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Victor J. Tremblay

This study estimates the welfare effects of cigarette advertising using the framework posited by Becker and Murphy (1993). This model exposes previously unaccounted benefits of cigarette advertising and allows for conventional social welfare estimation by assimilating the theory of advertising into the general theory of complements. The policy implications of the Becker and Murphy framework will rely on the impact of advertising on equilibrium output price. A modification of the new empirical industrial organization technique allows estimation of a supply relation containing advertising in an imperfectly competitive environment. Allowing for different price effects of cigarette advertising before and after the Broadcast Advertising Ban leads to the conclusion that advertising after the ban has a larger price effect than before. This suggests that cigarette advertising is better able to enhance market power after the Broadcast Advertising Ban. Parameter estimates indicate that a one percent increase in cigarette advertising above its 1994 level will precipitate a conservative estimate of a reduction in social welfare of $14.3 million (in 1982 dollars). Thus, even if one ignores externalities altogether, cigarette advertising is clearly excessive from society's point of view.

Cigarette Advertising, Price and Social Welfare: Empirical Evidence

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Stephen J. Farr

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APPROVED:

Redacted for Privacy

Major Professor, representing Economics

Redacted for Privacy

Chair of Department of Economics

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Stephen J. Farr, Author

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Cigarette Advertising, Price and Social Welfare: Empirical Evidence

1. INTRODUCTION

The welfare effect of advertising has long been a subject of debate among economists. The debate stems from diverse beliefs regarding the function of advertising in society. Stigler (1961) suggests that advertising may benefit society by providing information to consumers. Alternatively, Kaldor (1949-50) states that advertising is primarily deceptive in nature and hence reduces welfare by persuading consumers to purchase goods that do not maximize their pre-advertising utility. Nelson (1974) agrees that advertising may provide little direct information to consumers, but rather provides indirect information to consumers by signaling the quality of the advertised goods. Dixit and Norman (1978) argue that advertising shifts tastes and show that advertising is excessive under a variety of assumptions, even when post-advertising tastes are used as the standard for welfare analysis. Fisher and McGowan (1979) propose that advertising creates desirable brand images that increase social welfare through the joint consumption of image-enhancing characteristics along with the goods themselves. Shapiro (1980) suggests Dixit and Norman ignored the distributive gains from advertising in their welfare measure.

Though debate about advertising among economists is long-lived, they have until recently been unable to use standard welfare analysis to show that advertising is excessive. The model proposed by Becker and Murphy (1993) assimilates the theory of advertising

into the theory of complements and in doing so brings clarity and quantitative welfare analysis to the advertising debate. "A major analytical advantage of the [Becker-Murphy] approach that treats advertising as part of given preferences rather than shifting tastes is that the standard welfare analysis becomes directly applicable."[1] The Becker-Murphy model is used in this study to perform a standard welfare analysis of cigarette advertising.

The main insight of the Becker-Murphy model is that it accounts for the benefits of advertising to consumers. Specifically, Becker and Murphy argue that television and radio programming compensates consumers for television and radio advertisements that lower consumer utility. In this paper I will discuss the added possibility that compensation occurs in the form of discount coupons and advertising that subsidizes magazines, newspapers and public transit. Presumably, goods that contain advertisements are partially funded by revenues from advertisers. A glance at the morning newspaper or almost any magazine reveals a large proportion of space devoted to advertising. Without the funds paid to the paper or magazine for these advertisements, the profit-maximizing publishers would either raise the price of the publication or cease production. Hence consumers are compensated for advertising with utility-raising publications. Advertising is also apparent in mass transit. Buses, subways and taxicabs display a large number of advertisements which presumably lower the price of transit for consumers. Promotions at the point-of-sale and specialty item distribution through the mail or at promotional events provide consumers with free samples and price discounts. These benefits should be accounted for when analyzing the social impact of advertising.

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[1] Becker and Murphy (1993, p.956)

Another appealing attribute of the Becker-Murphy model is that it provides an empirical test of whether a change in the market level of advertising is beneficial or harmful to society. As previous research has indicated, the impact of a change in the level of advertising on equilibrium market price will be crucial in determining the total impact on social welfare.[2]

The advertising-price relationship is estimated using a modification of the new empirical industrial organization (NEIO) technique for estimating a firm's reduced- form price equation, or supply relation, in an imperfectly competitive industry. A supply relation is estimable and will include advertising.

