THE IMPACT OF ADDICTION INFORMATION ON CIGARETTE CONSUMPTION*

by

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Although cigarette manufacturers were aware of the addictive properties of nicotine as early as 1962, the information did not become available to the U.S. public until 1979 when it was disclosed by the Surgeon General. This study examines the impact that this information had on the demand for cigarettes. It is posited that the release of addiction information served to make consumers aware of the implications of current consumption levels for future choices. In the absence of this information, consumers had to rely on their past consumption experience of the addictive good. That is, we posit that consumer demand was myopic before the release of information in 1979 and switched to a rational form after the dissemination of addiction information. The theoretical model also generalizes the rational addiction model to include non-addictive goods. In addition, the model constructed in this paper empirically modifies the rational addiction model to allow for the possibility of structural changes in the demand function which may have occurred beginning in 1979. A number of empirically testable restrictions on the signs and relative magnitudes of the coefficients of the corresponding demand functions are derived from the theoretical model. A state disaggregated annual time series for the U.S. comprised of consumption, price, and income data along with three smuggling indices was used to empirically test our hypotheses. The data fit the hypothesized model remarkably well, and a switch from myopic to rational demand in 1979 was observed. Signs and relative magnitudes of all coefficients were significant and consistent with the theory. We find that the impacts of past consumption and price on current consumption decline after the release of addiction information, while future consumption becomes a significant factor only after the release of addiction information.

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Although per capita cigarette consumption in the U.S. increased rapidly until about 1960, the last four decades have experienced a steady decline in smoking. Part of this decline has been attributed to the increasing evidence of health hazards associated with smoking. As early as 1953, the American Cancer Society and the British Medical Research Council reported that smoking caused increased mortality rates. By 1964, the Surgeon General had linked smoking to cancer. In the ensuing 15 years, health warnings were required to be printed on cigarette packs and tobacco advertising was limited and eventually banned from broadcast media. In 1979, the Surgeon General conclusively stated that cigarettes were addictive and by 1986 reported that cigarette smoking was the leading preventable cause of premature death and disability in the U.S. During this same time frame, increasing excise taxes were working in combination with the health warnings to diminish aggregate smoking levels.

Econometric studies of the demand for cigarettes have been numerous in the literature. In the earliest studies, cigarettes were modeled as a non-addictive good with demand primarily dependent upon income and own price (Hamilton, 1972). Later, the addictive nature of cigarettes was accounted for in so-called “myopic” models by including past cigarette consumption as an additional independent variable in the demand equation (Winston, 1980). Most recently, Becker and Murphy (1988) suggested that agents were “rational” (i.e., considered the future consequences of their actions). Becker and Murphy explicitly accounted for the addictive effects of nicotine by incorporating an addictive stock into the utility function and by using an optimal control approach to derive time consistent dynamic demand functions. This approach yielded demand functions in which current consumption depended on both past and future consumption. Work by Chaloupka (1991) and by Becker, Grossman, and Murphy (BMG) (1994) gave empirical evidence to suggest that the rational model is more consistent with consumer behavior than the myopic model.

The specific focus of this study will be the impact of addiction information on the demand for cigarettes. The Surgeon General did not inform the public about the addictive nature of nicotine until 1979 although by the early 1960s major tobacco firms already knew that cigarettes were addictive (Glantz, et al., 1995). The theory of rational addiction will be used but modified both theoretically and empirically to account for the release of addiction information in 1979. Our theory will be empirically tested on annual U.S. per capita state-level data from 1955 to 1994.

THEORETICAL MODEL

In keeping with BGM who specify the optimization process in terms of discrete functions, the agent's utility function at any point in time is represented by

$$U_t = U(Y_t, C_t, A_t, e_t) \qquad (1)$$

where C_t is the addictive good (cigarettes); Y_t is the composite good; A_t is the stock of the addictive good; and e_t represents other unobservable period t events that impact utility. By assumption, $U_{C_t} > 0$ (withdrawal), $U_{A_t} < 0$ (tolerance), and $U_{Y_t} > 0$. $U(\cdot)$ is assumed to be strictly concave in all of its arguments. (See Becker and Murphy for details.)

As in other models of rational addiction, a stock constraint must be specified. Our simple constraint

$$A_t = (1 - \delta)C_{t-1} \qquad (2)$$

allows a non-addictive good to be nested within the rational model. δ is the depreciation rate of the addictive stock. Note that if the depreciation effects of the good are complete and instantaneous (i.e., δ=1), the addictive stock would be zero and the good is non-addictive.

