

Confirmations and Contradictions

Taxation and Product Quality: New Evidence from Generic Cigarettes

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I. Introduction

In this *Journal*, Barzel (1976) theorized that per unit taxes should increase the average quality of a product, whereas ad valorem taxes may either lower product quality or leave it unaffected. There are several different ways to present the logic behind this theory. Barzel stresses that per unit taxes do not tax all attributes of a commodity, causing a substitution from the taxed attributes (quantity) into the others (quality).¹ Another way is to draw an analogy to the Alchian and Allen (1964) theorem, where the addition of a fixed fee causes a decrease in the relative price of the higher-quality version of the product.² Because ad valorem taxes add the same percentage to the prices of both the high- and low-quality versions of the product, they do not distort relative prices. Thus ad valorem taxes should

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¹ This substitution can occur through either demand or supply. Firms may substitute between quantity and quality as factors of production, as stressed by Barzel, or consumers may substitute quality for quantity, as in the Alchian and Allen theorem. Just as the impact of a tax is independent of its imposition on buyers or sellers, the market impact here is also independent of the origin of the substitution. For this reason we do not make a distinction between these cases.

² For a discussion of the relationship between the Alchian and Allen theorem and Barzel's hypothesis, see Cowen and Tabarrok (1995).

exert no impact on product quality. However, if quality can be separated from the product and purchased outside the tax, then ad valorem taxes can cause a reduction in the quality of the product subject to the tax. The reason is that embedded quality would be reflected in the price of the good, and if purchased as part of the product, the quality would be taxed at the ad valorem rate. Thus a “specific” ad valorem tax (applied to only one good) will cause a reduction in quality when the quality can be separated from the product and purchased outside the tax. In contrast, a “general” ad valorem tax, such as a retail sales tax, would cause no change in product quality.³ The reason is that the purchase value of the quality will be taxed regardless of whether it is incorporated into the product or purchased separately.

Barzel originally tested his hypothesis by examining how these taxes affect the price of cigarettes. Since the publication of his article, there have been two updates in this *Journal*: Johnson (1978) and Sumner and Ward (1981). The paper by Sumner and Ward empirically rejected Barzel’s theory. If one is willing to accept the validity of the previous empirical models, the existing literature on Barzel’s theory leads scholars to one of two conclusions: either (1) Barzel’s theory was incorrect or (2) there were constraints in the cigarette market that prevented the market from adjusting in the manner theorized by Barzel. The purpose of our paper is to resolve this debate by using data on generic cigarettes, which did not exist at the time of these previous works. We find evidence in support of Barzel’s theory and conclude that previous rejections were due to problems inherent in the previous price-based empirical models and quality constraints in the cigarette market that disappeared with the introduction of generic cigarettes.⁴

II. Generic Cigarettes: A Direct Test of Barzel’s Theory

Previous empirical models have tested Barzel’s theory indirectly by examining how taxes affect the price of cigarettes. If taxes are fully

³ Barzel theorizes that general sales taxes might also reduce product quality if the quality can be provided by an employer to the consumer/employee. In this case the quality would be purchased as an intermediate good, escaping the retail sales tax. For cigarettes this is almost certainly not a relevant issue since employers do not generally provide cigarettes to their employees.

⁴ Barzel’s theory has also been criticized on theoretical grounds (see Leffler 1982; Kay and Keen 1991). Because the results of almost any theoretical model can be altered by changing assumptions or introducing other variables, we make no attempt at addressing the theoretical debate over Barzel’s *model*. Ultimately, the validity of Barzel’s *theory* is an empirical issue. This paper attempts to provide a more rigorous and direct empirical test of Barzel’s theory than has previously been done, in an effort to add to this ongoing debate.

passed on to consumers, then a per unit tax of 10 cents that causes product quality to increase should cause the price of cigarettes to rise by more than 10 cents. This is the basis of all previous empirical tests of Barzel's theory. These indirect tests are subject to many limitations, such as an assumption about how much of the tax is passed on to consumers.⁵ For example, if only 90 percent of the tax is passed on to consumers, this would result in an empirical rejection of Barzel's theory in the previous models, *even if his theory were true*. In addition, these models test for differences in quality level across states, and before the introduction of generic cigarettes, it was almost impossible for the average quality level of cigarettes to differ across states.