The cigarette industry provides an interesting application of the Becker-Murphy framework and NEIO method. Advertising regulation is prominent in the recent history of this imperfectly competitive industry, and further regulation has been proposed. The Broadcast Advertising Ban (1971) made it illegal to advertise cigarettes on television and radio. President Clinton suggested in the State of the Union speech on February 4, 1997 that cigarette advertisements that reach children be banned. Specific policies proposed by the Clinton administration include banning the advertisement of cigarettes on billboards near schools and in media that reach children.

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[2] Becker and Murphy (1993) show that when advertisements are given away with the quantity of advertisements controlled by producers, a firm that maximizes net profits must satisfy $p_x(1-1/\varepsilon_d) = c_x$ and $(\partial p_x/\partial A) = (\partial x/\partial A)(p_x - c_x) = c_a$ for good (x), advertising (A), cost of x = (c_x), cost of advertising = (c_a), price of $x = p_x$, and elasticity of demand for x is ε_d. Similarly, when firms allow consumers to buy all the advertising they want at p_a, the first-order condition becomes $p_x(1-1/\varepsilon_d) + (\partial p_a / \partial x)A = c_x$. Hence advertising tends to raise or lower equilibrium price as it lowers or raises the elasticity of demand for the advertised good. They proceed to show that "the amount of advertising is insufficient if the equilibrium price of the advertised product falls." (p. 958) The assumption that advertising generally raises price is a hallmark of the Dixit and Norman (1978) theory of advertising. Tremblay and Tremblay (1995b) find empirical support that beer advertising tends to raise price.

Cigarette smoking is the primary cause of preventable death according to the 1996 Surgeon General's Report. *Consumer Reports* (December, 1996) states that 419,000 deaths per year are directly attributable to tobacco use. The U.S. Supreme Court has ruled in *Central Hudson Gas Corporation v. Public Service Commission* (447 U.S. 557, 1980) that commercial speech can be restricted if restriction provides a substantial social gain and if the restriction is not more extensive than needed to fulfill its goal. The goal of this study is to determine if greater restrictions on cigarette advertising would augment social welfare.

2. ADVERTISING AND WELFARE

The debate on advertising and welfare is long and diverse. Kaldor (1949-50) discusses the positive and normative economic advertising issues, with the belief that advertising is primarily deceptive in nature. Stigler (1961) provides a discussion of the various forms of direct and useful information that advertising may provide to consumers. Dixit and Norman (1978) develop a model of advertising that shifts tastes and utility, which shows that advertising is always excessive in imperfectly competitive markets. Fisher and McGowan (1979) and Shapiro (1980) comment on Dixit and Norman and provide a discussion of the importance of including the benefits from advertising in a logical manner. Becker and Murphy (1993) consider advertising as part of the stable preference structure of consumers, clarifying the many positive and normative implications of advertising.

Because this paper uses the Becker-Murphy framework, a more detailed discussion is provided. Becker and Murphy (1993) consider a monopoly setting in which advertising (A) affects social welfare (S), measured by the sum of consumer and producer surplus. Social welfare is assumed to be strictly concave and twice continuously differentiable in advertising. The social welfare function is defined as follows:

$$S = V(A,p,T) + \pi(A,p,T), \tag{1}$$

where V is the money value of consumer utility,[3] π is the producer surplus from the production of advertising and output (Q), p is the price of output, and T is any revenue from the sale of advertising to consumers.

Within this framework advertising can be viewed by the consumer as either a good ($\partial V/\partial A > 0$) sold at a positive price ($T > 0$) or a bad ($\partial V/\partial A < 0$), which suggests that people will consume it only if adequately compensated, for example by partially funding magazines, newspapers, and other goods where advertisements are present. When advertising is a bad, revenues flow from producers to consumers ($T < 0$) in the form of subsidized television and radio broadcasting and by partially funding magazines, newspapers, transit, and the price of the advertised good through discount coupons. In this model advertising does not change tastes but is assumed to increase firm demand by acting as a complement to output.