Assuming the agent lives for T years and discounts future utility at r, the rate of market interest, and substituting equation (2) into (1), the agent's lifetime utility function can be written

$$U(0) = \sum_{t=1}^{T} \beta^{t-1} U(Y_t, C_t, (1-\delta)C_{t-1}, e_t) \tag{3}$$

where $\beta \equiv 1/(1+r)$ is the agent's discount factor. When perfect capital markets are assumed to exist, the lifetime budget constraint is given by:

$$\sum_{t=1}^{T} \beta^{t-1}(Y_t + P_t C_t) = W_0 \tag{4}$$

where W_0 is the present value of lifetime wealth; the price of Y_t is one since Y_t is the numeraire; and P_t is the relative price of the addictive good in period t. The consumer is assumed to maximize lifetime utility given by equation (3) subject to an initial value of consumption, C^0, and the lifetime budget constraint, equation (4). If it is further assumed that the utility function is quadratic in all its arguments, the following rational demand for cigarettes can be derived:

$$C_t = \alpha_0 + \alpha_1 C_{t-1} + \alpha_2 C_{t+1} + \alpha_3 P_t + \alpha_4 e_t + \alpha_5 e_{t+1} \tag{5}$$

where $\alpha_1 = \beta\alpha_2$ and the α's are non-linear functions of the parameters of the quadratic utility function, β, δ, and the Lagrange multiplier (which is fixed due to the assumption that the marginal utility of wealth is constant). (See Fenn and Antonovitz (1998) for details.)

The preceding derivation of a demand function for a rational addict is based on the assumption that the consumer knows that the good is addictive and acts in a forward looking or rational manner. However, for the case of cigarettes, the Surgeon General did not specifically inform the public that cigarettes were addictive until 1979. In this paper, we posit that without this addiction information, consumers act in a myopic manner. Although cigarettes are indeed addictive and consumption levels must compensate for the effects of tolerance, reinforcement and withdrawal due to past consumption, consumers do not explicitly account for the effect of present consumption on future utility before 1979. In other words, a one-period utility maximization process is undertaken subject to an addictive stock constraint and a one-period budget constraint. Again assuming a quadratic form of the utility function, the following myopic demand function can be derived:

$$C_t = \theta_0 + \theta_1 C_{t-1} + \theta_2 P_t + \theta_3 e_t \qquad (6)$$

where the θ's are non-linear functions of the parameters of the utility function, δ, and the Lagrange multiplier. (See Fenn and Antonovitz for details.)

In this study we posit that before 1979 demand was myopic and took the form of equation (6); while after the release of the Surgeon General's Report in 1979, demand became rational as represented by equation (5). It is also critical to note that the α's in the rational demand equation are not necessarily equal to the θ's in the myopic demand equation. Hence, unlike previous studies which simply include intercept shifters to capture changes in information sets, for the case of an addictive good, this model allows for the possibility of a change in both the intercept and the slope coefficients after the release of addiction information. Furthermore, in keeping with Chaloupka, if it is also assumed that C_t and A_t do not effect the marginal utility of Y_t, the following testable implications of our hypothesis can be easily derived: $\theta_1 > \alpha_1 > 0$, $\alpha_2 > 0$, $\theta_2 < 0$, $\alpha_3 < 0$, and $|\theta_2| > |\alpha_3|$. In other words, past consumption will have a positive impact, and price a negative impact, on current consumption in both the pre-information and post-information time periods. Future consumption is predicted to have a positive impact on current consumption only after 1979. In addition, after the release of addiction information, the ability of a unit of last period's consumption to increase this period's consumption declines, and the effect of current price on current quantity demanded is dampened. (See Fenn and Antonovitz for details.)

METHODOLOGY

The data set used in this work is comprised of state disaggregated annual time-series for the fifty U.S. states and the District of Columbia from 1955-1994. It is essentially the same as that used by BGM but extended by nine years. Hence, additional details on the sources and construction of the variables can be found in their paper. Consumption, C_t, is measured by per capita tax-paid cigarette sales in packs. Price, P_t, is the average real retail price per pack including state and federal excise taxes in 1982-84 dollars. Because of significant differences in state excise taxes, it is important to account for the impact of interstate smuggling on per capita cigarette sales. BGM as well as other authors account for two types of smuggling: short-distance or casual smuggling and long-distance or commercial smuggling. Casual smuggling refers to the actions of consumers who live in high-tax states but purchase cigarettes in neighboring low-tax states for consumption at home. Commercial smuggling refers to the organized attempts by distributors to purchase cigarettes in the low-tax states of Virginia, North Carolina, and Kentucky without the local tax indicia being attached. They then ship them to other states where counterfeit local indicia are attached. These cigarettes are sold at (higher) existing retail prices. We use the same indices as BGM to account for casual import smuggling, $SDTIMP_t$; casual export smuggling, $SDTEXP_t$; and commercial smuggling, $LDTAX_t$. Each of these tax indices is predicted to have a negative impact on cigarette consumption. (See Fenn and Antonovitz for details.) Finally, in keeping with BGM, annual state specific real per capita disposable income, INC_t, is also included in the analysis.