Lower-quality, generic-brand cigarettes began acquiring a share of the cigarette market in 1982 (see Scredon 1986; Shapiro 1993). The timing of the introduction of generics is interesting in its own right because it provides evidence regarding Barzel's theory. According to Barzel, the introduction of lower-quality generic cigarettes should have coincided with a period of very low unit taxes on cigarettes, immediately after a period of high unit taxes that supported high quality in the market.⁶ While there were no significant changes in the nominal unit taxes applied to cigarettes, the high inflation during the 1970s had significantly eroded the *real* value of the per unit tax on cigarettes by the early 1980s. In fact, the introduction of generic cigarettes coincides with the lowest real value of the unit tax on cigarettes in recent history, 1982, after it had fallen rapidly from its highest real value in 1972.⁷ Thus the introduction of generic cigarettes at the time of the lowest unit taxes on cigarettes is strong evidence in favor of Barzel's hypothesis that unit taxes have a direct positive relationship with product quality.

With the modern availability of data on the quantities of premium and generic cigarettes purchased by state, it is now possible to perform an even more direct test of Barzel's theory. Using market share data, we *directly* measure the impact of state taxes on the quality level of cigarettes consumed in a state. Because state unit taxes on cigarettes are the same for both lower-quality generic cigarettes and

⁵ Other problems with indirectly testing the impact of taxes on product quality through the price of cigarettes have been examined in other papers. Sumner and Ward (1981) mention cross-border shopping, whereas Daniel Sumner (1981) and Sullivan (1985) cite market structure (especially monopoly power) as a possible factor that may bias the relationship between cigarette taxes and cigarette prices.

⁶ We are indebted to Yoram Barzel for this insight.

⁷ The combined real state and federal unit tax on cigarettes (1982–84 dollars) hit its lowest value at 22.8 cents per pack in 1982; the highest value was 46.5 cents in 1972. This spans the entire history for which such tax data are available, beginning in 1954.

higher-quality premium cigarettes, Barzel's theory would predict that per unit taxes should cause consumers to substitute out of generic and into premium-brand cigarettes.

A second benefit of using market share data instead of price data is the increased ability to test Barzel's hypothesis regarding the impact of ad valorem taxes. In earlier papers that used cigarette prices, this part of Barzel's theory could be tested using only the single state of New Hampshire because it was the only state to levy the cigarette tax on an ad valorem basis. Since New Hampshire switched to a unit tax before the introduction of generic cigarettes and cannot be used in our models, we test the ad valorem part of Barzel's hypothesis differently. Of the 51 jurisdictions in our data set (the 50 states plus the District of Columbia), 44 levy a retail sales tax that applies to cigarettes.⁸ Unlike a specific ad valorem tax, the general sales tax applies to many goods, not just cigarettes. With a general ad valorem tax, product quality cannot be separated from the product and purchased outside the tax. Barzel's theory would predict that state retail sales taxes, when they apply to cigarettes, should not change product quality.

In summary, we use the market share of the higher-quality premium-brand cigarettes (as compared to the lower-quality generic brands) as a measure of the average quality level of cigarettes in a state. When the market share of premium cigarettes rises, the average quality level of cigarettes consumed in the state has risen. If Barzel's theory is valid, state unit taxes on cigarettes should increase the market share of premium-brand cigarettes, whereas state retail sales taxes should not cause a change in the market share of premium-brand cigarettes.

The exact specification of our empirical model is

$$\begin{aligned} \%PREMIUM_{it} = & \alpha_0 + \alpha_1 \cdot UNIT\ TAX_{it} \\ & + \alpha_2 \cdot SALES\ TAX_{it} + \beta \cdot \Gamma_{it} + \epsilon_{it}, \end{aligned} \tag{1}$$

where $\%PREMIUM_{it}$ is the market share of premium-brand cigarettes in state i and year t , $UNIT\ TAX_{it}$ is the cents-per-pack unit tax on cigarettes in state i and year t , and $SALES\ TAX_{it}$ is the ad valorem general sales tax rate applicable on cigarette sales in state i and year t . Also included in the regression are a set of other exogenous control variables represented by the matrix Γ_{it} . We run several specifications of the model, differing by what other variables are included in Γ . In the basic specification, Γ is composed of only year

⁸ There are five states that do not have retail sales taxes, and two of the states with sales taxes, Wyoming and Colorado, do not apply them to cigarettes.

dummy variables and state dummy variables. The more expanded models include other variables in Γ that might also be important to control for when explaining the market share of premium-brand cigarettes in a state. These additional variables are state per capita personal income, the state unemployment rate, and the number of acres of tobacco harvested in the state on a per capita basis. All dollar variables in the regressions are converted to real values using the consumer price index.⁹

Barzel's theory would imply that the coefficient on UNIT TAX is positive and significant, whereas the coefficient on SALES TAX is zero. Table 1 gives the results from the three different specifications of the model.¹⁰

