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Working Paper

Cigarette Demand, Health Scares and Education in Turkey

Center Discussion Paper, No. 660

Provided in Cooperation with:

Yale University, Economic Growth Center (EGC)

Suggested Citation: Tansel, Aysit (1992) : Cigarette Demand, Health Scares and Education in Turkey, Center Discussion Paper, No. 660, Yale University, Economic Growth Center, New Haven, CT

This Version is available at:

<https://hdl.handle.net/10419/160582>

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CENTER DISCUSSION PAPER NO. 660

**CIGARETTE DEMAND, HEALTH SCARES
AND EDUCATION IN TURKEY**

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and
Middle East Technical University - Turkey**

April 1992

Note: Center Discussion Papers are preliminary materials circulated to stimulate discussions and critical comments. Earlier versions of this paper were presented at the 1991 Northeast Universities Development Consortium Conference at the Harvard Institute for International Development, Harvard University and at the Middle East Economic Association meeting in Washington, D.C. in December 1990. This is a revised version of the paper originally written in December 1987.

Research for this paper was partially funded by The Rockefeller Foundation.

I am grateful to T. Paul Schultz for many comments and suggestions. Kenneth M. Kletzer made helpful comments on the manuscript. I would like to express my thanks to Ihsan Türker of the State Planning Organization, Ankara, for a number of discussions in constructing and interpreting the data. Thanks are also due to Oktar Türel and Haluk Kasnakoglu who commented on a preliminary version of this paper.

Abstract

The purpose of this paper is to examine the demand characteristics of cigarettes in Turkey. Aggregate time series data for the 1960-1988 period are used in estimation. Income and price elasticities of cigarette demand are obtained. The effect of health warning is estimated to reduce cigarette consumption by about 9 percent since the inception of warnings in 1982. Imports of cigarettes have been allowed since 1984 in addition to advertising of cigarettes in the non-electronic media. The effect of health warnings are found to be stronger than the opposing effect of advertising. The results also suggest that public education about adverse health effects of smoking may be more effective in reducing consumption and less regressive on consumer incomes than raising the price of cigarettes.

Key Words: Cigarette Demand, Health Scares, Education

I. INTRODUCTION

Knowledge of demand for cigarettes has the usual academic and commercial interests. It is also important for public policy because, it is a major source of tax revenue¹ and a factor for public health due to the adverse health effects of smoking. For this reason demand for cigarettes and tobacco products are widely investigated in many countries. The effects of advertising on cigarette consumption is studied by McGuinness and Cowling (1975) and Radfar (1985). The effectiveness of health warnings, anti-smoking publicity and discontinuing the electronic media advertising in reducing cigarette consumption are investigated by Hamilton (1972), Fujii (1980), Warner (1977), Bishop and Yoo (1985), and Baltagi and Levin (1986) in the U.S.; Young (1983) in the U.K.; McLeod (1986) in Australia and Stavrinou (1987) in Greece. Cigarette consumption in Turkey is studied less often and not at all during the past decade and a half. Therefore, the purpose of this study is to estimate a demand function for cigarettes in Turkey for the 1960-1988 period, obtaining the relevant price and income elasticities and to examine the effect of health warnings and education on cigarette consumption.

This paper is organized as follows. Section II describes the practices of the State Monopoly over production of tobacco products and the recent trends in smoking. The model specification is discussed in Section III. Section IV presents the estimation results. Section V discusses policy implications. Conclusions appear in Section VI. The data and data sources are provided in the appendix.

II. THE STATE MONOPOLY, ADVERTISING AND RECENT SMOKING TRENDS

The production and wholesale distribution of cigarettes and tobacco products are undertaken by a state firm called "Tekel," the Monopoly. Cigarettes are not advertised by the State Monopoly except for a limited advertisement in print for a short period of time when a new brand is introduced. Imports of cigarettes were allowed in 1984,² and since then

imported brands have been aggressively advertised by the manufacturers (but not the domestic brands) in print media and in public posters. No advertising is allowed in radio or television.

