THE DEMAND FOR PHYSICIANS' SERVICES AND THE PRICE OF CIGARETTES

by

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ABSTRACT: *This paper presents Tobit estimates of the demand for physician visits. Using the 1980 National Health Interview Survey and price data from the Tobacco Institute, estimates of the effect of cigarette prices on physician utilization are obtained. Statistically significant Tobit coefficients imply a cross-price elasticity of demand of approximately -0.5. This result implies increased cigarette taxes may help control health care utilization and expenditures. In addition, the estimated effects of physician prices, income, and socio-demographics are presented and discussed.*

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1. INTRODUCTION

This paper presents Tobit estimates of the demand for physician visits. Using the 1980 National Health Interview Survey (NHIS) and price data from the Tobacco Institute, estimates of the effect of cigarette prices on physician utilization are obtained. Statistically significant Tobit coefficients imply a cross-price elasticity of demand of approximately -0.5. This result implies increased cigarette taxes may help control health care utilization and expenditures. In addition, the estimated effects of physician prices, income, and socio-demographics are presented and discussed.

It is commonly thought that smokers impose a financial externality on nonsmokers because they share the same health insurance system (Atkinson and Townsend 1977, p. 494; Heins 1978, p. 1263; Wikler 1978, p.318; Wilkinson, et al. 1978, p. 1263; Sommers 1980, p. 1063; Benham 1981, p. 572; Harris 1982, p. 120; Cady 1983, p. 1105). Proponents of the cigarette tax (Wilkinson, et al. 1978; Heins 1978; Kristein and Grove 1978; Harris 1982; Cady 1983; Rosen 1983) frequently point to this alleged pecuniary externality as a partial justification for increased taxation. Less editorially inclined authors (Atkinson and Townsend 1977; Leu and Schaub 1984; Shelling 1986) have also recognized the potential presence of this pecuniary effect. In addition, empirical evidence indicates that at least a portion of present cigarette excise tax levels can be justified by external costs (Cooper and Rice 1976; Luce and Schweitzer 1978; Leu and Schaub 1983, 1984; Wright 1986; Stoddart, et al. 1986; Manning, et al. 1989). This paper focuses on the potential for using cigarette taxes to control health care demand, and thus, reduce external costs. The focus is on real effects rather than the distributional role of cigarette taxes. The results imply cigarette taxes may be a useful public

policy tool for controlling health care utilization.

2. DATA AND EMPIRICAL IMPLEMENTATION

The empirical results presented here are a microeconomic cross-sectional analysis of adult individuals' demand for physicians' services. Primary reliance is on the 1980 National Health Interview Survey (NHIS). The 1980 NHIS is national stratified probability sample of the non-institutionalized civilian population of the United States. The survey questionnaire is designed to acquire information on individuals' health care utilization and health status, as well as social, economic, and demographic characteristics including, but not limited to, age sex, race, educational attainment, income, marital status, and family size.

In addition, cigarette prices were obtained from the Tobacco Institute (1986) via their publication *The Tax Burden on Tobacco*, which contains average retail prices per package of 20 cigarettes inclusive of federal and state excises taxes, and applicable general state sales taxes. Cigarette price data was merged with the NHIS via geographical identifiers. Variation in state and local taxes permits, identification of the cross-price effect.[1]

The basic empirical model postulates the demand for physician visits as function of prices, income and socio-demographics.

(1) Visits/Year = f(Visit Price, Cigarette Price, Income, Socio-Demographics).

This list of demographic variables includes such characteristics as age,

[1]The appendix provides a detailed description of these data.

sex, race, educational attainment, and marital status. These variables are included as controls. Additionally, a set of dummy variables serving as proxies for the individuals' health status will be included in an alternative specification. However, the estimates of the key parameter, the cross-price effect, are robust to this change in specification.

3. ECONOMETRIC TECHNIQUE

The dependent variable takes on zero value for a large number of individuals surveyed. Approximately 25% of the individuals surveyed reported consuming no physician services in 1980. To place these data in a standard regression framework would be inappropriate, for it is likely to lead to biased estimates under the standard assumptions that usually accompany data of these type (Amemiya 1985, p. 367).

A more appropriate formulation is that of a censored regression model (Maddala 1983, pp. 149-196). The most common form, and that used here, is the standard Tobit model (Tobin 1958; Maddala 1983, p. 151; Amemiya 1985, p. 363).[2] For comparative purposes both OLS and Tobit estimates are presented.

4. PHYSICIAN DEMAND ESTIMATES

Using the data and technique described in the preceding sections,

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[2]The variable, y^*, is the underlying response variable, which in this case is interpreted as the "desired" number of physician visits. The "desired" level equals the actual level for values greater than zero. For values less than or equal to zero, the underlying response variable is unobserved and all corresponding observations take on zero value. In this standard formulation the errors are assumed to be identically and independently distributed normal.

$$(1) \qquad y_i^* = \mathbf{x}_i'\beta + \epsilon_i \qquad\qquad i = 1, 2, \ldots, n$$

$$(2) \qquad y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \qquad\qquad \epsilon_i \overset{i.i.d.}{\sim} N(0,\sigma^2)$$

estimates of physician service demand were computed. The estimated physician demand coefficients are contained in Tables 1 and 2, which present OLS and Tobit estimates respectively.

The key parameter of interest is the effect of cigarette price on physician demand. This section will be devoted to describing and interpreting the demand estimates in general and this parameter in particular.

The main empirical results to be discussed, the Tobit estimates, are presented in Table 2. For comparative purpose OLS estimates are also presented, Table 1. Many of the results are robust to changes in the econometric specification. However, it is theoretically appropriate to rely on the Tobit estimates rather than the OLS estimates. Therefore, most of the discussion which follows focuses on the Tobit estimates.

For each of the economic variables -- physician price, cigarette price, and income -- three partial derivatives of expected demand are presented.[3]

The first is the partial derivative of the expected "desired" level of

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[3]Given the normality assumption, at least three interesting expectation functions can be formed from the Tobit model: first, the expectation of the underlying response variable; second, the unconditional expectation of the observed variable; and third, the expectation of the observed variable conditioned on its value being greater than zero (Maddala 1983, pp. 159-160; Amemiya 1985, pp. 367-368). Of course, all three are conditioned on the values of the exogenous variables. Written below are the three expectation functions and more importantly their corresponding derivatives with respect to the kth exogenous variable (Maddala 1983, p. 160).

(i) $E(y_i^*) = x_i'\beta$

(ii) $\frac{\partial E(y_i^*)}{\partial x_{ik}} = \beta_k$

(iii) $E(y_i) = \Phi(x_i'\beta/\sigma)x_i'\beta + \sigma\phi(x_i'\beta/\sigma)$

(iv) $\frac{\partial E(y_i)}{\partial x_{ik}} = \Phi(x_i'\beta/\sigma)\beta_k$

(v) $E(y_i \mid y_i > 0) = x_i'\beta + \sigma \left[\frac{\phi(x_i'\beta/\sigma)}{\Phi(x_i'\beta/\sigma)} \right]$

(vi) $\frac{\partial E(y_i \mid y_i > 0)}{\partial x_{ik}} = \left[1 - (x_i'\beta/\sigma) \left[\frac{\phi(x_i'\beta/\sigma)}{\Phi(x_i'\beta/\sigma)} \right] - \left[\frac{\phi(x_i'\beta/\sigma)}{\Phi(x_i'\beta/\sigma)} \right]^2 \right]\beta_k$

demand with respect to the independent variable. This is simply the Tobit coefficient. These estimates are presented in the first row beside the name of each continuous economic variable (Table 2), with the corresponding t-ratios in parentheses below.

The second is the partial derivative of the unconditional expected actual level of demand with respect to the independent economic variable . These values are presented in the third row beside the name of each economic variable (Table 2), with the corresponding elasticity in brackets below.

Finally, the third estimated effect presented is the partial derivative of conditional expected actual level of demand with respect to the independent variable. These values are presented in the fifth now beside the name of each economic variable (Table 2), with the corresponding elasticity in brackets below.

This third partial derivative is conditional on the actual level of demand being greater than zero. Thus, it indicates the effect on demand given that the consumer has already chosen to enter the market. Whereas, the previous unconditional effect incorporates both the change in the choice to enter the market and the change in demand given the consumer has chosen to consume some positive amount.