The welfare effect of advertising is determined by totally differentiating equation (1) with respect to A:

$$dS/dA = \partial V/\partial A + (\partial V/\partial p)(dp/dA) + (\partial V/\partial T)(dT/dA) + d\pi/dA. \quad (2)$$

Note that $\partial V/\partial p = -Q$ by Roy's identity. Also $\partial V/\partial T = -1$ as all revenues from the sale of advertising flow from consumers to firms, and revenues are assumed to flow only between consumers and firms. In addition, if the monopoly firm is a profit maximizer, $d\pi/dA = 0$. Thus, equation (2) simplifies to:

$$dS/dA = \partial V/\partial A - Q(dp/dA) - dT/dA. \quad (3)$$

[3] This analysis follows the Becker-Murphy framework, where advertisements and the goods advertised are treated as complements in stable metautility functions.

Given that S is strictly concave in advertising, advertising is excessive if $dS/dA < 0$, is optimal if $dS/dA = 0$, and is undersupplied if $dS/dA > 0$.

It should be noted that the social welfare function given in equation (1) is incomplete if there are externalities associated with smoking [Tremblay and Tremblay (1995b)]. Whether there are significant externalities associated with smoking is also a source of debate among economists. Lee (1991) admits that "second-hand" smoke is irritating to nonsmokers, but argues that the external costs of smoking either do not exist or are internalized by private bargaining. However, Allen (1992) suggests that Lee overlooked the problem of identifying smokers in insurance markets. For example, smokers create a negative externality in life insurance markets, where one cannot identify smokers, and smokers have a higher probability of dying. Furthermore, many individuals (e.g. children) may not be involved in the bargaining process and will not be compensated through bargaining. Coasian bargaining also requires well-defined property rights, an issue that is still being litigated. Additionally, smoking may reduce labor productivity. Data in *Smoking and Health: A Report of the U.S. Surgeon General's Office* (1979) suggest that smokers are absent from work 73 percent more days per year than nonsmokers. This will create a negative externality if production takes place in a team environment. Furthermore, Manning et al. (1989) report that fires caused by smokers destroy more than $300 million worth of property each year.

The sensitivity of demand with respect to advertising is also a source of contention among economists. Schmalensee (1972) did not find significant advertising elasticities for 1953-1967. However Hamilton (1972) found that "advertising tended to boost consumption 95.0 cigarettes per year" per capita. Seldon (1989) also finds that

advertising increases demand. Tremblay and Tremblay (1995a, p. 123) found that a 1 percent increase in advertising expenditures would "generate a 0.095 percent increase in per capita cigarette consumption or 3.67 cigarettes per person (aged 18 or older) per year." Increased demand will lead to a higher associated externality. Hence smoking externalities and cigarette advertising are related through demand. These facts suggest that the social welfare function should include potential negative externalities when analyzing the welfare effect of cigarette advertising. Allowing for externalities and more than one producer of cigarettes, the social welfare function becomes:

$$S = V(A,p,T,E) + \pi(A,p,T,E) \tag{4}$$

where π is now the aggregate producer surplus from all firms in the economy and E is the dollar value of externalities associated with cigarette smoking. Note that $\partial V/\partial E < 0$ and $\partial \pi/\partial E \leq 0$.[4] The associated change in welfare due to a change in cigarette advertising is now:

$$dS/dA = \partial V/\partial A - dT/dA - Q(dp/dA) + (\partial V/\partial E + \partial \pi/\partial E)dE/dA + \Phi \tag{5}$$

where $\Phi \equiv [(\partial \pi/\partial A) + (\partial \pi/\partial p)(dp/dA) + (\partial \pi/\partial T)(dT/dA)]$. If competition is sufficient to ensure that long-run profit is zero or if producers act as a cartel then $\Phi = 0$.[5] Since there is no evidence of economic profit in cigarette production,[6] equation (5) can be rewritten as the partial differential:

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[4] Assuming an increase in the externality due to cigarette smoking does not increase profit. Studies show that smokers exhibit higher absentee rates, presumably negatively affecting the productivity of their co-workers.

[5] Otherwise, $\Phi < 0$ as in a non-cooperative setting it is optimal for each firm to advertise more than that which maximizes joint profit, hence the non-cooperative level of advertising will exceed the optimal (joint profit-maximizing) level of advertising. See Tremblay and Tremblay (1995b) Appendix B for a thorough proof.