The health warnings took the form of a warning on cigarette packages starting in September of 1981. In February 1986 there was an anti-smoking campaign by one of the national newspapers through a series of front page articles on hazardous health effects of smoking. Then, in 1988, the Ministry of Health initiated a short-lived anti-smoking campaign mainly by placing anti-smoking posters in public places.

The production and consumption of filter-tip cigarettes has increased steadily over the years. Table 1 shows the average annual share of filter-tip cigarettes in the total tobacco products. This share increased from about 9 percent in the late 1960s to over 90 percent in 1988.³ Table 1 also shows the average share of variety tobacco products in the total. Variety tobacco includes ground tobacco for cigarettes and pipes, as well as fancier products. Their share declined from about 8 percent in the late 1960s to about 1 percent in 1988.⁴ In this study cigarette tobacco includes tobacco used for filter and non-filter cigarettes, variety tobacco, imports (since 1984) and estimated amounts for the black market activity. Accordingly the cigarette price is a weighted average of the prices of these, where the weights are their respective consumption shares in the total. The data and their sources are given in the Appendix.

TABLE 1
Recent Trends in Cigarette Tobacco Consumption, Shares of
Filter-tip Cigarettes, Variety Tobacco and Prices

	Average Annual Share of Filter-tip Cigarettes in the Total (%)	Average Annual Share of Variety Tobacco in the Total (%)	Average Annual Cigarette Tobacco Consumption, Thousand Tons	Average Annual Rate of Growth (%)	Average Price of Tobacco Products
1960-65	-	13.0	33.3	3.2	24.3
1966-70	8.5	7.6	41.5	5.1	77.4
1971-75	19.9	6.3	53.1	6.6	136.4
1976-80	56.4	4.0	65.6	2.4	697.8
1981-85	80.1	2.4	69.1	1.0	5,174.3
1986-88	91.3	1.4	70.2	4.6	17,431.4

Table 1 also shows average annual cigarette tobacco consumption. Its average annual growth rate was 3.9 percent during the 1960-1988 period, with a marked slowing down during the 1982-1985 period. The last column shows the average price of cigarettes which grew by 717 times during the 1960-1988 period. Figure 1 shows cigarette tobacco consumption per adult over 15 during the period of 1950-1988, which displayed a steady increase over time reaching a peak of 2.723 kilograms (kg.) per adult in 1979. It is suspected that Turkish cigarettes were stocked for the purpose of smuggling them out to Middle Eastern countries in 1979. In 1980 there was a dip in per adult consumption probably because of a decline in illegal activities attributable to the imposition of marshal law and *coup de etat* that took place in that year. The year 1980 also coincides with a decline in real GNP by 1 percent, and a rate of inflation of 110 percent in the consumer price index (CPI). The nominal cigarette price also rose by 122 percent, resulting in an increase in real cigarette prices. Over time behavior of the real price of cigarettes (the nominal price divided by the CPI) is shown in Figure 2. The real price of cigarettes, although it fluctuated at times, has increased by one and a half times during 1960-75. It almost doubled during the 1976-1988 period.

Cox and Marks (1983) gives information on cigarette consumption trends in several OECD countries. According to the Organization for Economic Cooperation and Development (1990) the consumption of total tobacco products in 1980 ranged from highs of 3.6 kg. per adult in the Netherlands and 3.5 kg. in Canada to lows of 2.0 kg. in Sweden and 1.5 kg. in Finland. The same figure was 2.4 kg. in Turkey in 1980.

In Turkey, smoking has been a widespread habit among men of all socio-economic classes and has been socially accepted among urban women. There has been no systematic examination of the prevalence of smoking by gender, education, age and by urban, rural or other geographic locations. Öztürk and Aykut (1975) found that among the medical, divinity and engineering students of Uludağ University 9 percent of the students started smoking before the age of 13, 30 percent started between the ages of 14-16, and another 53 percent started smoking between 17-19, and 8 percent started after the age of 20. Ulusoy (1980) reported that 25 percent of the nursing high school (all girls) and 35 percent of the Hacettepe