Both the unconditional and conditional expectations are non linear in the independent variables. The partial derivatives presented (Table 2) and their respective elasticities are evaluated at the mean values of the independent variables (Tables A1-A4).[4]

[4] For the unconditional derivatives, the means over the entire sample are used. For the conditional derivatives the means are calculated over the non-zero observations only.

TABLE 1

Physician Demand Estimates: OLS Model.[†,††]

Dependent variable:	Number of Physician Visits Per Year			
Data set:	NHIS 1980, Person File			
Sub Set:	31 Largest SMSA's			
Model:	Includes Medicaid Patients		Excludes Medicaid Patients	
	w./Health	w.o./Health	w./Health	w.o./Health
	(1)	(2)	(3)	(4)
Independent variables:				
Physician Price	-0.026*	-0.023*	-0.026**	-0.024*
dollars/visit	(2.570)	(2.227)	(2.585)	(2.340)
	[-0.182]	[-0.164]	[-0.188]	[-0.178]
Cigarette Price	-0.021	-0.026	-0.021	-0.026
cents/pack	(1.517)	(1.785)	(1.593)	(1.878)
	[-0.359]	[-0.441]	[-0.388]	[-0.477]
Income	0.007	-0.012**	0.005	-0.013**
thousands/year	(1.755)	(3.140)	(1.469)	(3.402)
	[0.045]	[-0.084]	[0.040]	[-0.095]
Age	-0.027**	0.014**	-0.028**	0.010*
years	(6.249)	(3.233)	(6.596)	(2.330)
Medicaid	3.366**	5.440**		
Cardholder	(9.876)	(15.446)		
Health Status				
Excellent (omitted)				
Good	0.987**		0.950**	
	(8.217)		(8.085)	
Fair	3.208**		3.056**	
	(15.227)		(14.576)	
Poor	8.357**		7.961**	
	(22.015)		(20.047)	
Limitation of Activity:				
Not Limited (omitted)				
Cannot Perform	5.573**		5.516**	
Usual Activity	(15.613)		(14.853)	
Limited in	3.899**		3.813**	
Usual Activity	(17.155)		(16.751)	

TABLE 1 (continued)

	(1)	(2)	(3)	(4)
Limited in Outside Activity	3.057** (10.879)		3.227** (11.398)	
Education:				
1-11 years (omitted)				
None 0 years	-0.601 (0.628)	0.155 (0.155)	0.601 (0.577)	1.213 (1.117)
H.S. Graduate 12 years	0.521** (3.385)	-0.157 (0.987)	0.376* (2.469)	-0.272 (1.728)
Some College 13-15 years	0.846** (4.680)	0.197 (1.051)	0.720** (4.050)	(0.083) (0.454)
College Graduate 16 years	1.071** (5.140)	0.142 (0.663)	0.898** (4.408)	-0.009 (0.041)
Graduate School 17+ years	1.285** (5.676)	0.308 (1.317)	1.119** (5.066)	0.182 (0.798)
Marital Status:				
Married (omitted)				
Widowed	0.528 (1.959)	0.215 (0.766)	0.448 (1.664)	-0.081 (0.291)
Never Married	-0.959** (6.051)	-0.858** (5.188)	-0.935** (6.000)	-0.820** (5.050)
Divorced	-0.185 (0.082)	0.077 (0.329)	-0.140 (0.623)	-0.052 (0.222)
Separated	0.192 (0.586)	0.227 (0.663)	-0.033 (0.096)	0.070 (0.196)
Race:				
White (omitted)				
Black	0.406* (2.331)	0.638** (3.521)	0.342 (1.959)	0.584** (3.214)
Other	-1.011** (3.022)	-1.065** (3.050)	-0.903** (2.744)	-0.967** (2.820)

TABLE 1 (continued)

	(1)	(2)	(3)	(4)
Sex:				
Male (omitted)				
Female	1.875**	2.022**	1.695**	1.895**
	(12.452)	(13.013)	(11.398)	(12.342)
Female * LaborForce	-0.568**	-1.079**	-0.385*	-0.907**
	(3.494)	(6.394)	(2.397)	(5.440)
Region:				
West (omitted)				
Northwest	-0.091	-0.243	-0.098	-0.246
	(0.575)	(1.457)	(0.635)	(1.522)
Northcentral	-0.300	-0.246	-0.298	-0.236
	(1.953)	(1.531)	(1.974)	(1.503)
South	-0.239	-0.165	-0.206	-0.123
	(1.350)	(0.894)	(1.191)	(0.682)
Constant	4.183**	5.337**	4.486**	5.702**
	(4.184)	(5.125)	(4.585)	(5.606)
Sample Size	22646	22646	21971	21971
Adj. R-Squared	0.110	0.030	0.091	0.013
F-Statistic	104.7	34.4	85.5	15.4
degrees of freedom	27,22618	21,22624	26,21944	20,21950

† - (t-statistics in parentheses).
†† - [elasticities evaluated at sample means in brackets].
** - significant at the .01 level, two-tailed test.
* - significant at the .05 level, two-tailed test.

4.1. PHYSICIAN VISIT PRICE EFFECT

The estimated physician visit price coefficients are likely to be biased for at least two reasons. First, the price data used are average prices within a SMSA. Thus, the variation associated with individual transactions has been averaged away. The result is smaller variation with which to identify the price effect. Therefore, the estimated coefficients should be biased toward zero and the associated estimated standard errors should be biased upward. With respect to statistical inference, this should increase the probability of a Type II error. Second, these data contain no quality measures (e.g., physician specialty) which would help control for individual differences in demand not due to price. To the extent that price and quality are positively correlated, the estimated price effects will contain a positive bias.

Thus, using the data analyzed here, the estimated price effects should be biased toward zero due to averaging, and biased positive due to misspecification of quality.

All the estimated values of the own-price elasticity of demand for physician visits in the present study fall within the range from -.06 to -.19 (Tables 1 and 2). The values of the OLS estimates are near the high end of this range, approximately -.18 (Table 1). The elasticities computed from the Tobit estimates are substantially lower with an overall unconditional elasticity of approximately -.12 and a conditional elasticity of approximately -.06 (Table 2). Of course the price sensitivity conditional on demand being strictly positive is lower, in this case half as large.

Despite the inherent data limitations and resultant biases, these estimates are remarkably close to previously published estimates of the

elasticity of demand for physician visits (Table 3). Although many of these previous studies have used data containing accurate price and insurance information, all have had problems controlling for quality. Because of similar data limitations, one should be cautious in using these estimates including those contained in this present study. Nonetheless, the preponderance of existing empirical evidence implies the new results presented here are reasonable and as accurate as existing data allows.

4.2. CIGARETTE PRICE EFFECT

The most striking empirical results of this study are the estimated values of the cigarette price effect (Table 2). Succinctly interpreted, as the price of cigarettes rises the demand for physician visits declines. Based on the unconditional actual level of demand and the corresponding mean values, the estimates of the cross-price elasticity range from -0.48 to -0.58 (Table 2). In other words, these estimates indicate that cigarettes and physician visits are Marshallian complements.[5] This result is important because it implies cigarette taxation may be an effective method of curtailing health care expenditures.

Although not empirically estimated, the chain of causation underlying the relationship between the price of cigarettes and the demand for physician visits might be as follows. As the price of cigarettes rises, the demand for and consumption of cigarettes falls. Since consumers will be smoking less, their health will improve. Improving health status will result in declining

[5]Because the estimated income effects are small (Table 2), the Marshallian (income held constant) and the Hicksian (utility held constant) price effects are approximately equal. Thus the estimates presented here imply cigarettes and physician visits are complements by both the Marshallian and Hicksian definitions.

demand for physicians' services. Thus, an increase in cigarette prices results in decreased demand for physician visits.

Although the structural relationship just described is not directly tested, it seems quite reasonable that the relationship between cigarette prices and the demand for physicians' services is through health status. Partial support for this interpretation of the structural relationships is provided by the (quasi-) reduced form estimates (Table 2). Including the health variables in the regression specifications (Table 2, Columns 1 and 3), renders estimated cigarette price effects which are somewhat weak, but statistically significant at the .05 level. Omitting the health variables from the regression equations (Table 2, Columns 2 and 4) both increases the magnitude of the cross-price effect and decreases the level of significance. This is exactly the change one would expect, if the chain of causation is through health status.