[6] Tobacco manufacture seems to have normal returns compared to the rest of the manufacturing sector. Return on equity is ranked as the best measure of accounting profitability by CPA's according to Troy

$$dS = V_A dA - (dT/dA)dA - Q(dp/dA)dA + (V_E + \pi_E)(dE/dA)dA \quad (6)$$

where $V_A = \partial V/\partial A$, $V_E = \partial V/\partial E$, and $\pi_E = \partial \pi/\partial E$.

Equation (6) provides an estimable equation for the change in social welfare due to a change in cigarette advertising. General equilibrium effects are ignored in this study, which is appropriate if similar price and advertising changes occur in markets for pipe tobacco, chewing tobacco and cigars. Sources which are discussed below will provide estimates of V_A, dT/dA, and $(V_E + \pi_E)(dE/dA)$. Section 4 will estimate (dp/dA). Because it will be shown that cigarette advertising is excessive, and economists do not agree on the value of the components of equation (6), the selected estimates of the components of equation (6) are biased against this conclusion. This will bias the estimate of dS upward, in favor of the conclusion that advertising is insufficient from society's point of view.

The change in advertising (dA) is set equal to \$24.4 million, one percent of the 1994 level of domestic cigarette advertising expenditures in 1982 dollars.[7] The change in the money value of consumer utility with respect to a marginal increase in cigarette advertising, ceteris paribus is V_A. V_A times the change in advertising (dA) is then the total change in the dollar value of consumer utility, $V_A dA$. Tremblay and Tremblay (1995a) estimate $V_A dA$ to be at most \$18.3 million (1982 dollars) in the image-creating view of advertising.[8]

(1995). Return on equity in tobacco manufacture was 4.9% in 1995. Meat products and alcoholic beverages other than malt beverages also had a 4.9% return on equity for the same period. Dairy products, preserved fruits and vegetables, malt liquors, bottled soft drinks and women's and children's clothing manufacture exhibited 6.6%, 9.9%, 8.9%, 13.4% and 11.2% return on equity, respectively for the same period. Figures are from Troy (1995).

[7] Cigarette advertising expenditures are from the Federal Trade Commission (1994), deflated by the producer price index as published by the U.S. Department of Commerce (1995).

[8] This is the largest increase in consumer surplus reported by Tremblay and Tremblay (1995a) using similar data and a model similar to that described in section 3.

The change in the flow of revenue from the sale of advertising with respect to a change in advertising is dT/dA. Cigarette advertising in newspapers, magazines, coupons and transit accounted for 67 percent of domestic cigarette advertising expenditures in 1994.[9] The remainder of advertising expenditures went to fund outdoor (billboard), point-of-sale, specialty distribution and direct mail advertising. Though it may be difficult to argue that billboards and direct-mail advertising benefit consumers, I assume that all advertising expenditures subsidize the price of utility-raising goods. Hence $dT/dA = -1$ and $-(dT/dA)dA = \$24.4$ million.

Though the external costs of smoking are likely large, they are considered to be nonexistent in this study. Therefore the estimate of the increase in the externality due to an increase in advertising $(V_E + \pi_E)(dE/dA)dA = \$0$.

Given the above information, equation (6) reduces to (in millions of 1982 dollars):

$$dS = \$18.3 \text{ million} + \$24.4 \text{ million} - Q(dp/dA)dA - \$0 \text{ million}. \quad (7)$$

Equation (7) implies that cigarette advertising is socially excessive if the price effect due to a marginal increase in advertising expenditures, $Q(dp/dA)dA$, is greater than \$42.7 million in 1982 dollars. This result supports the Becker-Murphy (1993) and Dixit-Norman (1978) findings that the social impact of a change in advertising hinges on the price effect and indicates that the answer to this question is an empirical answer. The remainder of this study will focus on the price effect of a marginal change in advertising.

[9] Federal Trade Commission (1996).