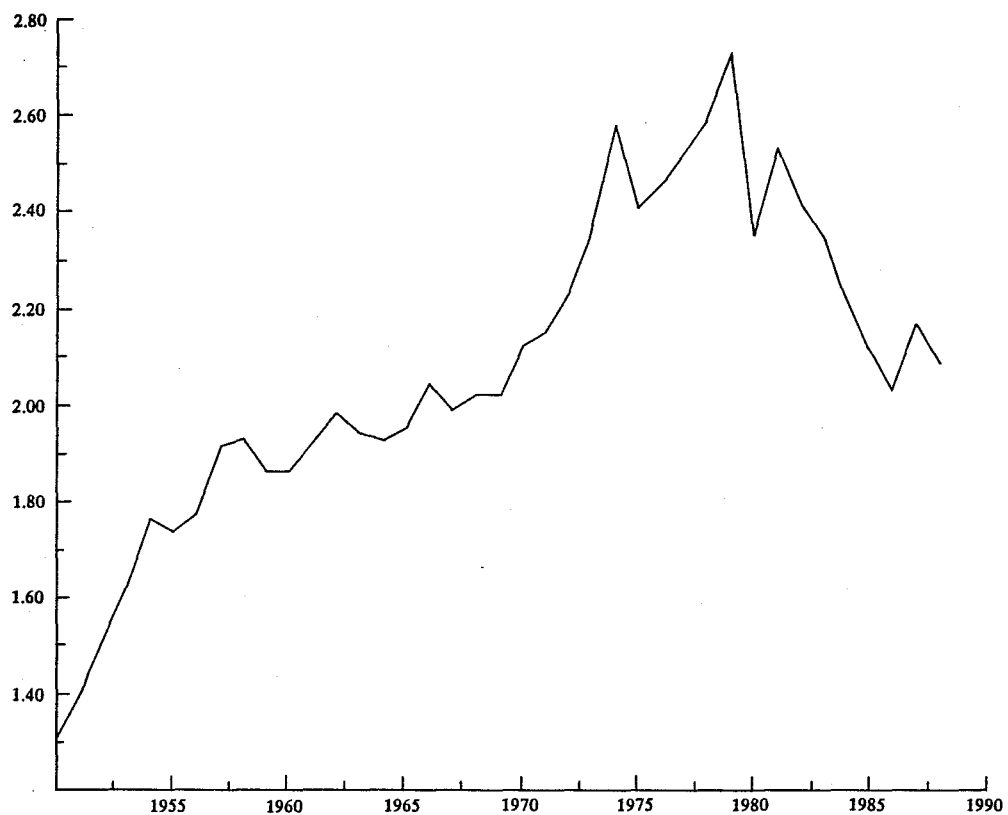


FIGURE 1: Cigarette Tobacco Consumption per Adult over Fifteen, 1950-1988, Turkey