Because myopic demand is a sub case of the rational addiction demand function, one can operationalize the hypothesized structural changes in the demand function by specifying a regression equation which allows one to model the changes in the magnitudes of the coefficients for the rational addiction demand function. This is done by including a dummy variable, INFO, which, if significant, will alter the magnitudes of the post-1979 coefficients. INFO takes on a value of zero for any year prior to 1979 and a value of one for the years 1979 and beyond. The complete regression equation is given by

$$
\begin{aligned}
C_t = {} & \eta_0 + \eta_1 C_{t-1} + \gamma_1(\mathrm{INFO} * C_{t-1}) + \eta_2 C_{t+1} + \gamma_2(\mathrm{INFO} * C_{t+1}) \\
& + \eta_3 P_t + \gamma_3(\mathrm{INFO} * P_t) + \eta_4 \mathrm{INC}_t + \gamma_4(\mathrm{INFO} * \mathrm{INC}_t) + \eta_5 \mathrm{SDTIMP}_t \\
& + \gamma_5(\mathrm{INFO} * \mathrm{SDTIMP}_t) + \eta_6 \mathrm{SDTEXP}_t + \gamma_6(\mathrm{INFO} * \mathrm{SDTEXP}_t) \\
& + \eta_7 \mathrm{LDTAX}_t + \gamma_7(\mathrm{INFO} * \mathrm{LDTAX}_t) + \varepsilon_t \qquad (7)
\end{aligned}
$$

Note that the theory only predicts structural breaks in the coefficients on C_{t-1}, C_{t+1}, and P_t. However, structural breaks in the remaining coefficients are also considered for completeness. Predicted signs for all of the regression coefficients are summarized in Table 1.

EMPIRICAL PROCEDURES AND RESULTS

Because the data set is a state-specific time-series, a fixed effects model that employs state-specific and annual dummies is used. The annual dummies pick up the yearly effects of health information and the recent media coverage of the tobacco industry, while the state dummies compensate for the diversity in demographic composition, income and other state specific variables that may be correlated with cigarette consumption.

Since the theoretical model is based on an intertemporal dynamic optimization, C_{t-1} and C_{t+1} are endogenous in equation (7). Faced with same problem but with a somewhat shorter data series, BGM reject the null hypothesis of consistent OLS estimates at the one percent level using a De-Min Wu F-test. They devise several different sets of instrumental variables to account for the endogeneity of past and future consumption. Similarly, we use different combinations of lags and leads of cigarette prices and excise taxes along with the other truly exogeneous variables in the model as instruments. These sets of instruments are summarized in Table 2. A two-stage least squares estimation (2SLS) procedure is performed using each of four models listed in this table. As a comparison, an OLS estimate is also obtained and is referred to as model (v).

Finally, BGM address the concern about the presence of serial correlation and heteroscedasticity by computing a variance-covariance matrix that was adjusted for the effects of serial correlation and found that the corrected standard errors were not very different from the uncorrected ones. They also used weighted least squares to correct for possible heteroscedasticity and found that their results did not change significantly. Hence, we felt that these concerns had already been adequately addressed for the purposes of our study.

The empirical results from each of the five models are reported in Table 3. The left half of the table gives the estimates of the demand equation parameters in the pre-information years (pre-1979), and the right half gives the post-information coefficients. The coefficients in any particular column correspond to the estimates obtained by using the set of instruments indicated by the column number described in Table 2. The estimates for the various sets of instruments are in general agreement in sign and magnitude and, hence, are used in the discussion of the empirical results that follows. OLS estimates (model v) are simply given for the purpose of comparison but are likely to be inconsistent.

First, note that both the pre and post-information coefficients on C_{t-1} are positive and significant giving empirical evidence that cigarettes are, indeed, an addictive good. Also, as predicted by theory, the coefficient on C_{t-1} becomes significantly smaller (or past consumption has a smaller influence on current consumption) after 1979.

