University of Toronto
Economics 336 – Public Economics

Midterm examination
October 13, 2009

1. Because of the SOE assumption, the tax raises the cost of capital from $\bar{r}$ to $\bar{r}+t$ and reduces the demand from $A-\bar{r}$ to $A-\bar{r}-t$. Therefore

$$R(t) = tK(\bar{r}+t) = t(A-\bar{r}-t)$$
$$-\Delta\text{Profit} = \int_{\bar{r}}^{\bar{r}+t} K(r)dr = R(t) + \frac{1}{2}t^2$$
$$EB(t) = \frac{1}{2}t^2$$

2. (a) In the short run, rental houses are in largely fixed supply in Toronto, so the tax should be fully shifted backward to owners. (It is not enough to say that the tax is shifted backward because of long term lease contracts: the question talks about 2 years, whereas leases are generally 1 year at most). In the longer run, the supply of rental accommodation is more elastic, so that more of the burden will be shifted forward to renters.

   (b) Since businesses are mobile and commercial land in Toronto and surrounding areas close substitutes, a tax on business properties in Toronto is mostly borne by immobile factors of production there – i.e. owners of land – and reduction in the tax rate largely reduces the tax burden on this group.

3. The compensated measure is the correct one. We can see this by noting either: (a) it corresponds exactly to the measure we get from the equivalent variation, which corresponds to movements along a demand curve, i.e. compensated price changes; or (b) all taxes, including lump-sum taxes, have income effects on demand; therefore, in computing the *excess* burden of an excess tax we are concerned only with the additional quantity distortions due to the substitution effect, which means using the compensated demand function. For a good the is in positive net demand and taxed at a positive rate, the Marshallian measure of EB is *larger* than the compensated measure, if the good is a normal good.

4. For full marks on (c), the graph should illustrate the idea that D lies to the SW of C and so cannot be on the UPF. Definitions:

   - utility possibilities frontier: in a two person economy, the set of utility pairs for A and B such that, given preferences and resource constraints, it is not possible to increase the utility of one agent without reducing the utility of the other, or the solutions to

$$\max u_A(x_A) \text{ s.t. } u_B(x_B) = \bar{u}_B \text{ and } (x_A, x_B) \text{ feasible.}$$

   - Pareto efficient: an allocation X is Pareto efficient if it is not possible to find another allocation Y that gives higher utility to all agents. (It is also acceptable to say it is not possible to find an allocation Y that increases the utility of one agent without harming another.)

- Pareto superior: An allocation X is Pareto superior to Y if all agents are better off at X than at Y.

5. For any tax rate t, the optimal demands are

$$X^* = \frac{64}{(1+t)^2}$$
$$Y^* = 156 - \frac{64}{1+t}$$

(The demand for X^* is both compensated an Marshallian - because this utility function is quasi-linear.) Demands before and after tax are

$$(X_0, Y_0) = (16, 140)$$
$$(X_1, Y_1) = (4, 148)$$

so tax revenue is $R = 4$. Excess burden is $EB = EV - R$ where EV solves

$$\frac{16}{2} = 16 - EV$$

or $EV = 8$. This means $EB = 8 - 4 = 4$.

The other approach is the Harberger triangle approximation. Since $-\Delta X = 12$, the Harberger formula is

$$EB \approx \frac{1}{2} \cdot 1 \cdot 12 = 6$$

(Note that the estimate is too high because the demand curve is strictly convex.)

6. Since supply is perfectly elastic the tax is fully shifted forward in a competitive market. But, due to the linear demand curve, the incidence in a monopolistic market is one-half on consumers and one-half on producers. This is not general however: a monopoly might shift more or less of the tax forward to consumers than a competitive industry.

7. The inverse elasticity formula applies, so a uniform tax is optimal if $b = 1$, and the tax rate on X should be double that of Y when $b = 2$.