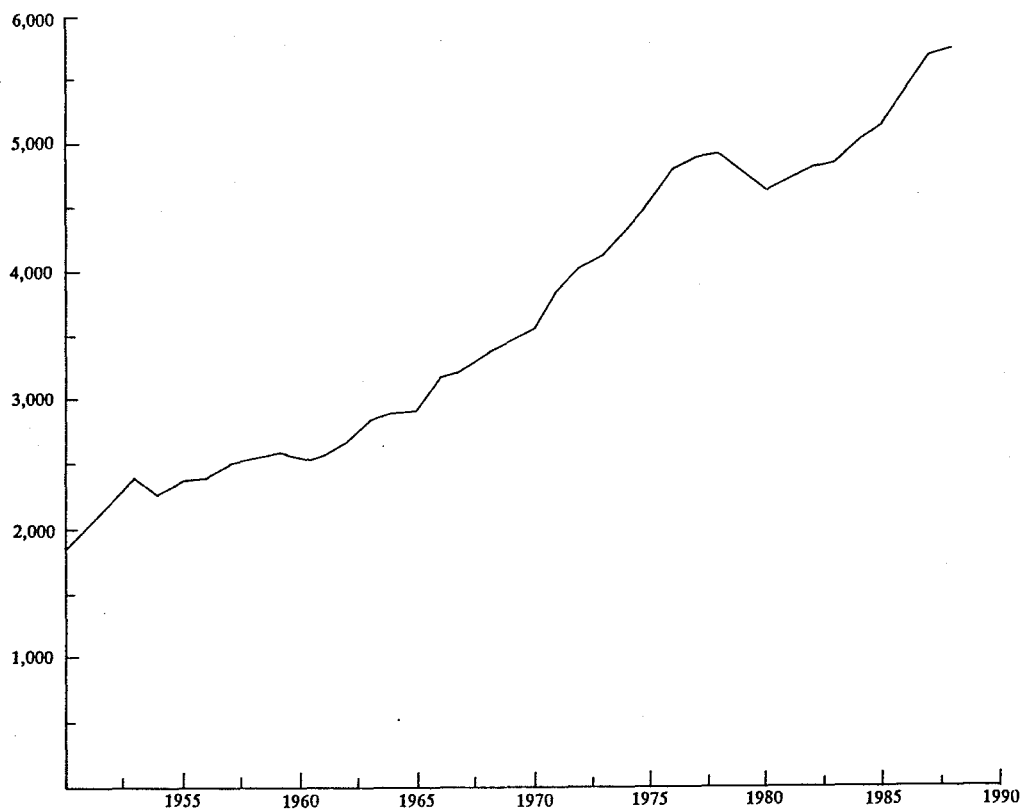


FIGURE 2: Per Capita Real GNP, 1950-1988, Turkey

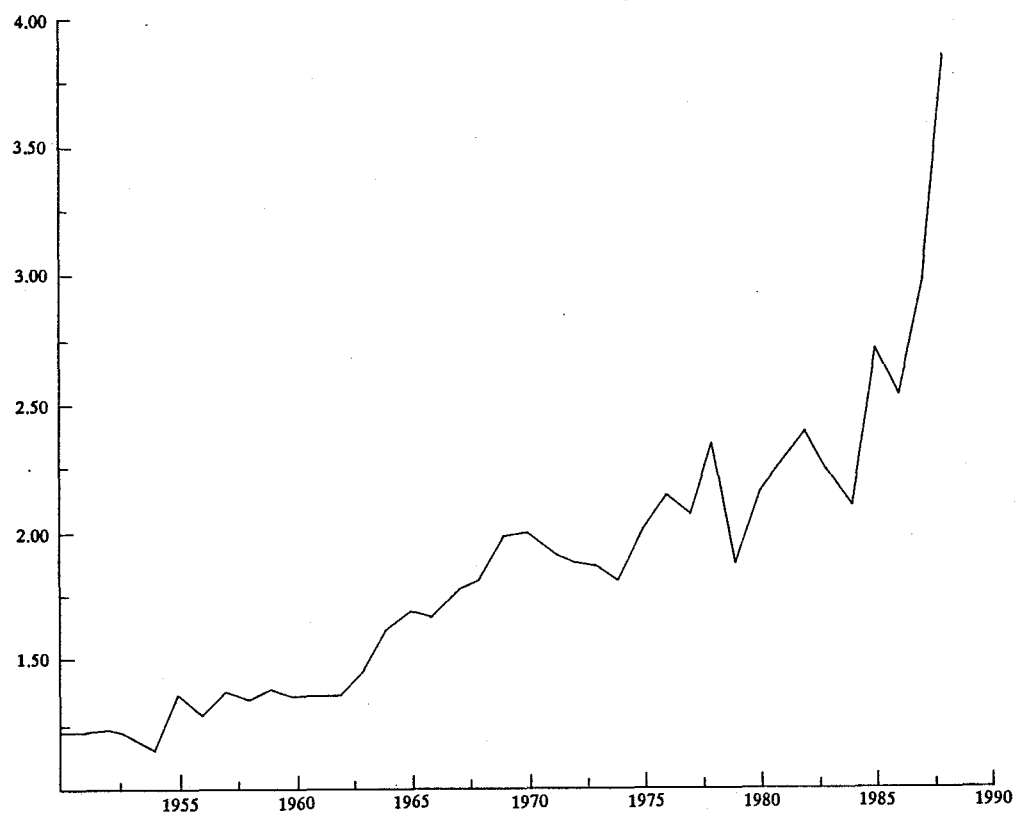


FIGURE 3: Real Price of Cigarettes, 1950-1988, Turkey

University nursing students (all girls) smoked regularly and 70 percent of smokers had at least two smoking family members. Doğan (1987) found that 27 percent of the male and 11 percent of the female high school students smoked in Sivas. Of those who smoked, 36 percent started at the age of 13 or 14, and 45 percent started at the age of 15 or above. Similar figures were obtained among high school students in Ankara by the same author.