Not only are these results important, they are also unique. Heretofore, no such relationship between health services and cigarette prices has been found. The only other study, which has come close to estimating such a relationship, is the Rand Health Insurance Experiment (HIE). In the HIE smoking behavior was estimated as a function of health insurance coverage. No relationship was discovered (Brook, et al. 1984, p. 67).

TABLE 2

Physician Demand Estimates: Tobit Model.[§,§§,†,††,‡,‡‡]

Dependent variable:	Number of Physician Visits Per Year			
Data set:	NHIS 1980, Person File			
Sub Set:	31 Largest SMSA's			
	Includes Medicaid Patients		Excludes Medicaid Patients	
Model:	w./Health	w.o./Health	w./Health	w.o./Health
	(1)	(2)	(3)	(4)
Independent variables:				
Physician Price	-0.030*	-0.029	-0.030*	-0.029
dollars/visit	(1.988)	(1.832)	(1.982)	(1.885)
	-0.018	-0.017	-0.017	-0.017
	[-0.123]	[-0.116]	[-0.126]	[-0.123]
	-0.013	-0.012	-0.012	-0.012
	[-0.067]	[-0.062]	[-0.069]	[-0.066]
Cigarette Price	-0.048*	-0.056**	-0.047*	-0.055**
cents/pack	(2.463)	(2.785)	(2.451)	(2.803)
	-0.028	-0.032	-0.027	-0.032
	[-0.481]	[-0.557]	[-0.492]	[-0.575]
	-0.020	-0.023	-0.020	-0.023
	[-0.263]	[-0.299]	[-0.267]	[-0.307]
Income	0.015**	-0.010	0.015**	-0.010
thousands/year	(2.728)	(1.673)	(2.646)	(1.813)
	0.009	-0.006	0.008	-0.006
	[0.061]	[-0.038]	[0.062]	[-0.042]
	0.007	-0.004	0.006	-0.004
	[0.034]	[-0.020]	[0.034]	[-0.023]
Age	-0.034**	0.214**	-0.036**	0.016**
years	(5.377)	(3.494)	(5.713)	(2.645)
Medicaid	4.059**	6.657**		
Cardholder	(12.912)	(20.844)		
Health Status:				
Excellent (omitted)				
Good	1.604**		1.545**	
	(8.225)		(8.133)	
Fair	4.413**		4.257**	
	(16.873)		(16.153)	
Poor	9.598**		9.196**	
	(30.102)		(27.921)	

TABLE 2 (continued)

	(1)	(2)	(3)	(4)
Limitation of Activity:				
Not Limited (omitted)				
Cannot Perform Usual Activity	7.266**		7.203**	
	(23.698)		(22.907)	
Limited in Usual Activity	5.145**		5.066**	
	(21.823)		(20.978)	
Limited in Outside Activity	4.014**		4.189**	
	(13.874)		(14.652)	
Education:				
1-11 years (omitted)				
None 0 years	-1.244	-0.138	0.250	1.092
	(1.286)	(0.142)	(0.249)	(1.109)
H.S. Graduate 12 years	0.888**	-0.025	0.741**	-0.151
	(4.334)	(0.125)	(3.575)	(0.752)
Some College 13-15 years	1.561**	0.693**	1.432**	0.555*
	(6.083)	(2.682)	(5.678)	(2.187)
College Graduate 16 years	1.894**	0.591*	1.704**	0.425
	(6.350)	(2.026)	(5.843)	(1.499)
Graduate School 17+ years	2.360**	0.994**	2.169**	0.853**
	(7.343)	(3.048)	(6.941)	(2.702)
Marital Status:				
Married (omitted)				
Widowed	0.552	0.099	0.465	-0.047
	(1.546)	(0.272)	(1.231)	(0.123)
Never Married	-1.572**	-1.458**	-1.537**	-1.398**
	(6.558)	(5.878)	(6.432)	(5.656)
Divorced	-0.058	0.071	-0.164	-0.024
	(0.205)	(0.241)	(0.555)	(0.077)
Separated	0.016	-0.011	-0.211	-0.116
	(0.042)	(0.027)	(0.478)	(0.256)

TABLE 2 (continued)

	(1)	(2)	(3)	(4)
Race:				
White (omitted)				
Black	0.749**	1.100**	0.678**	1.042**
	(3.396)	(4.818)	(2.926)	(4.397)
Other	-2.127**	-2.221**	-1.969**	-2.084**
	(3.916)	(4.004)	(3.693)	(3.830)
Sex:				
Male (omitted)				
Female	2.996**	3.211**	2.778**	3.049**
	(14.634)	(16.000)	(13.656)	(15.272)
Female * LaborForce	-0.356	-0.996**	-0.166	-0.825**
	(1.591)	(4.333)	(0.745)	(3.596)
Region:				
West (omitted)				
Northwest	0.004	-0.208	-0.010	-0.210
	(0.018)	(0.954)	(0.044)	(0.981)
Northcentral	-0.205	-0.135	-0.203	-0.124
	(0.949)	(0.611)	(0.952)	(0.565)
South	-0.093	0.002	-0.055	0.055
	(0.370)	(0.007)	(0.222)	(0.216)
Constant	2.580	4.310**	2.910*	4.717**
	(1.817)	(2.953)	(2.086)	(3.291)
Sample Size	22646	22646	21971	21971
Chi-Square	3015	916	2482	512
degrees of freedom	27	21	26	20

[§]Estimated Tobit coefficients are the first numbers presented.

[§§]t-ratios associated with the Tobit coefficients are in parentheses.

[†]Numbers on the third line are estimated partial derivatives of the unconditional expected number of physician visits.

[††]Elasticities associated with the unconditional partial derivatives evaluated at the full sample means are in brackets.

[‡]Numbers on the fifth line are estimated partial derivatives of the conditional expected number of physician visits.

[‡‡]Elasticities associated with the conditional partial derivatives evaluated at the sample means are in brackets.

**significant at the .01 level, two-tailed test.

*significant at the .05 level, two-tailed test.

4.3. INCOME EFFECT

Because income, as measured here, includes both earned and unearned income, the income effect estimated will include both an opportunity cost of time effect and a purchasing power effect (Pauly 1974, p. 61). Additionally, when the health variables are omitted from the regression equations (Table 2, Columns 2 and 4), the regression coefficient on income will capture a third demand effect, that of income on health (Pauly 1974, p. 62).

Since the consumption of physician services is relatively time intensive, the opportunity cost of time effect via income should be negative (Acton 1976, p. 169). Unless the commodity, physician visits, is an inferior good, the income effect associated with increased ability to purchase should be positive. The empirical results here indicate that the latter effect dominates, with an overall income elasticity of approximately .06 (Table 2, Columns 1 and 3). Except for a study of pediatric visits (Goldman and Grossman 1978), this point estimate is quite close to other published estimates (Table 3).

It is not surprising that the income elasticity is positive for these regressions (Table 2, Columns 1 and 3). Income measured here is total family income. Therefore, the opportunity cost of time effect, which is probably strongest for the major breadwinner, will be somewhat diluted by the non-income earning members of the household. Thus, the purchasing power effect should be relatively stronger for these individuals. This is reflected in the overall sample results.

Finally, with regard to the third effect, income is positively correlated with health. Therefore, when the health variables are omitted from the regression equations (Table 2, Columns 2 and 4), the income coefficients

are negative, although statistically insignificant. Obviously greater health is associated with lower demand. The direct effect of health on demand is so strong that even a small correlation between income and health is sufficient to completely mitigate the pure income effect.

