets are perfectly competitive.

a) Assume the government sets taxes to maximize utility of the representative agent. Set up the government problem and derive the first-order conditions for the policy choices. **8 Points**

Hint ($\mathcal{L}$ is the Lagrangean, λ is the Lagrange parameter):

$$\frac{\partial \mathcal{L}}{\partial t^w} = -\frac{\partial v}{\partial \omega} + \lambda \left[l + \ldots \right] = 0,$$
$$\frac{\partial \mathcal{L}}{\partial t^r} = -\frac{\partial v}{\partial \varrho} + \lambda \left[s + \ldots \right] = 0,$$
$$\frac{\partial \mathcal{L}}{\partial t^s} = \frac{\partial w}{\partial r}\frac{\partial v}{\partial \omega} + \lambda \left[-l\frac{\partial w}{\partial r} - t^s l \frac{\partial^2 w}{\partial r^2} + t^w \frac{\partial w}{\partial r}\frac{\partial l}{\partial \omega} - t^s \frac{\partial w}{\partial r}\frac{\partial w}{\partial r}\frac{\partial l}{\partial \omega} + t^r \frac{\partial w}{\partial r}\frac{\partial s}{\partial \omega} \right] = 0.$$

b) Use Roy's identity in the first-order conditions to derive optimal tax rates in two scenarios: (1) the government can only use t^w, t^s; (2) the government can choose t^w, t^r, t^s simultaneously. **8 Points**

c) Discuss verbally or formally the view that the efficiency argument for $t^s = 0$ is independent of distributional considerations. Then, contrast the case where $t^s = 0$ with a taxing scenario in which $t^s > 0$ because of efficiency considerations. Which of the taxes, t^w or t^r, must not be available to obtain $t^s > 0$ in the optimum? **8 Points**

Question 3: The Effects of Capital Taxation on Production

Consider a world which consists of two identical economies $i = 1, 2$ which are linked through perfect capital mobility. Production in both countries is characterized by the production function

$$Y_i = \log(K_i) \qquad \text{for all } i = 1, 2,$$

where $\log(\cdot)$ is the natural logarithm and K_i is capital investment (Hint: $\partial \log(K_i)/\partial K_i = 1/K_i$). In each economy exists a representative household which is endowed with $\overline{K}_i$ units of a capital good. In the presence of capital mobility capital market clearing requires that, in any equilibrium, the world capital endowment must equal world capital demand by firms, i.e. $\sum_i \overline{K}_i = \sum_i K_i$. The government in each country chooses the rate of a source tax t_i^s. Output and factor markets are characterized by perfect competition.

a) Set up the problem of the firm in both countries. Denote the world interest rate by R and derive the no-arbitrage condition which determines the allocation of capital across countries. Give a verbal explanation (and an illustration) of your results. **6 Points**

b) Determine the world interest rate $R(t_1^s, t_2^s, \overline{K}_1, \overline{K}_2)$. Give a verbal and formal explanation for the curvature of the $R(t_1^s, t_2^s)$ function in the R, t_1^s space. **6 Points**

c) Derive the capital demand functions of firms $K_i(t_1^s, t_2^s)$ and determine capital demand in three situations. (1) When $t_1^s = t_2^s = 0$ and $\overline{K}_1 = \overline{K}_2 = 2$. (2) When $t_1^s = 0, t_2^s = 0.5$ and $\overline{K}_1 = \overline{K}_2 = 2$. (3) When $t_1^s = t_2^s = 0.5$ and $\overline{K}_1 = \overline{K}_2 = 2$. Which case gives the highest level of production in country 1 and in which case(s) is world production, $\sum_i Y_i$, maximized? Explain your results verbally and use a graph to illustrate your points. **6 Points**

d) Assume the government in each country chooses t_i^s to maximize *domestic production*. Show that $t_1^s = 0, t_2^s = 0$ is a Nash equilibrium. Are there more, if so then explain why? **6 Points**