The coefficient on the state unit tax variable is positive and significant in all three specifications. This robust finding is supportive of Barzel's theory that a per unit tax increases product quality. A 1 cent increase in the state per unit tax on cigarettes is estimated to cause between a 0.32 and 0.33 percentage point increase in the market share of premium-brand cigarettes in that state. Thus, for approximately every 3 cents of state unit tax, there is an increase of one percentage point in the market share of premium brands. The coefficient on the retail sales tax is insignificantly different from zero in all three specifications. This finding is supportive of Barzel's theory that general ad valorem taxes have no impact on product quality when quality cannot be separately purchased outside the tax. The results also show strong support for Barzel's hypothesis that ad valorem and unit taxes have different effects on product quality. While we cannot test whether *specific* ad valorem taxes lower product quality, because New Hampshire switched to a unit tax, our results strongly support Barzel's theory regarding unit taxation and the fact that its impact differs from ad valorem taxation.

⁹ Data on the market shares of premium- vs. generic-brand cigarettes were obtained from the Tobacco Tax Council (1994) and Maxwell (1995). The data in the regression cover the full period for which market share data are now available, 1990–94.

¹⁰ We also explored whether the state tax rate should be made endogenous. Using a model of the state cigarette tax rate from Holcombe (1997) to form the basis for a second equation, we ran both two- and three-stage least squares models. We then performed a Hausman test for the following hypothesis: H_0 : a single-equation ordinary least squares (OLS) model is appropriate because there is no correlation between the state tax rate variable and the equation's error term; or H_1 : the state tax rate should be made endogenous by adding a second equation to form a simultaneous system. The details on this test can be found in Hausman (1978) and Godfrey (1988, chap. 5). The Hausman test statistic was 1.21, which had a probability value from the χ^2 distribution of .73 (implying that it would be significant at a level of 27 percent). Therefore, we find no statistical evidence that the state tax rate is endogenous to the OLS market share regressions, and we cannot reject the null hypothesis that a single-equation OLS model is appropriate.

TABLE 1
 MARKET SHARE OF PREMIUM-BRAND CIGARETTES:
 OLS REGRESSION RESULTS ($N = 255$)

VARIABLE	COEFFICIENT		
	(1)	(2)	(3)
Constant	62.80*** (8.348)	62.81 (.845)	64.64 (.867)
Unit tax (cents per pack)	.3340** (2.106)	.3272** (2.007)	.3231** (1.978)
Sales tax rate	-.4155 (.481)	-.3442 (.389)	-.3393 (.383)
Per capita income0003 (.073)	.0002 (.056)
Unemployment rate	...	-.7385 (.763)	-.7843 (.807)
Per capita tobacco acres harvested	468.93 (.692)
Set of year dummy variables	yes	yes	yes
Set of state dummy variables	yes	yes	yes
R^2	.551	.552	.553

NOTE.—Absolute t -ratios are in parentheses.

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

Our results also suggest that premium-brand cigarettes have a significantly higher market share solely because of the taxation of cigarettes. The average unit tax on cigarettes in the United States is 54 cents per pack. From our estimates, this would imply that premium-brand cigarettes have a 17 percentage point higher market share in the average state solely because of the taxes applied to cigarettes. The differential impact of per unit taxes on premium and generic brands also has interesting implications for proposals that would finance health care reform with significantly higher per unit cigarette taxes. One might predict that companies that deal primarily in generic brands would expend more in lobbying to prevent the imposition of this tax than companies that deal primarily in premium brands.

III. Conclusion

The empirical significance of Barzel's theory is extremely important since it has become a standard article in the theory of taxation. The most recent empirical test of Barzel's model in this *Journal*, by Sumner and Ward, rejected Barzel's theory. We believe that the previous literature's rejection of Barzel's theory was a result of two factors.

First, data limitations forced previous authors to measure product quality indirectly using data on cigarette prices. This was a problem not only because price is a poor proxy for the quality of cigarettes, but also because these price models required the assumption that the full amount of the cigarette tax was passed on to consumers. A second problem that might have resulted in the previous empirical rejection of Barzel's theory was that before the introduction of generic cigarettes it was much harder for the quality level of cigarettes to differ across states.

We perform the first direct test of Barzel's hypothesis, using data on the relative market shares of premium- and generic-brand cigarettes. In support of Barzel's theory, we find that per unit taxes increase product quality and that they have a different impact on product quality than ad valorem taxes do. In fact, the introduction of generic cigarettes may itself be explained by Barzel's theory regarding the impact of taxation on product quality.

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