On-Line Appendix of Managerial Firms, Taxation, and Welfare

by

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1 Equivalence of ad valorem and per unit taxation, conditional on the organizational choice

In this section, we consider the welfare equivalence between per unit and ad valorem taxation, when these two tax instruments induce an organizational change at the industry equilibrium. We follow Auerbach and Hines (2002) and compare an ad valorem and a specific tax that induce the same amount of revenues. We evaluate the welfare equivalence of these two tax instruments, when they induce an organizational change. We start from a tax induced change from integration to non-integration (when $\sigma = 0$), then turn to a tax induced change from non-integration to integration (when $\sigma > 0$).

1.1 Tax induced organizational change from integration to non-integration

Let us now consider an initial equilibrium, where price $P^* > 1$, then a share $\alpha = 1$ chooses to integrate and the corresponding supply quantity is $Q_s = 1$.

Consider a combined use of equivalent and ad-valorem taxation that induce an organizational change from integration to non-integration. The price after the combined tax scheme is $P(1-\tau) - t$. Managers' decisions to integrate are now described as follows:

$$\Pi_I^* \geq \Pi_N^* \;\Leftrightarrow\; P \geq \frac{1+t}{1-\tau}, \tag{1}$$

which identifies an upward shift of the organizationally augmented supply curve, such that $P^* < \frac{1+t}{1-\tau}$. The deadweight loss associated with the tax scheme is

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$$\Delta W_{IN}^{\tau t} = -\frac{P^*(P^*(1-\tau)^2+1) - 2P^*(1-\tau)t + t^2}{(1+P^*(1-\tau)-t)^2} < 0,$$

which goes back to ΔW_{IN}^{t} in equation (18) for $\tau = 0$.
Tax revenue from the joint tax scheme is:

$$TR_N^{\tau t} = (P\tau + t)(1 - \frac{1}{(1+P(1-\tau)-t)^2}),$$

where tax revenues are obtained given total production under non-integration.
As in Auerbach and Hines (2002), the relative size of the welfare change under the two tax schemes, must be compared for taxes that induce the same tax revenues. It can be easily shown that:

$$\frac{\frac{d\Delta W_{IN}^{\tau t}/dt}{d\Delta W_{IN}^{\tau t}/d\tau}}{\frac{dTR_N^{\tau t}/dt}{dTR_N^{\tau t}/d\tau}} = \frac{1/P}{1/P} = 1$$

This implies that a revenue equal substitution of ad valorem for specific taxation leaves the welfare difference unchanged at any t, τ combination. Notice that this equivalence result holds provided that the tax induced an organizational change at the industry equilibrium i.e. it does not account for the fact that a revenue equal substitution of ad valorem and per unit tax changes the probability of an integration outcome in the industry.

1.2 Tax induced organizational change from non-integration to integration

Let us now consider an initial equilibrium, where price $P^* > \overline{P}$; then a share $\alpha = 0$ chooses to integrate due to integration costs, which reduce output under integration by a fixed amount $\sigma > 0$ for any market price level. Thus the relevant initial supply curve is $Q_s = Q_N^*$.
It can be shown that the combined use of per unit and ad-valorem taxation changes managers' incentives to integrate as follows:

(2)
$$\Pi_I^* \geq \Pi_N^* \Leftrightarrow \underline{P} \leq P \leq \overline{P}, \text{ where } \underline{P} = \frac{1-2\sigma+4t\sigma-\Delta(\sigma)}{4\sigma(1-\tau)}, \overline{P} = \frac{1-2\sigma+4t\sigma+\Delta(\sigma)}{4\sigma(1-\tau)},$$

which includes special cases for $\tau = 0$, and $t = 0$, respectively. Consider a combined tax scheme, which induces an organizational change from non-integration to integration. Being independent of the tax, it can be shown that the deadweight loss associated with the tax scheme is still given by (24) in the paper. This is independent on the type of tax which is levied, which is enough to demonstrate that it is indifferent to choose an ad valorem or a specific tax,

provided that they induce an organizational change.

References

Auerbach, Alan J, and Jr. Hines, James R (2002), "Taxation and Economic Efficiency," in: *Handbook of Public Economics*, vol. 3, Elsevier, pp. 1347–1421.