3. THE EMPIRICAL MODEL

The new empirical industrial organization (NEIO) approach, as described by Bresnahan (1989), provides a method for estimating the determinants of a firm's equilibrium price in an imperfectly competitive setting. For empirical estimation, the firm's first order condition for profit maximization is normally written as:

$$p_i = MC_i + \lambda q_i, \tag{8}$$

where p_i is the price firm i charges, q_i is the quantity produced by firm i and λ is the market power parameter

$$\lambda = -[\partial p_i/\partial q_i + (\partial p_i/\partial Q_j)(\partial Q_j/\partial q_i)]. \tag{9}$$

The first order condition (8) is referred to as the firm's supply relation, where Q_j is aggregate industry output excluding q_i and $\partial Q_j/\partial q_i$ is the conjectural variation. The conjectural variation is a measure of the degree to which firm conduct is collusive.[10] This supply relation is desirable for it allows one to test for both price-setting ($\lambda > 0$) and price-taking ($\lambda = 0$) behavior. The industry supply relation is the aggregate of firm's individual profit maximization conditions. In this case λ measures average industry market power.[11]

To allow market power to vary with advertising, the supply relation should allow price to also be a function of advertising. Hence:

$$P = MC + \lambda_0 Q + \lambda_1 A \tag{10}$$

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[10] See Bresnahan (1989) and Schmalensee (1972) for more on this issue.

[11] This assumes Gorman polar form of costs: that firms have linear and parallel expansion paths, so that MC are constant and equal across firms. This is a common assumption that is usually implicit in aggregate production or consumption studies. See Bresnahan (1989) for aggregative interpretation issues.

at the industry level.[12] Advertising is interacted with two dummy variables to allow for different effects of advertising before and after the broadcast advertising ban. Adding a stochastic error term, the supply relation now becomes:

$$P = MC + \lambda_0 Q + \lambda_1 A^* D_{55} + \lambda_2 A^* D_{71} + \mu \qquad (11)$$

where D_{55} = 1 for 1955 to 1970 and = 0 thereafter, D_{71} = 0 for 1955 to 1970 and = 1 thereafter, and μ is the stochastic error term.

Following Tremblay and Tremblay (1995a), marginal cost (*MC*) is assumed to be constant and equal to average cost,[13] and is defined as:

$$MC = [PAY + MATL + (ASSETVAL^* AAABOND) + A] / Q + TAX \qquad (12)$$

where *PAY* = total payroll for all employees (in millions of 1982 cents), *MATL* = total cost of materials (in millions of 1982 cents), *ASSETVAL* = gross value of fixed assets (in millions of 1982 cents), *AAABOND* = Moody's AAA corporate bond rate, *A* = advertising expenditures (in millions of 1982 cents), *Q* = quantity of cigarettes domestically consumed (in millions), and *TAX* = total state and federal tax per cigarette (in 1982 cents).

Economic theory suggests that price and income should enter into the demand for cigarettes. I will also allow for variable advertising effects on demand before and after the Broadcast Advertising Ban. A post-1972 time trend allows for the possibility that preferences for smoking changed after 1972 due to increased awareness of the hazards of smoking and decreased availability of smoking areas due to adoption of Clean Air policies.[14] A dummy variable representing the Fairness Doctrine which required that one

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[12] Let $p = MC + \lambda Q$ where $\lambda = \lambda_0 + \lambda_1(A/Q)$. Then $p = MC + \lambda_0 Q + \lambda_1(A/Q)Q = MC + \lambda_0 Q + \lambda_1 A$.

[13] This assumption is consistent with Applebaum (1982).

[14] A time trend specification is used as a proxy for the increasing state and municipal adoption of Clean Indoor Air laws beginning in Arizona in 1972. See Chaloupka and Saffer (1992) for more on Clean Indoor Air laws.

anti-smoking advertisement be aired for every four pro-smoking advertisements is also included. The following market demand equation is proposed:

$$PCQ = \beta_0 + \beta_1 P + \beta_2 PCY + \beta_3 A*D_{55} + \beta_4 A*D_{71} + \beta_5 * T_{1972} + \beta_6 D_{FAIR} + \varepsilon \qquad (13)$$

where PCQ = per capita quantity (in thousands), P = retail price per cigarette (in cents), PCY = per capita disposable income (in 1982 dollars per person), A = advertising expenditures (in millions of 1982 dollars), T_{1972} = post-1972 time trend (= year - 1972 for 1973-94, = 0 otherwise), D_{FAIR} is the Fairness Doctrine dummy variable (= 1 for 1968-70, = 0 otherwise), and ε is a stochastic error term.[15]

Annual cigarette industry data from 1955 through 1994 are used to estimate the system of equations (11) and (13). The price effect of an increase in cigarette advertising expenditures, $Q(dp/dA)dA$, will be estimable after obtaining asymptotically unbiased and efficient parameter estimates of this system of equations.

