

Referee-report on "Environmental Taxes in the Long Run" by Henrik Vetter

The author draws on the Carlton-Loury model 1980 where environmental damage is a function of both emissions and the number of firms. Carlton and Loury make the point that if environmental damage is of the form $D(e,n)$, where e are per firm emissions and n is the number of firms, a Pigouvian tax is not optimal. This is a trivial point, and I have no idea how they got into QJE with this.

The author then looks at a special case of the Carlton and Loury model by assuming that emissions are proportional (actually identical) to output. He recalls the optimality conditions of Carlton and Loury 1980 and compares the laissez faire outcome with the socially optimal outcome.

Then he investigates, under what circumstances an output tax can lead to the social optimum. Doing this he ignores the most important case, namely where the damage function is of the form: $D(n,q) = D(nq)$. For this case Spulber (1985) has shown that a Pigouvian tax is optimal even in the long run. (Actually Spulber's model is more general. He uses a cost function $C(q,e)$, where q is output, and e are emissions, and the damage function depends on total emissions: $D(n,e) = D(ne)$.) Spulber also shows that with a tax, the firm's scale can be larger or smaller than under laissez faire. It is peculiar that the author does not know and mention the Spulber paper.

Another interesting case to look at would be $D(n,q) = D(an+bq)$ where a and b are emission coefficients. This case could be interpreted such that the firm emits some fixed emissions independent of output level. In this case there are actually two externalities which should be addressed by two policy instruments. I wonder why the author does not discuss this obvious policy.

It would be interesting to discuss some examples where a general firm $D(n,q)$ is relevant.

Another point is that I do not understand, why one needs assumption 3 to guarantee existence of a social optimum. By the theorem of Weierstrass, each bounded function on a compact set has a maximum. Obviously, welfare is bounded (except for the case where the integral under the inverse demand function does not converge, and the consumers's willingness to pay always exceeds the marginal cost, i.e. demand and supply functions do not intersect). We can certainly rule out such a case. If we assume that there is a point where $P(q) < C'(q)$, welfare must be bounded. You can then compactify the relevant set by choosing q between 0 and a sufficiently high level of output q_0 where $P(q_0) < C'(q_0)$. So what is the problem?

In Proposition 3 and 5 the author sets up the qualifier "If a unique social optimum exists". Since under reasonable assumptions a social optimum always exists, does this mean "if the social optimum is unique"? Now, when can it be non-unique? We are in a partial equilibrium world! Here a welfare function is typically unimodal. If it is not, it is extremely unlikely that two local peaks adopt the same value. Of course there can be a coordination problem in such

an unlikely case. But under monotonicity assumptions on demand and damage this cannot occur. So what is the problem?

I also find the introduction written in a rather confusing way. The authors writes “when scale effects matter for environmental harm a pure Pigou tax cannot lead to long run equilibrium”. As I wrote above: Under the Spulber model scale effects do matter. Still, a Pigouvian tax is optimal. If the damage function is of more general type $D(n,q)$ we have two externalities and you cannot achieve the first best with one instrument in general. This is a trivial point.

Reference

Spulber, Daniel, F. (1985): Effluent Regulation and Long-Run Optimality, *Journal of Environmental Economics and Management*, 12, 103-16.