III. THE MODEL

Following the usual approach to the specification of a demand function, the quantity consumed of cigarettes is expressed as a function of the real price of cigarettes and real disposable income. Since cigarettes have no direct substitutes or complements, no other price variables are considered. Under certain assumptions, one can consider both the quantity demanded per capita and income per capita in a demand function as is shown by Barten (1977). It is assumed that adults over the age of 15 define the relevant smoking population and accordingly Q measures quantity consumed of cigarette tobacco per adult and Y represents per capita real income (rather than per adult) to reflect the fact that all individuals hold claims on disposable income. P is the real price of cigarettes. Shifts in information, tastes and preferences are represented by a vector of dummy variables D and an unobservable random disturbance term u . The dummy variables are expected to capture the effect of the health warning written on cigarette packages since September 1981 and the 1986 and 1988 anti-smoking campaigns. The model can be written as:

$$Q = F(Y, P, D, u).$$

A priori, we expect the coefficients of real price and the dummy variable to be negative and that of real disposable income to be positive. The estimated equations in the next section also include education variables representing secondary and tertiary enrollments.

Several authors, including McGuinness and Cowling (1975), Fujii (1980), Radfar (1985), Baltagi and Levin (1986) and others, used an adaptive expectations hypothesis in modelling the demand for cigarettes to reflect the habit forming nature of smoking. In this

paper a general dynamic version of the above model is employed and tested to achieve a parsimonious specification.

Only the demand for cigarettes is modelled. The supply side is ignored since the State Monopoly is a monopolist and there is no one-to-one correspondence between the quantity supplied and the price. The State Monopoly is actually a monopsonist-monopolist. While there are a large number of tobacco growers, it is the sole purchaser of raw tobacco and the sole producer and seller of processed tobacco products. Accordingly, the ordinary least squares (OLS) estimation of the demand function for cigarettes will give consistent and efficient estimates.

IV. ESTIMATION RESULTS

The ordinary least squares estimates of the models of demand for cigarette tobacco are summarized in Tables 2 and 3. Turkish annual time series data for the 1960-1988 period are used in estimation. In these models the dependent variable, Q is the quantity of cigarette tobacco consumed per adult over 15. Y is the per capita real GNP in terms of 1968 prices used as a proxy for per capita disposable income since consistent real disposable income series do not exist for the estimation period. The real price of cigarettes is taken as the ratio of the nominal price and the consumer price index (CPI) base 1976. Finally, Y_{-1} , Q_{-1} and Q_{-2} are the one- and two-period lagged values of the respective variables. All variables are in logarithms so that the coefficients represent the relevant elasticities. D82-88 is the dummy variable over the 1982-1988 period used to proxy the effect of health warning on consumption. D86-88 is the dummy variable over the 1986-1988 period used to proxy the effect of the 1986 anti-smoking campaign.^{5,6}

In the tables, R^2 denotes the coefficient of determination. F is the standard F -statistic for testing the joint significance of the regression coefficients. SER is the standard error of regression. DW is the Durbin-Watson statistic. $AR(i)$, $i = 1, 2$ is the F -form of the Lagrange Multiplier (LM) test of i -th order autocorrelation starting at the first lag (Harvey (1981) and Godfrey (1978)). It is distributed as $F(i, T-k-i)$ under the null of serial independence, where T