TABLE 3

Empirical Studies of the Demand for Physician Visits

Author (date)	Data and Source	Estimated Elasticities	
		Price	Income
Feldstein and Severson (1964)	Micro cross-sections 1953, 1958 Health Information Foundation (HIF) and National Opinion Research Center (NORC) University of Chicago Survey	-.14 to -.19	.44 to .62
Fuchs and Kramer (1972)	State cross-section, 1966 National Center for Health Statistics (NCHS)	-.06 to -.36	.04 to .57
Phelps and Newhouse (1974)	Micro cross-section Pala Alto prepayment plan arc-elasticity 1966, 1968	-.14	
Newhouse and Phelps (1974)	Micro cross-section 1963 Center for Health Admin. Studies (CHAS) University of Chicago	-.02 to -.06	.06 to .08
Phelps (1975)	Micro cross-section 1970 CHAS-NORC University of Chicago	-.18	-.03
Newhouse and Phelps (1976)	Micro cross-section 1970 CHAS Survey University of Chicago	-.07 to -.08	.03

TABLE 3 (continued)

Guzick (1978)	Micro cross-section 1970 CHAS-NORC University of Chicago	-.08 to -.41	.03
Miners, et al. (1978)	Household cross-section 1973-75, Dept. of Community Health Services Survey, Duke University	-.15	
Goldman and Grossman (1978)	N.Y.C. monthly panel 1965-66 N.Y.C. Health Services Administration	-.03 to -.06 (pediatric visits)	1.32
Newhouse, Phelps, and Marquis (1980)	Micro cross-section CHAS Survey University of Chicago	-.09 to -.13	.03
Miners (1981)	Household cross-section 1973-75, Dept. of Community Health Services Survey, Duke University	-.01 to -.08	.05 to .10
Russo (1990)	Micro cross-section NHIS 1980, NCHS	-.06 to -.19	-.10 to .06

4.4. AGE

Age is measured in the typical manner as the number of years since birth. The estimated coefficients on the age variable, are quite interesting because these estimates are statistically significant in all four specifications (Table 2), while switching sign depending on whether the health indices are included (Table 2, Columns 1 and 2) or excluded (Table 2, Columns 3 and 4).[6]

When the health of the individuals is controlled for, albeit partially, the estimated coefficients on age are negative (Table 2, Columns 1 and 2). This result is consistent with the hypothesis that medical care is an investment good (Mushkin 1962; Grossman 1972a, 1972b; Muurinen 1982).[7] Under this hypothesis the purchase and consumption of medical services is a way to augment one's health capital.

Typically, older individuals will have fewer years of life remaining and thus, less time to enjoy the flow of utility resulting from an investment. Assuming the primary effect of health care is to increase the amount of healthy time rather than the total amount of time (i.e., the length of life) available to an individual, economic theory predicts, *ceteris paribus*, a smaller investment by older individuals. In this case a smaller investment means lower consumption of physician services.

However, age and health indices tend to be negatively correlated. Put differently, older individuals tend to have poorer health and "need" more health care. When the health variables are excluded from the specification

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[6]Similar results are evident in the OLS estimates as well (Table 1).

[7]Grossman (1972b) has both a pure investment model and a pure consumption model of health.

(Table 2, Columns 2 and 4), this strong correlation causes the health effect of age to swamp the pure investment effect. Since these are not "other things held constant" estimates, it is not surprising that these coefficients are positive. This is precisely the result one would expect given the high correlation between age and health, and the extreme explanatory power of the health variables in this regression model.

In Grossman's (1972a, p. 239; 1972b, p. 17) theoretical model (i.e., pure investment model), the rate at which one's health capital depreciates increases with age. In order to partially offset this depreciation, the demand for medical care increases. Grossman's empirical results are consistent with his theory.[8] That is, age has a positive effect on medical services demand (Grossman 1972b, p. 57). Using the data analyzed in this present study and omitting health from the regression (Table 2, Columns 2 and 4), renders results consistent with Grossman. Demand increases with age.

The regressions which include health (Table 2, Columns 1 and 3) are inconsistent with Grossman, because they indicate a negative relationship between age and medical care demand. However, Grossman would consider these regressions misspecified because health is a consumer choice variable and therefore, does not belong as independent variable in a demand equation unless predicted via a simultaneous system.

Newhouse and Phelps (1976, p. 276) estimated demand for physician services and report a negative age effect. Their specification includes health status dummies, and therefore, is most similar to regressions contained in Table 2, Columns 1 and 3, which also indicate negative age effects. In

[8]An additional theoretical assumption, that the demand for health is inelastic, is required for the demand for medical services to increase with age (Grossman 1972a, p. 239, 1972b, p. 17).

another study which controlled for health status, Phelps (1975, pp. 122-123) found a positive effect of age on physician visit demand.

A study by Wagstaff (1986) utilizes a Grossman-type model, controls for health status, and properly deals with the simultaneity problem in estimating demand for physician visits. His structural demand equations indicate a negative and statistically significant estimated age effect (Wagstaff 1986, pp. 218, 224). Thus, his results are similar to those reported here (Table 2, Columns 1 and 3) and are consistent with the time preference hypothesis.

In summary, one might infer that there is a pure age effect and an age effect through health. The age effect through health is the Grossman-type effect. As age increases the depreciation of health increases and the demand for medical care rises (Table 2, Columns 2 and 3). The pure age effect indicates that older individuals will have fewer years until they reach some exogenously determined upper limit on the length of life and therefore, fewer years to recoup an investment. Thus, they demand less medical services, *ceteris paribus*.

4.5. MEDICAID

The difference between the level of demand by Medicaid cardholders and the level of demand by all other groups is positive and statistically significant (Tables 1 and 2).[9] There are at least two factors which explain this result. First, under the Medicaid program these individuals receive insurance coverage which substantially lowers their out-of-pocket expenses for

[9]For a detailed analysis of the utilization of physicians' services under the Medicaid program, see a paper by Long, Settle, and Stuart (1986).

physician services.[10] In other words the consumer price faced by this group is relatively low. Second, the medicaid eligibles, who have invested the time to keep their coverage and corresponding documentation current, are probably the individuals within the overall eligibility pool with the greatest underlying demand for medical care.

To reiterate, the coefficient on this dummy variable captures two effects: first, a price effect due to insurance coverage; and second, a self-selection by individuals with greater health care demand.

4.6. HEALTH VARIABLES

The health variables clearly have the greatest explanatory power in the physician visits demand equations (Table 2).[11] This can easily be seen by comparing the regressions which include the health variables (Table 2, Columns 1 and 3) with those regressions which omit these variables (Table 2, Columns 2 and 4). The dramatic difference in the Chi-square statistics is evidential of this explanatory power.

In addition, the coefficients associated with the health variables indicate what one would intuitively expect. That is, the poorer an individual's health or the more limited an individual's activities, the greater the demand for physician visits. However, these estimates are subject to simultaneity bias.

An individual is more likely to seek care if his health is poor.

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[10]The exact level of coverage varies from state to state. In addition, individual physicians may forgive the already small fee due from the patient.

[11]For a discussion of the problems associated with using health variables like these, see a paper by Manning, Newhouse, and Ware (1982).

Presumably, the physician care will alleviate some of the individual's health problems. Therefore, the direction of causation runs both ways. Moreover, even if physician services due not affect health, the contemporaneous nature of the data will result in inconsistent estimates (Manning, Newhouse, and Ware 1982).

A more appropriate analysis would measure health prior to the physician visits or treat health as an endogenous variable to be estimated. Unfortunately, with the cross-sectional data analyzed here, the physician visits and health status information has been collected contemporaneously. There is no mechanism to determine the health status prior and post of the physician visits. Nor are there sufficient instruments to predict health. Recognizing this predicament, the demand equations are estimated both including (Table 2, Columns 1 and 3) and omitting (Table 2, Columns 2 and 4) these health variables.

The robustness of the price coefficients to this change in specification seems to indicate little contamination.

4.7. EDUCATION

The more educated, be definition, have invested more in human capital than the less educated. Under the hypothesis that the well educated have invested more because they have a lower rate of time-preference, one should observe educated individuals engaging in other types of investment as well. According to Fuchs (1982), and in the spirit of Becker (1962) and Grossman (1972b), individuals with lower rates of time-preference, *ceteris paribus*, will invest more in their health. Since the more educated have lower rates of time-preference, they should be observed demanding more medical services. The

overall results on education from the physician visits demand equations (Table 2) support this rate of time-preference hypothesis.

However, there are at least two other education effects which should lead to lower health care demand, not higher as the estimates here show. First, the more educated are likely to be more productive and command higher wages. This implies a higher opportunity cost of time. Since the consumption of physician services is costly in time (e.g., travel time, waiting time, etc.) the more educated will face higher real costs and therefore, should demand a smaller quantity (Acton 1976).[12]

Second, the more educated may be more efficient in the use of medical services (Grossman 1972a, 1972b). Although the more educated invest more in health, their greater productivity in the use of health care leads to lower demand (Grossman 1972a, p. 246; 1972b, pp. 28, 37).[13] However, neither Grossman's (1972b, p. 37) empirical results nor the estimates presented herein (Table 2) support this productivity hypothesis. Although, using Grossman's model Wagstaff (1986, p. 213) reports a reduced form estimate which does support the productivity hypothesis.