The coefficient on C_{t+1} is not significantly different from zero in the pre-1979 years. However, in the post information period, estimates are positive and significant which is in keeping with the prediction that a higher level of past consumption will spur an increase in current consumption for a known addictive good. Hence, these results suggest that the demand for cigarettes was myopic prior to 1979 but switched to a rational demand function after the release of addiction information.

The pre-1979 coefficient of INC_t suggests that cigarettes were a normal good before information was released; while afterwards, this coefficient became negative but lost significance. The theory gives no prediction of the sign of this coefficient before or after the release of information. In addition, it is interesting to note that a decline in the price of cigarettes appears to lose its sales generating potential in the post-1979 time period as predicted by the theory.

The coefficients of all three smuggling variables are negative and significant both before and after 1979 which is consistent with predictions from the theory. Although there are no theoretical predictions for structural breaks on these coefficients, only $SDTEXP_t$ exhibits one.

The empirical results support the theory quite strongly. The 2SLS estimates are not sensitive to the choice of instruments. The hypothesized shift from myopic to rational demand is observed. All coefficients have signs and relative magnitudes that are in accordance with their theoretical counterparts. These were summarized earlier in Table 1.

Recall that in the derivation of the rational addiction demand, equation (5), $\alpha_1=\beta\alpha_2$. This suggests that estimates of the discount factor, β, and the corresponding interest rate, r, can be easily obtained by η_1/η_2 before 1979 and by $(\eta_1+\gamma_1)/(\eta_2+\gamma_2)$ after 1979. These estimates are given at the bottom of Table 3. Prior to 1979, the estimates of r are implausibly large; while after 1979, they are negative. Since these estimates of the interest rates may cast suspicion on the robustness of our model, we re-estimate model (iv) using values of β fixed at more plausible values. The results from these restricted regressions are reported in Table 4.

The basic findings that were reported in Table 3 remain unaltered by the imposition of different values of β ranging from 0.75 to 0.95. These values of β correspond to interest rates of 0.33 to 0.05, respectively. As Table 4 indicates, there is still a shift from a myopic to a rational pattern of consumption after the release of addiction information. The influence of past consumption on current consumption gets weaker after the release of addiction information. The influence of price on current consumption declines in the post-1979 period compared to its influence prior to 1979. The smuggling indices retain their negative signs as predicted by the theory. In essence, the imposition of reasonable discount factors does little to undermine the empirical support the for rational addiction model with structural breaks.

SUMMARY AND CONCLUSIONS

In 1979 the Surgeon General informed the American public that cigarette smoking was addictive. This study examines the impact that this information had on the demand for cigarettes. We posit that consumer demand was myopic before the release of this information in 1979 but switched to a rational form after the dissemination of addiction information. Given these hypotheses, a number of empirically testable restrictions on the coefficients of the corresponding demand functions were derived. A state disaggregated annual time series for the U.S. comprised of consumption, price, and income data along with three smuggling indices was used to empirically test our hypotheses. The data fit the hypothesized model remarkably well, and a switch from myopic to rational demand in 1979 was observed. Signs and relative magnitudes of all coefficients were significant and consistent with the theory.

This work provides a starting point for many interesting research questions. Perhaps an estimate of how the demand for cigarettes might have changed if the addiction information had been released in the early 1960s could be examined along with the value of this information.

Table 1. Regression Coefficients and their Predicted Signs

Variable	Regression Coefficient	Predicted Sign
C_{t-1}	η_1	Positive
C_{t+1}	η_2	Zero
P_t	η_3	Negative
INC_t	η_4	Indeterminate
$SDTIMP_t$	η_5	Negative
$SDTEXP_t$	η_6	Negative
$LDTAX_t$	η_7	Negative
$INFO*C_{t-1}$	γ_1	Negative
$INFO*C_{t+1}$	γ_2	Positive
$INFO*P_t$	γ_3	Positive
$INFO*INC_t$	γ_4	Indeterminate
$INFO*SDTIMP_t$	γ_5	Indeterminate
$INFO*SDTEXP_t$	γ_6	Indeterminate
$INFO*LDTAX_t$	γ_7	Indeterminate

