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A Note on Tax Shifting, Slope, and Elasticity

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All too often in our attempts to teach sophisticated concepts to students in the elementary economics course, we simplify to the point of error. One common such fallacy deals with the degree of tax shifting, and is a consequence of failing to distinguish properly between elasticity and slope.

Many elementary textbooks use the following example to demonstrate an application of supply and demand curve analysis. In Figure 1, the initial supply and demand curves, S and D_1, determine an equilibrium price at A. When a per-unit tax is imposed, S shifts upward to S^t, resulting in a new equilibrium price, B. Since the tax equals the vertical difference between S^t and S, which is less than the difference between A and B, the tax has been shifted partially onto the demanders. The vertical difference between A and B measures the amount shifted onto the consumers, while the remainder, viz. the per-unit tax less (A – B) is borne by the suppliers.

Virtually all of the texts I've examined—a non-random sample of 13—use the tax-shifting example. All except (4), (6), and (12) relate the degree of forward shifting onto the demander to the price elasticity of demand. The less elastic is the curve, it is claimed by (1–3, 5, 8–11 and 13), the more of the tax is shifted onto the consumers.

This assertion is false. *The extent of the tax shift is dependent on the slope of the demand curve, not its elasticity.*

Consider D_2 in Figure 1, which has the same slope as D_1, but is less elastic at every price. (Elasticity is calculated geometrically as follows: at a, e = OA/AC; at a', e = OA/AD, which is less than OA/AC). As can be determined from close visual examination, the amount of the tax shifted forward is precisely the same in both instances, despite the differences in elasticity. The outcome is obviously due to the equalities of the slopes. (A mathematical proof is offered in the appendix.)

Alternatively, consider the rectangular hyperbola demand curve portrayed in Figure

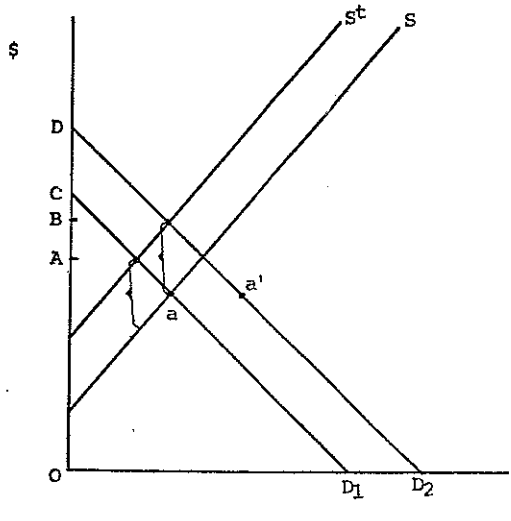

Figure 1

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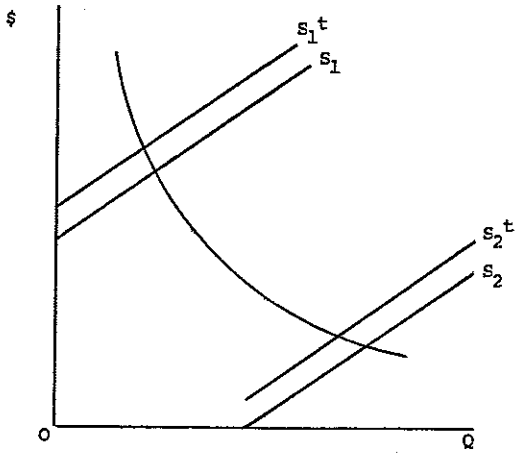

Figure 2

2. As is well known, elasticity of this demand curve is unitary throughout. Yet it is obvious that forward shifting differs—more of the tax is shifted when a per-unit tax is levied on S_1 than when the identical per-unit is imposed on S_2.

Students often confuse slope and elasticity. Textbook writers should set a better example.

Mathematical Appendix*

Let the demand function be: $q = f(p)$ and the supply function be: $q = g(p - t)$, where t = the tax. Equilibrium requires that: $f(p) = g(p - t)$.

Now, if t changes, reestablishment of equilibrium requires:

$$f'(p)dp = g'(p - t)dp - g'(p - t)dt$$

or

$$dp/dt = g'/(g' - f')$$

*My thanks to William J. Baumol for this formulation.

(For a normal shaped demand curve, $f' < 0$. Thus dp/dt must be <1.)

The magnitude of the shift depends solely on f' and g', the slopes of the demand and supply curves, and not elasticities.

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