AS/ECON 4070 Public Finance I November 2001

Answers to Mid–term

1. The correct answer is "uncertain". Depending on the shapes of the demand curve and the cost curve, a single–price monopoly might shift more, or less, of a tax forward onto buyers than a perfectly competitive industry with the same demand and cost curves.

If there are constant returns to scale, that is if the marginal cost equals the average cost, and the marginal cost does not vary with output, then the supply curve would be perfectly horizontal (and would be the marginal cost curve). Under perfect competition, a horizontal supply curve means that 100% of the tax would be shifted forward onto buyers.

A single–price monopoly chooses a quantity Q such that marginal cost equals marginal revenue. if the demand curve is a straight line, then the marginal revenue curve is exactly twice as steep as the demand curve. A tax will shift up the monopolist's marginal cost curve, so that it now chooses an output level Q such that

$$MR(Q) = MC(Q) + t$$

That means that the monopoly's *marginal revenue*, evaluated at the output it actually chooses, will increase by the amount of the tax. Since the marginal revenue curve is twice as steep as the demand curve, that means that the price paid by buyers will increase by exactly half of the tax.

But if the demand curve is not linear, or the marginal cost curve is not horizontal, the monopoly might not shift exactly half of the tax onto buyers. The monopoly might shift more, or less, of the tax than a perfectly competitive industry. For example, if the demand curve had a constant *elasticity*, rather than a constant slope, and if the marginal cost were constant, then the monopoly would shift *more* of the tax onto buyers than would a perfectly competitive industry.

2. The most important assumptions in Harberger's model of general equilibrium tax incidence are :

• The overall quantities of each input to the economy as a whole are fixed. (This assumption ensures that a general factor tax is born entirely by the factor on which it is levied.)

• Inputs are perfectly mobile among industries. (This assumption implies that a tax cannot be born by "labour in the food industry", only by labour everywhere in the economy, since labour earns the same net return in each industry.)

• Consumers of final goods have identical homogeneous preferences. That is, the proportion of income spent on a good is the same for everyone. (This assumption ensures that only *backward* shifting of taxes onto factors of production matters, not forward shifting onto buyers.)

Among the other assumptions of the model :

• All markets are perfectly competitive.

• Technology in each industry exhibits constant returns to scale.

• Industries can be ranked unambiguously by factor intensities. That is, one industry will be more labour–intensive than the other, no matter what are the factor prices.

• The tax change considered is an exercise in *differential* tax incidence. That is, changes in government spending are not considered.

Pages 440 and 441 of the text list most of these assumptions.

3. There are several ways of calculating the excess burden.

First of all, note that the "before" price is 5, and the tax is 20 percent of 5, or 1, so that the "after tax" price is 6. Given the demand curve has the equation $Q = 30/P$, the consumer would buy 6 units if there were no tax, and would buy 5 units if she is taxed (and compensated so as to stay on the same demand curve).

The excess burden is, exactly, the area to the left of the compensated demand curve (between the old and new prices) minus the tax yield. The the area "under" a curve is the integral of the equation of the curve. So

$$EB = \int_5^6 \frac{30}{P} dP - (1)(5)$$

since the tax yield here is 5.

The integral of $1/x$ is $\ln x$, where ln is the natural logarithm. Thus

$$EB = \ln 6 - \ln 5 - 5$$

which works out to about 0.46.

Another way of calculating approximately the excess burden is to use the formula for the area of a triangle : one-half of the base times the height, here one-half times the change in quantity times the change in price. Here the quantity has fallen from 6 to 5 while the tax has increased the price from 5 to 6, so that the excess burden is approximately $(0.5)(1)(1) = 1/2$.

Alternatively, the excess burden is approximately

$$\frac{1}{2}\eta\tau^2 pQ$$

where η is the compensated price elasticity of demand, and τ is the tax rate.

Here

$$\eta = -\frac{\partial Q}{\partial P}\frac{P}{Q} = -\frac{-30}{P^2}\frac{P}{(30/P)} = 1$$

If the tax rate is calculated on the net–of–tax price 5, this formula gives

$$EB \approx \frac{1}{2}(30)(\frac{1}{5})^2 = 0.6$$

If the tax rate is calculated on the gross–of–tax price 6, the formula gives

$$EB \approx \frac{1}{2}(30)(\frac{1}{6})^2 \approx 0.43$$

Any of these approximations is pretty close to the true value.