It should be emphasized that no existing empirical study can refute the existence of the before mentioned effects. At most one can conclude that these are not the primary or sole effects. This present study indicates that the time-preference hypothesis may have some merit. Theory does not provide a definitive qualitative prediction of the impact of education on medical

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[12]Acton (1976) uses direct measures of the time costs in estimating health care demand. He concludes that the time cost elasticities are of comparable magnitude to price elasticities and therefore, are important rationing mechanisms.

[13]For this theoretical result to hold in Grossman's (1972b, p.37) pure consumption model, the wealth elasticity of demand for health must be less than one; and in Grossman's (1972b, p.28) pure investment model, the elasticity of the marginal efficiency of health capital schedule must be less than one.

services demand (Pauly 1974). It is an empirical issue. The results here indicate a positive effect.

By comparison, other studies which have estimated the demand for physician visits have essentially found no effect of education on demand. Estimates reported by Phelps (1975, pp. 122-123), Guzick (1978, p. 361), and Wagstaff (1986, pp. 218, 224) are positive but not significantly different from zero. Newhouse and Phelps (1976, p. 276) report a negative estimated coefficient, but likewise, their estimate is insignificant. All these studies treated education as a continuous variable.

In an earlier study, Newhouse and Phelps (1974, p. 162) enter education as a series of dummy variables similar to those contained in this present study. The results were mixed indicating a non-monotonic relationship. Again, none of the estimates were statistically significant. However, estimates reported by Feldstein and Severson (1964, p. 65) are negative and significantly different from zero. Overall though, empirical studies have found very little.

4.8. MARITAL STATUS

The only noteworthy result amongst this categorical variable pertains to individuals who have never been married. In terms of "desired" levels, this group demand significantly less physician visits than married individuals (Table 2).

This result may be due to a correlation with age, with the never married individuals being the younger group.

An additional explanation pertains to the time-preference hypothesis. The never married may discount the future to a greater extent than the

married. Therefore, they seek to invest less in their health by consuming fewer physician services.

Closely related to this argument, is an argument based on interdependent preferences. Just as we would expect the married to be more likely to purchase life insurance vis-à-vis the unmarried, so too, we would expect the married to care more about their health than the unmarried.

However, neither of these closely related hypotheses, the time-preference hypothesis and the interdependent preferences hypothesis, fully explains the empirical results. These hypothesis should also apply to other unmarried groups, especially the widowed and divorced. But there are no statistically significant differences between these other unmarried groups and married individuals.

Perhaps age and health effects, which are not fully captured by those variables, are swamping the pure marital effects associated with these groups. Or, since these individuals were once married, perhaps habit formation is resulting in persistent demand. Finally, to the extent that there are family members other than a spouse (e.g., children), the two suggested hypotheses would imply not lower demand but greater, and one would expect widowed, divorced and separated individuals to behave more like married than never married individuals. This is perhaps the most reasonable interpretation of the empirical results.

4.9. RACE

The "desired" demand for physician visits by blacks is significantly greater than that for whites. Although somewhat reduced quantitatively, this result holds qualitative even when the differential health status of blacks is

controlled for (Table 2, Columns 1 and 3). Additionally, this result is robust to the exclusion of Medicaid recipients from the analysis (Table 2, Columns 3 and 4), a subgroup of which blacks comprise a disproportionate percentage.

Other racial groups seem to consume significantly less physician visits than whites. This in part may be due to different supply conditions other than those reflected through price. Perhaps it is due to less insurance coverage than whites.

4.10. SEX

The female dummy variable must be interpreted carefully because of the presence of the female-labor force participation interactive dummy. The use of both of these dummy variables in the same regression alters the usual interpretation of each. The coefficient associated with the female dummy variable should be interpreted as the difference in demand between females not in the labor force and all males. Whereas, the coefficient associated with the interactive dummy can be correctly interpreted as the difference in demand between females in the labor force and females not in the labor force.

With the above interpretations in mind, all four regression estimates contained in Table 2 indicate that females not participating in the labor force demand significantly more physician visits than males.[14] This result is robust to inclusion (Table 2, Columns 1 and 3) or exclusion (Table 2, Columns 2 and 4) of the health indices.

However, some of the difference can be explained by labor force

[14]All these interpretations pertain to the Tobit coefficients which indicate differences in "desired" not actual levels.

participation, a traditional difference between males and females which has been dissipating over time. When health is controlled for, (Table 2, Columns 1 and 3), female labor force participants seem to demand fewer physician visits than non-participating females. Although statistically insignificant, there is probably a small real difference due to differing opportunity costs of time. When the health variables are omitted from the regressions (Table 2, Columns 2 and 4), larger and statistically significant differences are indicated, with the female labor force participants demanding fewer visits than non-participants. The results becoming significant when the health variables are omitted, is easily explained by the positive correlation between health and labor force participation. Many of the females who participate in the labor force are able to do so by virtue of their good health. Their better health also leads to fewer physician visits. The correlation between labor force participation and health is particularly strong for these data because health is proxied by dummy variables which indicate whether an individual's chronic conditions are limiting the individual's activities (e.g., work).

Even controlling for labor force participation, the coefficients overall indicate that females utilize more physician services than males. This is a standard empirical result (Newhouse and Phelps 1974, p. 153; Newhouse and Phelps 1976, p. 276; Wagstaff 1986, pp. 213, 218, 224), however it has not been found uniformly across all physician visit demand studies (Phelps 1975, pp. 122-123).

5. POLICY IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The preceding empirical analysis leads to the important conclusion that

physicians' services and cigarettes are complementary goods. This unique empirical result is rendered by Tobit estimation of the demand for physician visits as a function of cigarette prices. The estimated Tobit coefficients imply a cross-price elasticity equal to -0.5. This estimated interaction between the demand for physicians' services and cigarette prices implies cigarette taxes may be an important health care policy instrument.

This empirical evidence, that the demand for physicians' services (visits) is negatively influenced by the price of cigarettes, comes from the Tobit estimates (Table 2, Column 4) which render a partial derivative evaluated at the means of -0.03 [(visits/year)/(cents/pack)]. This intuitively appealing result implies that cigarette taxation may be an effective policy instrument for curtailing health care utilization and the resultant health care expenditures. To dramatize this point, a linear extrapolation around this estimate implies a $1.00 increase in the price of a package of cigarettes leads to a reduction in physicians' services demand of 3 visits per year per (adult) person. Although data limitations particularly the absence of insurance information call into question the magnitude of this estimated effect, the resultant policy implications are of sufficient importance to warrant further research.

With regard to the scope empirical results, the estimations contained herein predominantly capture the contemporaneous effects of the interaction between the demand for cigarettes and physicians' services. However, many of the major health consequences of smoking are long-term effects. In other words, current demand for health care depends on lagged cigarette demand (prices). Additionally, cumulative (lifetime) demand for cigarettes may be the critical determinant. Similarly, current cigarette demand should be

specified as a function of expected future health care prices. Therefore, a full dynamic system of demand functions is necessary to capture the complete relationship. However, less significant short term health consequences (e.g., bronchitis) are probably adequately captured by these results. Nevertheless, future research should focus on long run formulations of demand.

In addition, all forms of health services, including hospitalization, should be included in the analysis. Because this analysis is restricted to a static contemporaneous formulation and focuses only on physicians' services, it is likely to underestimate the full interaction between the demand for cigarettes and health services. Future research should analyze the effect of cigarette prices on health care demand across all services and across time.

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APPENDIX

DATA: SOURCES, TYPES, AND LIMITATIONS

The micro-cross-sectional data used in the following analysis were assembled from one primary and three secondary data sources. They include the National Health Interview Survey, 1980; The Tax Burden on Tobacco, 1986; The Statistical Abstract of the United States: 1981; and the Physician Capacity Utilization Survey, 1979.