Table 2. Sets of Lag and Lead Instruments for C_{t-1} and C_{t+1}

Model	Instruments Used
(i)	P_{t-1} and P_{t+1}
(ii)	P_{t-1}, P_{t+1} T_t and T_{t-1}
(iii)	P_{t-1}, P_{t+1} T_t, T_{t-1} and T_{t+1}
(iv)	P_{t-2}, P_{t-1}, P_{t+1} T_t, T_{t-1} , T_{t+1} and T_{t-2}

Table 3. Pre and Post-Information Estimates of Cigarette Demand

(Asymptotic t-ratios are in parentheses)

RHS	PRE-1979 COEFFICIENTS						POST-1979 COEFFICIENTS					
Variables	Reg	2SLS[b]				OLS[c]	Reg	2SLS[b]				OLS[c]
	Coef[a]	(i)	(ii)	(iii)	(iv)	(v)	Coef	(i)	(ii)	(iii)	(iv)	(v)
C_{t-1}	η_1	0.557	0.445	0.509	0.562	0.489	$\eta_1+\gamma_1$	0.312	0.276	0.261	0.314	0.491
		(7.438)	(6.411)	(7.845)	(9.696)	(32.380)		(6.913)	(6.020)	(5.514)	(7.500)	(17.656)
C_{t+1}	η_2	0.054	0.105	0.013	0.056	0.437	$\eta_2+\gamma_2$	0.348	0.338	0.328	0.347	0.429
		(0.607)	(1.210)	(0.172)	(0.784)	(27.090)		(9.081)	(8.448)	(7.902)	(9.240)	(15.170)
P_t	η_3	-34.886	-39.473	-41.633	-34.290	-10.833	$\eta_3+\gamma_3$	-19.581	-22.123	-23.122	-18.745	-7.365
		(-6.752)	(-7.600)	(-7.833)	(-7.354)	(-3.849)		(-4.824)	(-5.287)	(-5.323)	(-4.827)	(-2.627)
INC_t	η_4	0.184	0.223	0.227	0.180	0.061	$\eta_4+\gamma_4$	-0.027	-0.035	-0.042	-0.025	0.031
		(4.467)	(5.328)	(5.197)	(4.631)	(2.241)		(-0.895)	(-1.105)	(-1.266)	(-0.820)	(1.369)
$SDTIMP_t$	η_5	-59.116	-59.513	-64.894	-58.706	-27.821	$\eta_5+\gamma_5$	-48.092	-53.685	-56.868	-48.362	-15.676
		(-5.826)	(-5.665)	(-6.105)	(-6.001)	(-4.132)		(-5.409)	(-5.885)	(-6.053)	(-5.732)	(-2.714)
$SDTEXP_t$	η_6	-60.478	-65.938	-69.743	-59.726	-24.906	$\eta_6+\gamma_6$	-45.960	-49.554	-51.405	-45.854	-26.221
		(-8.503)	(-9.212)	(-9.654)	(-9.382)	(-6.902)		(-5.008)	(-5.178)	(-5.163)	(-5.087)	(-3.868)
$LDTAX_t$	η_7	-8.773	-9.670	-10.597	-9.059	-1.226	$\eta_7+\gamma_7$	-9.428	-10.386	-11.361	-9.979	-1.455
		(-5.666)	(-6.163)	(-6.751)	(-6.289)	(-1.522)		(-5.101)	(-5.500)	(-5.949)	(-5.612)	(-1.340)
R^2		0.970	0.967	0.964	0.971	0.982		0.970	0.967	0.964	0.971	0.982
β		0.097	0.237	0.026	0.099	0.894		1.115	1.224	1.258	1.105	0.875
r		9.342	3.227	36.931	9.107	0.119		-0.103	-0.183	-0.205	-0.095	0.143

[a] Intercepts for model (iv) are reported in Fenn and Antonovitz.
[b] Columns (i)-(iv) give 2SLS estimates with instruments described in Table 2.
[c] Column (v) gives an OLS estimate.

Table 4. Pre and Post-Information Estimates of Cigarette Demand,

with exogenously imposed values of β[a]

(Asymptotic t-ratios are in parentheses)