[15] Alhough the theory of rational addiction has found widespread empirical support, [Becker et al. (1991), (1994), Chaloupka (1991), Olekalns and Bardsley (1996)], it requires the inclusion of all past and future prices and advertising, and is therefore unidentified. Akerloff (1991) poses a strong argument that the decision to pursue addictive activities represents time-inconsistent behavior, with rapid and large discounting of the future. Keeler et al. (1993) find little difference in elasticity of demand estimates for no addiction, myopic addiction and rational addiction to cigarettes.

4. EMPIRICAL RESULTS

Means and standard deviations of variables are listed in Table 1. The demand function and supply relation are estimated using two-stage least squares (2SLS) and three-stage least squares (3SLS) to correct for correlation of errors across equations. Analysis detects significant first-order autocorrelation in both the demand equation and supply relation.[16] Hence 2SLS and 3SLS estimates are corrected for first-order autocorrelation using generalized least squares. Regression results are reported in Table 2.

The price coefficient estimates are negative and significant. 2SLS and 3SLS parameter estimates and mean values for price and per capita consumption provide inelastic 2SLS and 3SLS price elasticity of demand estimates of -0.53 and -0.65 respectively. This is in accordance with a wealth of prior research on cigarette price-elasticity estimates as reported by Sung et al. (1994). Price elasticity of demand estimates evaluated at 1994 levels of price and quantity are elastic at -1.12 and -1.37 for 2SLS and 3SLS respectively. The difference in the estimates is most likely a consequence of the linear specification suggesting high elasticities at extreme values.[17] Estimates for the post-1972 time trend are negative and significant, suggesting that state and local laws regarding smoking have reduced per capita consumption of cigarettes. The W3SLS parameter estimate for pre-1971 advertising is positive and significant at the 5 percent level of significance. The other demand parameter estimates for advertising are positive, but

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[16] First-order autocorrelation is detected by regressing the two-stage least squares residuals on their lagged values. The autoregressive parameter (ρ) is significant at the .10 level of confidence. This estimate was used to correct for autocorrelation in the demand function and supply relation.

[17] The 1994 quantity is 467,000,000,000 cigarettes (lower than the mean value), and the 1994 price is 5.33 cents per cigarette (higher than the mean value).

Table 1
Variable Definitions, Means and Standard Deviations
for Cigarette Industry Data, 1955-1994

Variable Name	Definition	Mean (Std. Dev.)
PCQ	Per capita quantity (in thousands) = Q/(Population 18 years and older)	3.7426 (0.5262)
P	Retail price per cigarette including taxes (in cents; 1982 $)	4.8135 (0.6333)
PCY	Per capita disposable income (1982 $) = Disposable income/total population	9550.82 (2049.66)
MC	Marginal cost proxy (in cents; 1982 $) =[payroll for all cigarette employees + total cost of cigarette materials + (gross value of fixed assets in cigarette industry x Moody's AAA corporate bond rate) + Advertising expenditures] / Q + Federal and weighted average state tax per cigarette (in cents; 1982 $)	2.9897 (0.4221)
Q	Quantity of cigarettes domestically consumed (in millions)	530333.08 (67511.69)
A	Advertising expenditures (millions of 1982 $)	1180.69 (759.138)
T_{1972}	Clean Indoor Air time trend = year-1972 for 1973-1994; = 0 otherwise	5.775 (7.1198)
D_{FAIR}	Fairness Doctrine Act Dummy = 1 for 1968-1970; = 0 otherwise	0.075 (0.2667)
D_{55}	Pre-Broadcast Advertising Ban Dummy =1 for 1955-1970; = 0 otherwise	0.400 (0.4961)
D_{71}	Post-Broadcast Advertising Ban Dummy =1 for 1971-1994; = 0 otherwise	0.600 (0.4961)

Table 2
Cigarette Industry Demand Equation and Supply Relation
Parameter Estimates