TABLE 2
Estimates of Cigarette Demand Models, 1960-1988, Turkey

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant	-2.809** (3.29)	-3.274** (3.13)	-3.188** (3.62)	-4.383** (8.31)	-2.664** (2.92)	-2.975** (3.24)	-2.789** (3.36)	-4.652** (8.46)
Income (Y)	.413** (3.43)	.4817** (3.22)	.471** (3.75)	.648** (9.29)	.392** (3.03)	.267 (.86)	.411** (3.50)	.687** (9.56)
Price	-.179* (1.94)							
CPI	.172* (1.75)							
Real Price		-.188* (1.85)	-.196* (2.05)	-.247** (2.71)	-.198* (1.94)	-.232* (2.21)	-.214* (2.22)	-.329** (3.88)
Y_{-1}						.174 (.51)		
Q_{-1}	.438** (3.08)	.286 (1.47)	.292 (1.68)		.368* (2.01)	.379* (2.26)	.424** (3.03)	
Q_{-2}	.355* (2.08)	-.005 (.02)			.089 (.51)			
D82-88	-.072 (1.69)	-.089** (3.21)	-.086** (3.29)	-.099** (3.90)	-.088** (3.16)	-.089** (3.28)	-.087** (3.29)	-.121** (4.41)
D86-88		-.059 (1.16)	-.054 (1.16)	-.099* (1.84)				
R^2	.879	.879	.886	.882	.872	.879	.878	.841
F	31.892**	24.390**	34.190**	44.990**	28.521**	32.078**	41.352**	43.930**
SER	.040	.041	.040	.040	.041	.041	.039	.046
DW	2.262	2.030	2.010	1.46	2.191	2.252	2.270	1.422
AR(2)	2.27	4.65*	2.56	5.38*	3.28	2.46	2.66	2.53
AR(1)	1.01	.10	.01	2.11	.94	.73	.86	3.01
ARCH(2)	1.06	1.40	1.72	1.64	.45	.61	.59	.07
ARCH(1)	2.46	1.58	1.84	.89	.05	.26	.69	.17
Normality	.60	.62	.69	.70	.74	1.02	.87	2.57
Reset(4)	.71	.46	.47	.92	.58	.65	.63	.62
Chow Test	1.44	1.25	1.63	3.05*	1.42	1.59	1.55	3.92*
T/m	28/4	27/2	28/2	29/2	27/4	28/4	28/4	29/4

Notes: The absolute value of the t-ratios are in parentheses. A single asterisk indicates significance at 5 percent level and a double asterisk at 1 percent level.

is the number of observations and k is the number of parameters estimated. ARCH(j), $j = 1, 2$ is the F -form of the LM-test of j -th order autoregressive conditional heteroskedasticity due to Engle (1982). It is distributed as $F(j, T-k-2j)$ under the null of conditional homoskedasticity. Normality denotes Jarque and Bera's (1980) test of normality distributed as Chi-square with two degrees of freedom under the null of normality of the residuals. RESET(q) is Ramsey's (1969) test of functional form misspecification distributed as $F(q-1, T-k-q+1)$

under the null of correct specification where q is the order of polynomials of the predicted dependent variable. The Chow test is the test of parameter stability due to Chow (1960). It is distributed as $F(m, T-k-m)$ under the null of parameter stability over the last m observations.

TABLE 3
Long-Run Static Solutions of Models in Table 2

Variables	Model 1	Model 2	Model 3	Model 5	Model 6	Model 7
Constant	4.998** (4.55)	-4.554** (5.88)	-4.500** (6.05)	4.904** (4.96)	4.788** (5.72)	4.838** (5.48)
Income	.736** (5.03)	.670** (6.57)	.665** (6.77)	.721** (5.59)	.709** (6.48)	.714** (6.16)
Price	-.319* (2.30)					
CPI	.307* (2.07)					
Real Price		-.261* (1.91)	-.277* (2.13)	-.365* (2.34)	.374** (2.81)	-.370** (2.64)
D82-88	-.128* (1.78)	-.124** (2.70)	-.122** (3.02)	-.162** (2.92)	-.143** (3.15)	-.151** (3.21)
D86-88		-.082 (1.46)	-.076 (1.47)			
Wald Test	3354	5184	5672	2910	2028	3667

Notes: See Table 2.