A1. NATIONAL HEALTH INTERVIEW SURVEY

The 1980 National Health Interview Survey (NHIS) is a national stratified probability sample of the non-institutionalized civilian population of the United States. The survey questionnaire is designed to acquire information on individual health care utilization and health status, as well as social, economic, and demographic characteristics including, but not limited to, age, sex, race, educational attainment, income, martial status, and family size. This study utilizes the NHIS 1980 Person File which contains a total of 102,629 observations.

Sponsorship of the NHIS is by the Public Health Service (PHS) within the U.S. Department of Health and Human Services (US DHHS). Indirect acquisition of the survey data was through the Inter-University Consortium for Political and Social Research (ICPSR). However, the survey may be acquired directly from the National Center for Health Statistics (NCHS).

In order to maintain individual privacy all detailed information concerning geographical location has been suppressed by the NCHS in producing the public use versions of the NHIS. However, the public use versions do provide geographical identification if the individual resides in one of the 31

largest Standard Metropolitan Statistical Areas (SMSAs).[15] Via this identifier, data on average cigarette prices and average physician service prices by SMSA were merged with the NHIS data.

Do to this lack of complete geographical identification, as well as other missing data, the number of observations analyzed is much fewer than the total contained in the NHIS. A maximum of only 22,646 out of 102,629 observations from the main survey, the Person File, are analyzed. Only residents of the 31 largest SMSAs are analyzed throughout. In addition, only observations on adults whose 1980 age is between 20 and 74 years are analyzed.

A2. CIGARETTE PRICES

Cigarettes prices were obtained from the Tobacco Institute (1986) via their publication The Tax Burden on Tobacco, which contains average retail prices per package of 20 cigarettes inclusive of federal and state excise taxes, and applicable general state sales taxes. Additionally, tax information for the relatively few municipalities and counties which impose local taxes on cigarettes was obtained via direct correspondence with the Tobacco Institute.[16]

This price information by state was merged with the NHIS data base in the following manner. Individuals who reside in a SMSA which is located entirely within the border of a single State (e.g., Denver, Colorado) were assigned the average price of cigarettes for that state. Individuals who reside in an SMSA which lies within the boundaries of more than one State

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[15]The largest, New York and Chicago, are Standard Consolidated Statistical Areas (SCSAs) and consist of more than one SMSA. Subsequent to the conducting of this survey many areas have been redefined and all redesignated Metropolitan Statistical Areas (MSAs) (U.S. Bureau of the Census 1986).

[16]The Tobacco Institute, 1975 I Street, Washington, DC 20006, Phone (202) 457-4800.

(e.g., The Philadelphia SMSA consist of the cites of Philadelphia, PA and Camden, NJ) were assigned a weighted average of the average retail cigarette price in each state. Where the weights are the proportion of the SMSA's population which resides in each State (U.S. Bureau of the Census 1982, pp. 579-593).[17] In those SMSAs where county and municipal taxes apply, the local tax was added to the state average retail price for the applicable portion of the SMSA and again a weighted average was calculated.[18] With these procedures, the Tobacco Institute's prices by State were converted to prices by SMSA.

Given these data all individuals residing in a given SMSA are assigned the same weighted average cigarette price. This procedure squelches individual retail price variation and will bias estimated price effects toward zero and standard errors upward. Presuming that individuals purchase where they reside, this averaging procedure will overstate the price for individuals in the low price position of the SMSA and understate the price for individuals in the high price portion. However, to the extent that individuals cross political boundaries to avoid state and local taxes (incidental bootlegging), the understatement of price for individuals residing in the high price portion will be less severe. This is little consolation considering that the incidental bootlegging introduces additional measurement error, albeit of a slightly different type.

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[17]The state average retail price reported by the Tobacco Institute is itself a weighted average. The weights are the proportion of total retail sales at each price. Sumner (1981, p. 1016) discusses the Tobacco Tax Council's weighting procedure in more detail.

[18]For example, the Chicago SCSA contains two localities whose governments impose additional taxes, the City of Chicago and Cook County. Both imposed a 5¢ per pack excise tax in 1980. An additional complication arises due to the fact that the City of Chicago is located within the political borders of Cook County. Therefore, for cigarettes purchased within the City of Chicago both taxes apply. These figures are added to the State average price before calculating an weighted average for the entire SCSA. No provision is made for the portion of local taxes which may be absorbed by suppliers.

To the extent that bootlegging of cigarettes is conducted by organized criminal elements, mismeasurement of price due to bootlegging should be less severe. Organized criminals typically counterfeit tax stamps and collect the tax receipts as additional rents accruing to their activities. Thus, retail prices faced by the consumer should be less affected. It is the incidental bootlegging by individual consumers which remains a source of measurement error in the use of these data.

A3. PHYSICIAN SERVICE PRICES

Data on physician prices come from the Physician Capacity Utilization Survey 1979, which was conducted by Mathematica Policy Research. Hopefully, the one year difference between this survey and NHIS 1980 will create only innocuous errors. No attempt was made to temporally realign these data.

The variable used is the average fee charged by physicians for a routine office visit by SMSA. The average was across all physicians surveyed in a given SMSA and takes no account of quality or specialty.

Since quality and price maybe highly correlated, the use of these data are likely to generate positive bias in estimating own-price effects for the physician service demand equations. This possible source of bias is in addition to the bias toward zero generated by averaging alone. That is, one would expect that averaging away variation in prices, even when quality and specialty were held constant, would make it difficult to identify the price parameter and increase the chances of both observing and inferring a zero own-price effect.

An additional limitation is the lack of insurance information to accompany the price variable. This survey provides the producer price,

whereas, the appropriate variable for this analysis is the consumer price. Without data on third-party payments, the own-price effect is likely to be underestimated. However, insurance coverage for physician visits tends to be substantially less than that for other services, most notably hospitalization. Therefore, the divergence between out-of-pocket expense and provider price is relatively small, when compared to other health service type (i.e. hospitalization) for which data are available within the NHIS. Nonetheless, individuals with Medicare Part B, Medicaid, Blue Shield, and/or HMO coverage, as well as many other forms of health insurance, would face substantially lower prices than those analyzed here.

A4. CROSS-SECTIONAL PRICE INDEX

The three economic variables analyzed here are, family income, physician price, and cigarette price. Physician price and cigarette price are SMSA specific. Family income is household specific. A substantial portion of the variation in these values is due to variation in price levels alone. Therefore, to garner estimates of real effects a normalization is necessary.

Pursuant to that end, a cross-sectional price index was created using family budget data. More specifically, data on the urban intermediate budget for a four person family in 1980 was obtained from the Statistical Abstract of the United States: 1981 (U.S. Bureau of the Census, 1981, p. 472). Family budget data is available for 23 of the 31 SMSAs analyzed here. For the remaining 8 SMSAs the figure for all metropolitan areas was used. From these data a cross-sectional price index was created by normalizing the family budget figures by the family budget of one of the larger SMSAs (i.e., Philadelphia). The result was used to price adjust prices and income for all

subsequent analyses.

A5. DESCRIPTIVE STATISTICS

This section presents in tabular form descriptive statistics on all the variables used in the subsequent statistical analyses. For all continuous variables the mean, standard deviation, and range will be presented. Means will also be presented for the dichotomous/categorical variables. Of course these means are directly interpretable as the proportion of individuals which fall into each category. The tables are essentially self-explanatory, but a few additional details need to be provided.

The economic variables, physician price, cigarette price, and family income, have been cross-sectionally price adjusted and are presented in their adjusted form. Family income data, as produced by NHIS, is a categorical variable. It has been converted to a continuous variable by assigning the value at the center of each categorical cell. It was then price adjusted.

Tables A1-A4 describe the data for the physician service demand equations. The means presented are used to evaluate the partial derivatives described by equations (iv) and (vi) (See footnote 3). Although the estimated functions are linear with respect to the expected "desired" level of demand, equation (i), these same functions are non-linear with respect to the expected actual levels of demand, equations (iii) and (v). Thus, the partial derivatives of the actual levels of demand, equations (iv) and (vi), are functions of the independent variables as well. The mean values, which follow in excruciating detail for all sample sizes and regression models estimated, are used to evaluate these partial derivatives.

