Econ4622 autumn 2014. Guidelines for marking.

Problem 1 sketch of answer

See Haufler, Andreas (2001). Taxation in a global economy. Cambridge: Cambridge University Press, selected parts: pp. 29-33, 47-61 and 125-136.

a) This is the surplus that will accrue to the owners after deducting the loss of capital through depreciation and the opportunity cost of equity or interest paid on debt.

b) $(1-\tau)\big(f(k)-(\delta+R)k\big)$ is obviously maximised for the same k for all $0 \le \tau < 1$.

c) With $\alpha = 1$ the tax will be non-distortive. The tax will be set such that the marginal utility of public consumption is equated to the marginal cost, which is the marginal utility of private consumption foregone by domestic owners of the company. To let α deviate from 1 will create a distortion, which lowers the tax base. The marginal return to capital will deviate from the marginal cost (depreciation plus interest). A smaller α will diminish the amount of capital, which in turn lowers the tax base and tax revenue without any gain for the (domestic) owners. A larger α will drive the amount of capital to a point where the marginal return falls short of the marginal cost. In brief, the income available for the owners and the government is maximized setting $\alpha = 1$.

d) Arm's length principle: Set the price equal to what would have been the market price had the firms been independent market agents (in this case 1). In practice, it is in the interest of the company to set a higher (lower) price if the tax is higher in the country with the buying (selling) firm. The gain will be traded off against a concealment cost.

e) Assume a sale from A to B, and a higher tax in B. A larger τ in country A implies that there is a smaller gain from a large transfer price and it will be lowered to save concealment cost. This will lower the tax base and tax revenue of country A. A larger τ in country B implies that there is a larger gain from a large transfer price, and it will be increased to obtain larger tax savings. This implies a loss of tax revenue for country B. In either country, one will trade off the gain from larger public consumption, i.e. the marginal utility of public consumption minus the utility of private consumption of domestic owners foregone, and the loss of revenue due to the adjustment of the transfer price. That means that for $\alpha = 1$ taxation will be confined to a level where the marginal benefit of public consumption exceeds the marginal opportunity cost, in order to limit profit shifting. Starting out from $\alpha = 1$, slightly reducing α (restricting deductions) will increase the tax base and tax revenue with a negligible distortionary effect (which for a small change is a second order effect). This will have a beneficial effect as the marginal benefit of public consumption initially exceeds the marginal opportunity cost. One will set $\alpha < 1$ and trade off the associated distortionary effect against the profit shifting due to τ.

Problem 2 – sketch of answer

See Lund, D. (2002b). Rent taxation when cost monitoring is imperfect. Resource and Energy Economics 24(3), 211-228. Notation is changed in the exam problem just as in the lecture, so that r in the article is theta here (and in the lecture), and t in the article is tau here (and in the lecture).

The relevant lecture notes are:

See also Lund, D. (2014). State participation and taxation and taxation in Norwegian petroleum: Lessons for others? Energy Strategy Reviews 3, 49-54.

Part (a), without reference to the specific model of Lund (2002b):

A royalty is a tax on revenue, not on the rent, and is distortionary. The private value of a marginal unit extracted equals the marginal (private and social) cost and falls short of the social value which includes also the revenue accruing to the state (the royalty). The social marginal value exceeds the marginal cost. A rent tax (<100%) is non-distortionary and a better way to raise revenue. One cannot tax away more than the rent, and the rent is maximised when there is no distortion.

However, a large rent tax may induce profit shifting at a concealment cost. A royalty does not. Profit shifting means that, through transactions across borders or sectors of the economy, more of the accounting profits show up where the tax rate is lower. True profits are not observable as the cost is hardly observable even if the value of output is likely to be observable.

Moreover, for a rent tax (alone) to be neutral, it must be symmetric, with full loss offset. This implies that the government carries much risk. In many developing nations, the government may be poor and credit constrained, or risk averse on behalf of the population, which is an argument why it might want to rely partly on royalties instead of neutral rent taxes.

Part (b):

The model from Lund (2002b) ignores risk and uncertainty. The article assumes that the government maximizes a linear combination of its own revenue and after-tax profits of the companies. In the version to be discussed here, only a special case is considered, with maximization of government revenue only.

The production cost function is assumed to be convex. When extracting, one will start with the fields where extraction is cheap before developing the more expensive fields. Also for a given field a moderate extraction is cheaper than squeezing out the marginal units.

Also the concealment function is convex. A moderate concealment may not be very suspicious and may not require sophisticated arrangements, while reporting a small rent may be dubious. Extensive concealment may require expensive purchases of professional services from lawyers and accountant, disguisable transactions and the setting up of non-transparent legal arrangements.

Profit shifting will be increasing in the discrepancy between domestic and foreign tax rate $\tau - s$ and decreasing with concealment cost, c.

There are interactions between τ and θ. The optimum is characterised by a trade-off between the distortions inflicted by θ and the profit shifting and associated concealment induced by τ.

The distortionary effect of θ (erosion of the tax base) is more harmful the larger is τ and is a case for a more modest θ as reflected in $\theta = \dfrac{1-\tau}{2-\tau}$. Where the foreign tax rate is larger there is scope for setting a larger domestic tax rate without inducing much profit shifting, explaining why τ is increasing with s for a given θ.

With a larger θ profits are smaller and raising τ will raise less revenue while still inducing profit shifting. Where θ is smaller, there is a larger tax base and more revenue is raised by increasing τ, which is an argument for a larger τ, reflected in $\tau = \alpha(1-\theta)^2 + \dfrac{s}{2}$. The effect is larger the larger is p since the profit tax base is more affected by a change in output the larger is p. The effect is smaller the larger is b. A steeper marginal production cost curve has a dampening effect on the change in output. However, a larger decrease in the concealment cost as concealment diminishes (a larger c) will strengthen the effect of a lower θ.

The optimal mix of the two tax rates is the solution to the two equations together, which is a messy third (or higher) degree polynomial. The solution can easily be illustrated, see pages 12 and 13 of the lecture notes. The discussion shows that for some high values of alpha, the optimum will be a rent tax of (close to) 100 percent, and no royalty. The "close to" means that at 100 percent, the company has no incentive to produce. Additional assumptions are needed to describe the solution at for $\tau = 100$ percent. But the maximand (government revenue) is increasing as τ approaches 100 percent from below, and θ is approaching zero.

Problem 3

This is taken from Hart O., A. Schleifer and R.W. Vishny (1997). The proper scope of government: Theory and an application to prisons. Quarterly Journal of Economics 112, 1127-1161, on the reading list.