		PRE-1979 COEFFICIENTS							POST-1979 COEFFICIENTS					
RHS Variables	Reg Coef	r=0.43 β=0.70	r=0.33 β=0.75	r=0.25 β=0.80	r=0.18 β=0.85	r=0.11 β=0.90	r=0.05 β=0.95	Reg Coef	r=0.43 β=0.70	r=0.33 β=0.75	r=0.25 β=0.80	r=0.18 β=0.85	r=0.11 β=0.90	r=0.05 β=0.95
C_{t-1}	η_1	0.569	0.567	0.566	0.566	0.565	0.564	$\eta_1+\gamma_1$	0.391	0.380	0.369	0.359	0.350	0.340
		(9.893)	(9.88)	(9.863)	(9.842)	(9.819)	(9.794)		(18.022)	(18.068)	(18.097)	(18.111)	(18.112)	(18.103)
C_{t+1}	η_2	0.083	0.078	0.074	0.070	0.066	0.062	$\eta_2+\gamma_2$	0.391	0.380	0.369	0.359	0.350	0.340
		(0.820)	(0.835)	(0.842)	(0.844)	(0.841)	(0.832)		(18.022)	(18.068)	(18.097)	(18.111)	(18.112)	(18.103)
P_t	η_3	-33.763	-33.753	-33.772	-33.816	-33.880	-33.961	$\eta_3+\gamma_3$	-18.995	-18.899	-18.827	-18.776	-18.743	-18.725
		(-7.304)	(-7.31)	(-7.319)	(-7.331)	(-7.345)	(-7.359)		(-4.931)	(-4.907)	(-4.887)	(-4.872)	(-4.859)	(-4.850)
INC_t	η_4	0.171	0.172	0.173	0.174	0.175	0.176	$\eta_4+\gamma_4$	-0.032	-0.031	-0.030	-0.029	-0.028	-0.027
		(4.455)	(4.482)	(4.511)	(4.541)	(4.571)	(4.601)		(-1.061)	(-1.021)	(-0.986)	(-0.953)	(-0.923)	(-0.901)
$SDTIMP_t$	η_5	-58.899	-58.747	-58.644	-58.581	-58.554	-58.556	$\eta_5+\gamma_5$	-48.401	-48.259	-48.169	-48.123	-48.115	-48.138
		(-6.065)	(-6.052)	(-6.042)	(-6.033)	(-6.026)	(-6.02)		(-5.778)	(-5.765)	(-5.755)	(-5.750)	(-5.743)	(-5.740)
$SDTEXP_t$	η_6	-58.856	-58.855	-58.897	-58.974	-59.080	-59.211	$\eta_6+\gamma_6$	-46.155	-46.004	-45.896	-45.824	-45.783	-45.769
		(-9.332)	(-9.344)	(-9.359)	(-9.376)	(-9.394)	(-9.413)		(-5.160)	(-5.145)	(-5.133)	(-5.122)	(-5.114)	(-5.106)
$LDTAX_t$	η_7	-8.972	-8.955	-8.948	-8.951	-8.961	-8.978	$\eta_7+\gamma_7$	-9.814	-9.804	-9.805	-9.816	-9.836	-9.863
		(-6.276)	(-6.27)	(-6.269)	(-6.271)	(-6.277)	(-6.286)		(-5.565)	(-5.565)	(-5.570)	(-5.580)	(-5.588)	(-5.600)
R^2		0.971	0.971	0.971	0.971	0.971	0.971		0.971	0.971	0.971	0.971	0.971	0.971

[a] These regressions were run using the set of instruments from model (iv) described in Table 2.

BIBLIOGRAPHY

Becker, Gary S. and Murphy, Kevin M. “A Theory of Rational Addiction.” *Journal of Political Economy*, August 1988, 96(4), pp. 675 - 700.

Becker, Gary S.; Grossman, Michael and Murphy, Kevin M. “An Empirical Analysis of Cigarette Addiction.” *The American Economic Review*, June 1994, 84(3), pp. 396-418.

Chaloupka, Frank. “Rational Addictive Behavior and Cigarette Smoking.” *Journal of Political Economy*, August 1991, 99(4), pp. 722 - 742.

Fenn, Aju J. and Frances Antonovitz. “The Impact of Addiction Information on Cigarette Consumption.” Iowa State University, Department of Economics Staff Paper No. 298, May 1998.

Glantz, Stanton A.; Barnes, Deborah E.; Bero Lisa; Hanauer, Peter and Slade John. “Looking through a Keyhole at the Tobacco Industry.” *The Journal of the American Medical Association*, July 1995, 274(3), pp. 219 - 258.

Hamilton, James L. “The Demand for Cigarettes: Advertising, the Health Scare, and the Cigarette Advertising Ban.” *Review of Economics and Statistics*, November 1972, 54(4), pp. 401 - 411.

Winston, Gordon C. “Addiction and Backsliding: A Theory of Compulsive Consumption.” *Journal of Economic Behavior and Organization*, 1980, 1, pp. 295-324.