TABLE A1

DESCRIPTIVE STATISTICS
VARIABLES USED IN PHYSICIAN SERVICE DEMAND EQUATIONS
INCLUDES ZERO AND NON-ZERO OBSERVATIONS
INCLUDES MEDICAID RECIPIENTS
SAMPLE SIZE = 22646

Variable	Mean	Std. Dev.	Min.	Max.
Physician Visits per year	3.90	8.63	0	518
Physician Price $'s per visit	27.29	5.59	15.21	47.29
Cigarette Price ¢'s per pack	67.45	4.32	59.57	78.52
Family Income $1000's per year	26.64	16.56	00.46	52.82
Age years	41.82	15.21	20	74
Medicaid:				
Cardholder	0.030		0	1
Not a Cardholder and/or Ineligible	0.970 (omitted group)		0	1
Self-Reported Health Status:				
Excellent	0.483 (omitted group)		0	1
Good	0.390		0	1
Fair	0.098		0	1
Poor	0.029		0	1
Limitations Due to Chronic Conditions:				
Not Limited and/or No Chronic Conditions	0.853 (omitted group)		0	1
Cannot Perform Usual Activity	0.033		0	1
Can Perform Usual Activity but Limited in Amount and/or Kind	0.074		0	1
Can Perform Usual Activity but Limited in Outside Activity	0.040		0	1
Education:				
0 years	0.003		0	1
1-11 years	0.224 (omitted group)		0	1
12 years	0.360		0	1
13-15 years	0.198		0	1
16 years	0.121		0	1
17+ years	0.094		0	1

TABLE A1 (continued)

Variable	Mean	Min.	Max.
Marital Status:			
Married	0.669 (omitted group)	0	1
Widowed	0.050	0	1
Divorced	0.069	0	1
Separated	0.030	0	1
Never Married	0.182	0	1
Race:			
White	0.861 (omitted group)	0	1
Black	0.112	0	1
Other	0.027	0	1
Sex:			
Male	0.474 (omitted group)	0	1
Female	0.526	0	1
Sex - Labor Force Participation Interaction:			
Female in the Labor Force	0.316	0	1
Male, or Female Not in the Labor Force	0.684 (omitted group)	0	1
Region:			
Northeast	0.307	0	1
Northcentral	0.270	0	1
South	0.174	0	1
West	0.249 (omitted group)	0	1

A5.1. Physician Visits

Tables A1-A4 contain descriptive statistics on the data used in the physician service demand equations. Table A1 contains the descriptive statistics for the largest sample size analyzed, 22,646 observations, which includes observations on both individuals who did (non-zero observations) and did not (zero observations) consume physician services in 1980.[19] Consumption of medical services is measured as the number of physician visits per year.[20] Out of the 22,646 individuals observed, 17,042, or 75%, reported consuming at least 1 physician visit in 1980. For this sub-group, the mean number of physician visits is 5.2 per year (Table A2) as compared to 3.9 per year for the sample as a whole (Table A1).

This study treats the physician visit as if it is a homogeneous commodity. However, there is substantial variation in quality and type of service, across physician specialties, within physician specialties, and even within the visits associated with an individual physician. Unfortunately, these data include no quality measures to control for these variations.

[19] As previously mentioned, throughout this analysis only observations on individuals residing in one of the 31 largest SMSA's are used. Again, this is due to the lack of additional geographical identifiers with which to merge the price data necessary for the demand estimations.

[20] A physician visit, as defined by the NHIS, includes any contact between doctor and patient for the purpose of receiving treatment or advice. This contact may occur in an office, hospital, clinic, or by telephone.

TABLE A2

DESCRIPTIVE STATISTICS
VARIABLES USED IN PHYSICIAN SERVICE DEMAND EQUATIONS
EXCLUDES ZERO OBSERVATIONS
INCLUDES MEDICAID RECIPIENTS
SAMPLE SIZE = 17042

Variable	Mean	Std. Dev.	Min.	Max.
Physician Visits per year	5.18	9.61	1	518
Physician Price $'s per visit	27.28	5.58	15.21	47.29
Cigarette Price ¢'s per pack	67.38	4.32	59.57	78.52
Family Income $1000's per year	26.78	16.61	00.46	52.82
Age years	42.03	15.37	20	74
Medicaid:				
Cardholder	0.035		0	1
Not a Cardholder and/or Ineligible	0.965 (omitted group)		0	1
Self-Reported Health Status:				
Excellent	0.450 (omitted group)		0	1
Good	0.400		0	1
Fair	0.114		0	1
Poor	0.036		0	1
Limitations Due to Chronic Conditions:				
Not Limited and/or No Chronic Conditions	0.826 (omitted group)		0	1
Cannot Perform Usual Activity	0.039		0	1
Can Perform Usual Activity but Limited in Amount and/or Kind	0.090		0	1
Can Perform Usual Activity but Limited in Outside Activity	0.045		0	1
Education:				
0 years	0.003		0	1
1-11 years	0.218 (omitted group)		0	1
12 years	0.358		0	1
13-15 years	0.201		0	1
16 years	0.122		0	1
17+ years	0.098		0	1

TABLE A2 (continued)

Variable	Mean	Min.	Max.
Marital Status:			
Married	0.675 (omitted group)	0	1
Widowed	0.052	0	1
Divorced	0.072	0	1
Separated	0.031	0	1
Never Married	0.170	0	1
Race:			
White	0.848 (omitted group)	0	1
Black	0.129	0	1
Other	0.023	0	1
Sex:			
Male	0.429 (omitted group)	0	1
Female	0.571	0	1
Sex - Labor Force Participation Interaction:			
Female in the Labor Force	0.343	0	1
Male, or Female Not in the Labor Force	0.657 (omitted group)	0	1
Region:			
Northeast	0.308	0	1
Northcentral	0.272	0	1
South	0.176	0	1
West	0.244 (omitted group)	0	1

A5.2. PHYSICIAN PRICE

The mean charge for a routine physician visit is approximately $27 for the 1979 data analyzed here (Physician Price, Tables A1-A4).[21] As already mentioned, these physician price data are at the aggregate (SMSA) level as opposed to the micro (consumer) level. The average physician price varies from a high of $47.29 for the Atlanta SMSA to a low of $15.21 for the Milwaukee SMSA (Tables A1-A4).[22]

Although averaging prices squelches individual variation which otherwise could be used to identify the price coefficients, it also squelches a positive bias in the estimates. Prices and quality are likely to be positively related. This positive correlation will make it difficult to identify the true (quality held constant) price effect. By averaging across all physicians, some of the positive bias will be replaced with a zero bias. However, to the extent that quality of physician care varies across SMSA's, the estimated price coefficients will be positively biased. There is probably greater quality variation within rather than across SMSA's. Therefore, by use of these data, some of the positive bias is abated.

A5.3. CIGARETTE PRICE

Cigarette prices, like the physician visit prices used here, are SMSA specific. The means of both variables vary little between the samples and subsets analyzed (Tables A1-A4). This is because the proportion of individuals residing in each SMSA varies only slightly across subsets. The

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[21] The physician prices analyzed here are producer prices and therefore are gross of any insurance payments that may have been made to physicians. See Section 4.3.3.

[22] These figures and all price and income data presented have been cross-sectionally price adjusted. See Section 4.3.4.

mean cigarette price throughout (Tables A1-A4) is approximately 67¢ per pack. The average cigarette price per pack varies from a low of 59.6¢ for the Washington, D.C. SMSA to a high of 78.5¢ for the Dallas SMSA.[23] Partly due to state and local taxes, absolute cigarette prices in Florida, Massachusetts, and New York are the highest in the nation. However, the general price level in these same states is also amongst the highest in the nation. Therefore, the relative cigarette prices in these areas is much closer to the national average. This, in part, explains why the Dallas SMSA ranks highest in terms of relative price.

[23]In the regression analysis which follows, this slight inter-SMSA variation is what is relied upon to identify the cigarette price effects.