General dynamic specifications are estimated to achieve stationary residuals and parsimonious representations are obtained through testing. In model 1 the own price of cigarettes and the CPI are included separately. As expected the own price coefficient estimates are negative and those of CPI are positive. Further, these two coefficient estimates are nearly equal in size with opposite signs. Therefore, models 2-8 are estimated using the real price of cigarettes, the ratio of the own price and the CPI. Models 2-4 include both D82-88 and D86-88. Since the estimated coefficient of D86-88 is found to be insignificant, models 5-8 include only D82-88. Models 4 and 8 are the static models and suffer from coefficient instability as indicated by the Chow test, and also of autocorrelated residuals in the case of model

4. Models 3 and 7 represent the partial adjustment hypothesis with one period lagged value of the dependent variable among the regressors. In models 2 and 5, the two-period lagged value of the dependent variable is not significant. In model 6, although the income and one-period lagged value of income are insignificant, income is significant in the corresponding long-run static solution. The long-run static solutions of the equations in Table 1 are given in Table 2. The Wald test is distributed as a Chi-square variate under the null hypothesis of zero long-run parameters which is rejected for all of the models. Model 7 which is a partial adjustment model passes all of the diagnostic tests and variance dominates the other equations.⁷

Model 7 indicates an income elasticity of cigarette demand equal to .411 in the short run. The corresponding long-run income elasticity is .714. The price elasticities are .214 and .370, respectively, in the short- and long-runs. These results are in concordance with the international evidence for income and price inelastic cigarette demand, as well as the prior Turkish evidence provided by Türel (1975) using quarterly data. The income elasticities obtained by Türel are .68 and .62 for the periods of 1950-73 and 1963-73, respectively. The associated price elasticities are .32 and .21, respectively, for the same periods.

An income elasticity of less than unity does not indicate necessity of cigarettes for survival as food is. The price and income inelasticity of cigarette demand is explained by the absence of direct substitutes, by the widespread prevalence of its use, and by its addictive nature.

In all of the models the coefficient estimates of the lagged dependent variable is positive reflecting the addictive nature of smoking. In model 7 the coefficient estimate indicates that about 40 percent of additional current cigarette consumption is due to previous additional cigarette consumption.

The coefficient estimate of the dummy variable D82-88 is significant in all the models, and indicates about 9-12 percent decline in cigarette demand over the 1982-88 period. The corresponding long-run declines range between 12 and 16 percent. Our preferred specification, model 7 indicates a 9 percent decline over the 1982-88 period. This decline can be

attributed to the health warning found on the cigarette packages since the end of 1981. The dummy variable D82-88 implies that the initial impact of the health warning remains the same over the years which may not be true. To allow for the separate impacts of the 1986 and 1988 anti-smoking campaigns and for the possibility of nonconstant effect of the 1982 health warning over time, a separate dummy variable for each of the years 1982-88 are included.⁸ The estimated equation is given in note 8. The estimates indicate that each of the years (except 1982) represent significant declines in per adult tobacco consumption including the years 1986 and 1988. The largest annual decline in consumption occurred in 1986 by 24 percent which is the first year of the anti-smoking campaign. The coefficient for 1984 also indicates a significant decline. Since 1984 marks the inception of cigarette advertisement we can conclude that the effect of health warning was stronger than that of advertisement.

Studies by Hamilton (1972), Warner (1977), and Baltagi and Levin (1986) indicate that health scares significantly reduced cigarette consumption in the U.S. Fujii (1980) and Bishop and Yoo (1985) suggested that rising taxes would be more successful in reducing consumption. McLeod (1986) found that advertising bans brought about a short-lived reduction in tobacco consumption in Australia. Cox and Smith (1984) compared different approaches towards smoking and found that the countries which fought smoking via official regulations such as smoking bans in public places have been more successful in achieving a reduction in consumption than the countries with no such official policy.⁹

Effects of Education

The effects of education on cigarette demand is hypothesized to be through two channels. The higher educational attainments mean, on the one hand, higher incomes, and hence increased cigarette demand. On the other hand, we can expect the better educated to be better informed about the adverse health effects of smoking, and hence a factor decreasing cigarette demand. Enrollment ratios are included in the demand equations to examine these effects, although these effects may be difficult to observe at the aggregate level. Estimation results together with corresponding long run solutions are shown in Table 4. In this table

"education" is the ratio of the total of enrollments in the middle schools, high schools and universities to the population in the 12-24 age group. Models 1 and 2 in Table 4 indicate that the coefficient estimates of "education" are negative but insignificant.