Variable Name	W2SLS Parameter Estimates	W3SLS Parameter Estimates
	Demand Equation	
Constant	5.0483[a] (4.97)	5.0173[a] (5.72)
P	-0.4636[a] (-4.31)	-0.5664[a] (-6.06)
PCY	0.0001 (1.08)	0.0002 (1.79)
*A*D55*	0.0005 (1.39)	0.0008[b] (2.43)
*A*D71*	0.0001 (0.60)	0.0002 (1.14)
T_{1972}	-0.0670[a] (-3.48)	-0.0743[a] (-4.24)
D_{FAIR}	0.0266 (0.05)	0.0605 (0.13)
Adjusted R^2	0.9322	0.9004
	Supply Relation	
Q (x10^6)	2.3696[a] (12.51)	2.3673[a] (12.50)
*A*D55*	0.0004[a] (2.29)	0.0004[a] (2.30)
*A*D71*	0.0005[a] (7.62)	0.0005[a] (7.63)
Adjusted R^2	0.8287	0.8287
N	40	40

Note: Figures in parentheses are t-ratios (two-tailed test).
a = significant at .01 level of confidence
b = significant at .05 level of confidence
c = significant at .10 level of confidence

individually insignificant. However, the demand parameters for advertising before and after the Broadcast Advertising Ban are positive and jointly significant.[18] Given a number of pairwise correlation coefficients among exogenous variables in excess of .80 and a high adjusted R^2, the individual lack of significance is likely due to multicollinearity.

Supply relation parameter estimates are positive and significant at better than one percent. These results indicate that market power is present in the cigarette industry, and that advertising enhances market power. An interesting result is that λ_2 is significantly greater than λ_1 at conventional levels of confidence. This suggests that advertising is better able to enhance market power after the Broadcast Advertising Ban. The Broadcast Advertising Ban limited the national advertising possibilities for cigarettes, and hence may have increased the barrier to entry of new products.[19]

Interpretation of this positive price-advertising effect may be due to the fact that advertising signals a higher level of quality. Becker and Murphy (1993, p.956) point out that "advertised goods may have good qualities that are not observed by econometricians, as implied by the signaling literature." In general, however, advertising does not appear to signal high quality [Caves and Greene (1996)], and it appears to be particularly unlikely for cigarettes. Indeed, Becker and Murphy (p. 944) "do not believe that the intensive advertising for Miller beer, Chevrolet cars, or Marlboro cigarettes, to take a few examples, is signaling exceptionally high product quality." Cigarette producers use a similar technology and inputs, hence cigarettes are generally of the same quality level regardless of brand. The industry data utilized in this study do not imply that advertised cigarettes are

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[18] Reject H_0: $\beta_3 = \beta_4 = 0$ at the .05 level of significance. (F-statistic: $F_{(1,30)} = 4.17$. F-values for 2SLS and 3SLS respectively: 7.2567, 4.4865 > 4.17 therefore reject H_0.)

[19] This is supported by Eckard (1991).

higher-priced than cigarettes that are not advertised, rather they imply that a higher aggregate level of advertising leads to market power and higher aggregate prices.

Estimates of λ_2 indicate that a one percent increase in the 1994 level of cigarette advertising will result in a price effect ($Q(dp/dA)dA$) of -$57 million (in 1982 dollars).[20] Substituting the price effect into equation (7), a one percent increase in cigarette advertising above its 1994 level will precipitate the following conservative estimate of a reduction in social welfare (in 1982 dollars):

$$dS = \$18.3 \text{ million} + \$24.4 \text{ million} - \$57 \text{ million}$$

$$= -\$14.3 \text{ million.}$$

Thus, even if one ignores externalities altogether, cigarette advertising is clearly excessive from society's point of view.

[20] Q = 467,000,000,000 cigarettes, dp/dA = 0.0005 cents per cigarette per millions of 1982 dollars ceteris paribus, and dA = $24,400,000 (in 1982 dollars).

5. CONCLUSION

Becker and Murphy have recently developed a theoretical model of advertising and welfare that may be empirically estimated. Following Becker and Murphy, this analysis incorporates previously unaccounted social benefits of cigarette advertising including the utility from advertising when analyzing social welfare effects. An application of the NEIO technique within the Becker-Murphy framework provides an estimate of the welfare effect of advertising in the domestic cigarette industry.

Advertising may benefit consumers by providing useful information and subsidizing consumer goods. However, results show that an increase in advertising decreases social welfare as these benefits are outweighed by the large positive effect of cigarette advertising on the price of cigarettes. Therefore cigarette advertising is excessive in spite of the television and radio broadcast advertising ban. Hence society may benefit substantially from limiting cigarette advertising below its current equilibrium level.

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