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CORE CONCEPTS: ECONOMICS OF TAX INCIDENCE

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In a world without taxes, prices paid by consumers are equal the prices received by companies. However, consumption-style taxes drives a wedge between buyers and sellers equal to the amount of the tax. The wedge either forces up prices paid by consumers, forces down prices received by sellers, or some combination of the two. Whether buyers or sellers mostly bear this burden is known as the "economic incidence" of the tax.[1]

Basic Model of Tax Incidence

Imagine imposing a simple per-unit tax. After the tax is imposed, the price received by suppliers will no longer equal the price paid by demanders. Because of the tax wedge, the price received by suppliers will be equal to the price paid by demanders minus the amount of the tax. That is,

$$(1) \qquad P_s = P_d - t$$

Equation (1) can also be written as a relationship between changes in the variables,

$$(2) \qquad \Delta P_s = \Delta P_d - \Delta t$$

In equilibrium, the quantity demanded in the taxed market must equal the quantity supplied, or $Q_d = Q_s$. Since these quantities will be the same at equilibrium, we can convert this into a relationship between the percentage changes in quantity demanded and supplied as follows,

$$(3) \qquad \frac{\Delta Q_d}{Q_d} = \frac{\Delta Q_s}{Q_s}$$

Recall the definition of price elasticity of supply and demand as the percentage change in quantity given some percentage change in price. That is,

$$(4) \qquad \eta_d = \frac{\%\Delta Q_d}{\%\Delta P_d} = \frac{P_d}{Q_d} \cdot \frac{dQ_d}{dP_d},$$

[1] For an explanation of the difference between economic and "legal" incidence—that is, the difference between who bears tax burdens and who is legally required to remit tax payments—see Andrew Chamberlain and Gerald Prante, "Economic vs. Legal Incidence: Comparing Census Bureau Figures with Tax Foundation Tax Burdens," *Tax Foundation Fiscal Fact* No. 59 (June 9, 2006). Available online at www.taxfoundation.org/news/show/1656.html.

$$(5) \qquad \eta_s = \frac{\%\Delta Q_s}{\%\Delta P_s} = \frac{P_s}{Q_s} \cdot \frac{dQ_s}{dP_s}$$

From the definition above, if we multiply the price elasticity by the percentage change in price it will yield the percentage change in quantity. Following this reasoning we can rewrite (3) as the following,

$$(6) \qquad \frac{\Delta P_d}{P_d} \cdot \eta_d = \frac{\Delta P_s}{P_s} \cdot \eta_s$$

Since $\Delta P_s = \Delta P_d - \Delta t$ as noted in equation (2), we can rewrite (6) as,

$$(7) \qquad \frac{\Delta P_d}{P_d} \cdot \eta_d = \frac{\Delta P_d - \Delta t}{P_s} \cdot \eta_s$$

Substituting in the definitions of price elasticity of supply and demand we get,

$$(8) \qquad \frac{\Delta P_d}{P_d} \cdot \left(\frac{P_d}{Q_d} \cdot \frac{dQ_d}{dP_d} \right) = \frac{\Delta P_d - \Delta t}{P_s} \cdot \left(\frac{P_s}{Q_s} \cdot \frac{dQ_s}{dP_s} \right)$$

Simplifying and multiplying both sides of (8) by Q_s (which is also equal to Q_d) to clear the Qs from both denominators we get,

$$(9) \qquad \Delta P_d \cdot \frac{dQ_d}{dP_d} = (\Delta P_d - \Delta t) \cdot \frac{dQ_s}{dP_s}$$

Solving for $\Delta P_d / \Delta t$ which is the change in prices paid by buyers relative to the tax imposed we get,

$$(10) \qquad \frac{\Delta P_d}{\Delta t} = \frac{\frac{dQ_s}{dP_s}}{\frac{dQ_s}{dP_s} - \frac{dQ_d}{dP_d}}$$

In (10), notice that the three terms on the right-hand side are very close to the definitions of price elasticity of supply and demand from (4) and (5). By multiplying both the numerator and denominator of this by P_s / Q_s (or the equivalent $(P_d - t)/Q_d$) we get the following,

$$(11) \qquad \frac{\Delta P_d}{\Delta t} = \frac{\frac{dQ_s}{dP_s} \cdot \frac{P_s}{Q_s}}{\frac{dQ_s}{dP_s} \cdot \frac{P_s}{Q_s} - \frac{dQ_d}{dP_d} \cdot \frac{P_d - t}{Q_d}}$$

Substituting the simpler notation for elasticity of supply and demand into this we arrive at our final result,

$$(12) \qquad \frac{\Delta P_d}{\Delta t} = \frac{\eta_s}{\eta_s - \eta_d} = I_d$$

Equation (12) is the classic relationship between tax incidence and the price elasticity of supply and demand. On the left-hand side is the change in prices paid by consumers from a given change in tax. This is the incidence of the tax borne by consumers, or I_d. In the center is the ratio of supply and demand elasticities.

Since demand curves slope downward the sign on η_d is always negative. That means the middle term in (12) is essentially the ratio of supply elasticity to the sum of the absolute value of demand and supply elasticities. This way of interpreting (12) makes it clear that tax incidence is simply a tug-of-war between demand and supply elasticities.

Note that the value of I_d can only range from zero to one:

- If supply elasticity η_s is zero (very inelastic supply), I_d is zero; consumers bear none of the tax incidence.
- If supply elasticity $\eta_s \to \infty$ (very elastic supply), I_d is one; consumers bear the entire tax incidence.
- If demand elasticity η_d is zero (very inelastic demand), I_d is one; consumers bear the entire tax incidence
- If demand elasticity $\eta_d \to \infty$ (very elastic demand), I_d is zero; consumers bear none of the tax incidence.

The intuition behind the above is simple. If demand elasticity is high relative to supply, consumers have good substitutes and can shift away from the tax. If supply elasticity is high relative to demand companies can do the same, escaping the tax by shifting it onto consumers with fewer alternatives.

In general, the lesson from the above analysis is that tax burdens always tend to get shifted onto whoever has the fewest options—a result that is often at odds with the intention of lawmakers crafting tax policy.

Please direct all questions and comments about the above analysis to the following:

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