TABLE A3

DESCRIPTIVE STATISTICS
VARIABLES USED IN PHYSICIAN SERVICE DEMAND EQUATIONS
INCLUDES ZERO AND NON-ZERO OBSERVATIONS
EXCLUDES MEDICAID RECIPIENTS
SAMPLE SIZE = 21971

Variable	Mean	Std. Dev.	Min.	Max.
Physician Visits per year	3.71	8.26	0	518
Physician Price $'s per visit	27.30	5.59	15.21	47.29
Cigarette Price ¢'s per pack	67.44	4.33	59.57	78.52
Family Income $1000's per year	27.24	16.39	00.46	52.82
Age years	41.80	15.16	20	74
Medicaid:				
Cardholder	0		0	0
Not a Cardholder	1		1	1
Self-Reported Health Status:				
Excellent	0.491 (omitted group)		0	1
Good	0.391		0	1
Fair	0.093		0	1
Poor	0.025		0	1
Limitations Due to Chronic Conditions:				
Not Limited and/or No Chronic Conditions	0.863 (omitted group)		0	1
Cannot Perform Usual Activity	0.028		0	1
Can Perform Usual Activity but Limited in Amount and/or Kind	0.070		0	1
Can Perform Usual Activity but Limited in Outside Activity	0.039		0	1
Education:				
0 years	0.003		0	1
1-11 years	0.214 (omitted group)		0	1
12 years	0.362		0	1
13-15 years	0.200		0	1
16 years	0.124		0	1
17+ years	0.097		0	1

TABLE A3 (continued)

Variable	Mean	Min.	Max.
Marital Status:			
Married	0.681 (omitted group)	0	1
Widowed	0.047	0	1
Divorced	0.066	0	1
Separated	0.026	0	1
Never Married	0.180	0	1
Race:			
White	0.861 (omitted group)	0	1
Black	0.112	0	1
Other	0.027	0	1
Sex:			
Male	0.481 (omitted group)	0	1
Female	0.519	0	1
Sex - Labor Force Participation Interaction:			
Female in the Labor Force	0.320	0	1
Male, or Female Not in the Labor Force	0.680 (omitted group)	0	1
Region:			
Northeast	0.306	0	1
Northcentral	0.271	0	1
South	0.175	0	1
West	0.248 (omitted group)	0	1

A5.4. MEDICAID RECIPIENTS

The lack of insurance data indicates that the physician prices analyzed here overstate the out-of-pocket expenses faced by consumers. Therefore, the estimated price coefficients will be biased towards zero. In an attempt to correct for some of this bias, observations on medicaid recipients are eliminated from the sample for some estimations (Columns 3 and 4, Table 1; and Columns 3 and 4, Table 2). Observations on medicaid recipients comprise 3% of the overall sample (675 out of 22,646 observations). This is the one identifiable group within this sample for which insurance coverage is likely to be extensive. Because of this Known mismeasurement, these observations are singled out.

Tables A3 and A4 present the descriptive statistics on the data used in the physician visits equations, with observations on the medicaid recipients eliminated. Tables A3 and A4 are identical in structure to Tables A1 and A2 respectively, except for the exclusion of these observations. Medicaid benefits are usually legally restricted to low income households with single female heads. Additionally, this profile is correlated with non-participation in the labor force and low educational attainment. These socio-demographic characteristics are reflected in the differences in the mean values between Tables A1 and A3, and Tables A2 and A4. However, as shown in Table 2, the exclusion of these relatively small number of observations has little effect on the overall regression results.

TABLE A4

DESCRIPTIVE STATISTICS
VARIABLES USED IN PHYSICIAN SERVICE DEMAND EQUATIONS
EXCLUDES ZERO OBSERVATIONS
EXCLUDES MEDICAID RECIPIENTS
SAMPLE SIZE = 16444

Variable	Mean	Std. Dev.	Min.	Max.
Physician Visits per year	4.95	9.23	1	518
Physician Price $'s per visit	27.29	5.59	15.21	47.29
Cigarette Price ¢'s per pack	67.37	4.34	59.57	78.52
Family Income $1000's per year	27.50	16.40	00.46	52.82
Age years	42.00	15.31	20	74
Medicaid:				
Cardholder	0		0	0
Not a Cardholder	1		1	1
Self-Reported Health Status:				
Excellent	0.460 (omitted group)		0	1
Good	0.401		0	1
Fair	0.108		0	1
Poor	0.031		0	1
Limitations Due to Chronic Conditions:				
Not Limited and/or No Chronic Conditions	0.836 (omitted group)		0	1
Cannot Perform Usual Activity	0.034		0	1
Can Perform Usual Activity but Limited in Amount and/or Kind	0.085		0	1
Can Perform Usual Activity but Limited in Outside Activity	0.045		0	1
Education:				
0 years	0.002		0	1
1-11 years	0.206 (omitted group)		0	1
12 years	0.360		0	1
13-15 years	0.205		0	1
16 years	0.126		0	1
17+ years	0.101		0	1

TABLE A4 (continued)

Variable	Mean	Min.	Max.
Marital Status:			
Married	0.690 (omitted group)	0	1
Widowed	0.049	0	1
Divorced	0.068	0	1
Separated	0.026	0	1
Never Married	0.167	0	1
Race:			
White	0.859 (omitted group)	0	1
Black	0.118	0	1
Other	0.023	0	1
Sex:			
Male	0.437 (omitted group)	0	1
Female	0.563	0	1
Sex - Labor Force Participation Interaction:			
Female in the Labor Force	0.350	0	1
Male, or Female Not in the Labor Force	0.650 (omitted group)	0	1
Region:			
Northeast	0.307	0	1
Northcentral	0.273	0	1
South	0.178	0	1
West	0.242 (omitted group)	0	1

A5.5. HEALTH VARIABLES

There are two sets of health variables used in these regression analyses. The first is the individuals self-reported health status. This is represented by a set of dummy variables; "excellent," "good," "fair," and "poor" with those responding "excellent health" being placed in the omitted group.

The second set of dummy variables pertains to limitations in physical activity due to one or more chronic conditions with which individuals may be inflicted. The omitted group consists of individuals who either have no chronic conditions or have one or more chronic conditions which do not limit their activities.

The remainder of the survey respondents fall into either one of three categories. The first categorical group consists of individuals whose chronic conditions are so limiting that they cannot perform their usual activities.[24] The second group consists of individuals who can perform their usual activities but those activities are limited in scope.[25] Finally, individuals in the third group can perform their usual activities without limitation. However, they face limitations on their activities other than their usual activities. All this survey information pertains to the individuals' current situation.

Looking at the overall sample used to analyze physician visits demand, the percentage of individuals in each category, "excellent," "good," "fair,"

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[24]The usual activity for an individual who is employed is working, for an individual who attends school attending school, etc. A construction worker who gives up his/her job as a result of a chronic heart condition, is an example of an individual in this first categorical group.

[25]For example, an auto mechanic with a chronic heart condition may no longer be able to repair cars, but can direct others, process orders, and so on. The individual is still gainfully employed in his/her usual place of employment but his/her activities are limited.

and "poor," is 48%, 39%, 10%, and 3% respectively (Table A1). Restricting the sample for the physician visit demand equations to individuals who had one or more physician visits in 1980, the percentages are 45%, 40%, 11% and 4% respectively (Table A2). Obviously individuals who seek physician care tend to have worse health.

Medicaid recipients also tend to report lower health status. This is reflected in the percentages as well, but only slightly since this group comprises only 3% of the overall sample. Excluding Medicaid recipients from the overall sample used to estimate the physician visits demand, the percentages for the categories "excellent," "good," "fair," and "poor" are 49%, 39%, 9%, and 3% respectively (Table A3). Excluding Medicaid recipients, and non-users of physician care renders percentages of 46%, 40%, 11%, and 3% (Table 4).

Finally, the percentage of smokers self-reporting their health as "excellent," "good," "fair," or "poor" is 43%, 42%, 12% and 4% respectively (Table 6). Comparing these figures to the ones contained in Table 5, one notices that the percentage reporting their health as excellent drops five percentage points (48% to 43%) when the non-smokers are eliminated from the sample.[26]

With regard to the limitation-of-activity variables, the percentage of individuals responding in each category, "not limited," "cannot perform usual activity," "limited in usual activity," and "limited in outside activity," is 85%, 3%, 7%, and 4% respectively (Table A1). These figures are for the overall sample used to estimate physician visits demand. Restricting the

[26]The strong correlation between smoking and health led the researchers conducting the Rand Health Insurance Experiment to use smoking levels as one of the proxy variables for health (Brook, et al. 1984).

sample, so as to eliminate non-users of physician care (Tables A2 and A4) and Medicaid recipients (Tables A3 and A4) will alter the percentages in a way similar to the alteration in the health status percentages previously discussed.