Abstract

Within the last few years, two articles in this journal (one ours) have discussed the relationship between product quality, excise taxes, and tax revenue. The articles are marked by seemingly contradictory results regarding the effect specific taxes and ad valorem taxes have on product quality. This article reconciles the contradiction. The authors show that the difference stems from opposite assumptions about the substitutability between physical units and their quality attributes. For all intermediate substitutabilities, the tax-quality relationship of this article is relevant for specific taxes, while the tax-quality relationship of the other article is relevant for ad valorem taxes.

PRODUCT QUALITY AND TAXATION: A RECONCILIATION

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In an article in a previous issue of this journal, John Kay and Michael Keen (1987) examined the implications endogenous product quality has for government revenue from specific and ad valorem taxes. Underlying their analysis was the proposition that "quality is entirely unaffected by specific taxation, and is decreasing in the ad valorem rate" (p. 377). Their tax-quality proposition seems to contradict our (Bohanon and Van Cott 1984) conclusion in this journal that specific taxes increase product quality, while ad valorem taxes leave it unchanged.[1]

Kay and Keen failed to explore the source of the different results. Indeed, they confined their remarks to a dismissal of our proposition as "an extreme case that, although informative, is in some respects misleading" (p. 373). In what follows, we show Kay and Keen's tax-quality proposition to be *no* less "extreme" than ours; the two propositions lie at opposite ends of a product taxonomy continuum.

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In addition, we show that for specific taxes, our proposition applies for all cases between the extremes while Kay and Keen's proposition holds for ad valorem taxes in these intermediate cases.

THE ANALYTICAL SETTING

We discuss a product with one quality dimension. The good is denoted by X, while Z denotes the quality attribute. The demand price for X is assumed to increase at a decreasing rate as more Z is embedded in X. Specific taxes are defined in terms of X. Let the composite product be produced by independent price-taking firms.

The substitutability of X and Z in generating consumption services is a key consideration in what follows.[2] No substitutability implies a lumpy consumption pattern for X. Consumers, for example, cannot maintain a level of satisfaction by embedding more Z into less X. The optimal amount of Z in any unit of X is independent of the amount of Z in any other unit of X. The consumer's decision is solely one of the optimal amount of Z in the lumpy unit of X. Products that are characterized by a one-or-none consumption pattern fit into this rubric.

Funeral caskets (X) and their durability (Z) are an example of this lumpiness. People buy one casket or none. People do not purchase a partial but more durable casket, nor are they willing to trade casket durability for more than one casket (and periodic exhumation). Kay and Keen's solution for optimal quality holds physical units constant (see their equation 2.2, p. 374). At another juncture, they assume consumers purchase "one unit of the commodity or none at all" (p. 380). Both assumptions are equivalent to assuming *no* X-Z substitutability.

On the other hand, perfect substitutability implies that consumers are indifferent between X and Z as the source of the product's consumption services. Two one-year light bulbs, for example, are equivalent in the consumer's mind to one two-year bulb. Market participants combine X and Z such that the cost of consumption services is minimized.[3]

THE TAX-QUALITY PROPOSITION: NO SUBSTITUTABILITY

Kay and Keen's lumpy consumption pattern means consumers "escape" specific taxes *only* by not purchasing the unit of X. In terms of caskets, a specific tax is like an entry fee on casket shopping, similar to the price searcher's lump-sum cover charge in all-or-nothing pricing strategies. Accordingly, casket purchasers will be those whose consumer surplus exceeds the tax.

Given that one decides to pay the tax by purchasing a casket, the additional cost of spending one's "eternal repose" in a bronze box instead of a pine box is the same as it was prior to the tax. Likewise, the marginal valuation placed on the additional durability implicit in the bronze box is unaffected by the tax. It follows that post-tax casket purchasers have no incentive to alter casket durability.[4]

An ad valorem tax is different in that it increases the marginal cost of casket durability. Accordingly, post-tax purchasers opt for less durable caskets. These conclusions are the same as Kay and Keen's.

THE TAX-QUALITY PROPOSITION: PERFECT SUBSTITUTABILITY

With perfect substitutability between X and Z, consumers are not constrained to lumpy consumption. Consumers can "escape" specific taxes by substituting into fewer but more Z-laden units of X. In terms of our light bulb example, a specific tax simply renders bulbs a more costly source of lighting services compared to durability, and consumers respond by upgrading durability.

An ad valorem tax, by way of contrast, is levied proportionally on the value of the product. Because consumers are indifferent between bulbs and durability as sources of lighting services, and because an ad valorem tax increases the cost of both sources by the same percentage, there is no incentive to change durability. This result, together with the result for specific taxes, corresponds to our price-quality proposition.

THE INTERMEDIATE CASE

What is the effect of a tax when substitutability between X and Z exists but is less than perfect? Luggage volume comes to mind as an example of less than perfect substitutability. A single large suitcase or two smaller bags with the same volume are not necessarily perfect substitutes; however, it is clear that as the relative price of two bags rises, the large suitcase becomes more attractive.[5]

With imperfect substitutability, the predicted effect of both taxes on quality lies between the extreme propositions. As long as some substitutability exists, specific taxes cause quality upgrading, though obviously less than if there were perfect substitutability. On the other hand, only if substitutability is perfect will an ad valorem tax fail to reduce product quality.

FINAL COMMENT

We and Kay and Keen were equally negligent in not realizing the importance of the substitutability of quality attributes and physical units. Polar assumptions about this substitutability were adopted in the two articles. It is not surprising, therefore, that seemingly contradictory tax-quality propositions resulted. In the general case where substitutability is present but not perfect, one proposition holds for specific taxes while the other holds for ad valorem taxes.

NOTES

1. This proposition does not originate with us. As we noted in our article, the proposition originated with Barzel (1976). Barzel points out that to the extent that there are quality attributes not subject to an ad valorem tax, the tax reduces product quality.

2. We were not explicit about substitutability, nor were Kay and Keen.

3. Aided by 20-20 hindsight, we now see that our example of light bulbs and their durability implied perfect substitutability.

4. While casket durability for continuing purchasers is not affected, the average durability may rise, fall, or stay the same following the specific tax. What happens depends on the durability

that noncontinuing purchasers would have opted for relative to continuing purchasers. Kaempfer and Brastow (1985) argue that average durability rises.

5. The analysis that follows is similar to Umbeck's (1980) perspective on the "Alchian and Allen" hypothesis. Umbeck couched the issue in terms of intertemporal substitution of desired characteristics.

REFERENCES

Barzel, Y. 1976. An alternative approach to the analysis of taxation. *Journal of Political Economy* 84:1177-97.

Bohanon, C., and T. Van Cott. 1984. Specific taxes, product quality, and rate-revenue analysis. *Public Finance Quarterly* 12:500-11.

Kaempfer, W., and R. Brastow. 1985. The effect of unit fees on the consumption of quality. *Economic Inquiry* 24:341-48.

Kay, J., and M. Keen. 1987. Commodity taxation for maximum revenue. *Public Finance Quarterly* 15:371-85.

Umbeck, J. 1980. Shipping the good apples out: Some ambiguities in the interpretation of "fixed charge." *Journal of Political Economy* 88:199-208.

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