TABLE 4
Estimates of Cigarette Demand Models Including Education
and Long-Run Static Solutions, 1960-1988, Turkey

Variables	Model 1	Model 2	Model 3	Model 5	Long Run Solutions Model 6	Model 7
Constant	-6.500* (2.15)	-5.638* (2.01)	-7.365* (2.48)	-10.264* (2.17)	-10.001* (1.92)	-12.033* (2.37)
Income (Y)	.524 (1.41)	.701* (2.36)	.888** (2.77)	1.271** (2.60)	1.244* (2.30)	1.452** (2.69)
Real Price	-.207* (1.97)	-.183* (1.83)	-.169* (1.74)	-.327* (2.42)	-.325* (2.15)	-.276* (2.00)
Education	-.255 (1.22)	-.213 (1.06)		-.403 (1.18)	-.378 (1.00)	
Secondary			-.182 (1.03)			-.298 (.98)
Tertiary			-.129* (1.84)			-.211* (1.82)
Y_{-1}	.281 (.81)					
Q_{-1}	.367* (2.21)	.437** (3.12)	.388** (2.78)			
D82-88	-.096** (3.50)	-.092** (3.43)	-.110** (3.75)	-.152** (3.33)	-.163** (3.26)	-.179** (3.80)
Wald Test				2162	3521	4450
R^2	.887	.884	.896			
F	27.576	33.498	30.303			
SER	.040	0.039	0.039			
DW	2.181	2.233	2.260			
AR(2)	1.07	1.41	2.17			
AR(1)	.34	.57	.74			
ARCH(2)	.25	.25	.08			
ARCH(1)	.09	.58	.14			
Normality	.53	.74	.99			
Reset(4)	.86	.63	.70			
Chow Test	2.05	1.66	1.20			
T/m	28/4	28/4	28/4			

Notes: See Table 2.

In model 3, the educational attainments are represented by two variables. The "secondary" is the ratio of the enrollments in the middle and high schools to the population in the 12-17 age group. Its estimated coefficient is negative but insignificant. The "tertiary" is the ratio of university enrollments to the 20-24 age group. Its estimated coefficient is negative and significant at the 5 percent level. We can conclude that at university level education the effect of having better health information is stronger than the opposite effect of higher income.

V. POLICY IMPLICATIONS

The estimated price elasticities of demand for cigarettes imply that a 10 percent price increase will reduce consumption by 2 percent in the short run and by 4 percent in the long run. Thus, increased taxes could be used as a tool for curtailing consumption. There will also be an increase in government revenue since the percentage change in quantity is smaller than the percentage change in price. However, how much the taxes could be raised without encouraging smuggling is an important question. There is already evidence of increased black market activity in 1988 after two years of absence. In general not all of the price increase will be translated into a reduction in consumption. A restructuring of demand by switching to low cost brands of cigarettes usually accompanies taxes. To be effective in reducing consumption, proportionally higher price increases are suggested for the low cost brands than for the expensive brands. It may also be true that price increases affect the decision to start smoking rather than the amount smoked.

The incidence of the tax will differ by the socio-economic and education groups. Lower smoking rates are associated with higher education levels in the United States and the Soviet Union. Analysis of the previous section indicates that this may be true in Turkey also. Thus, the incidence of the tax will be larger on the uneducated who will have smaller disposable income as a result than on the educated rich.

The estimated effect of the health warning indicates that it reduced consumption by about 9 percent over the period of 1982-1988. This is larger than the reduction that could be achieved by a 10 percent price increase. Realization of a 9 percent reduction in consumption

would require a 23 percent increase in taxes. Thus, health warnings may be more powerful in reducing consumption than taxes and less regressive with respect to consumer income than taxes. In practice, a combination of taxes and educational actions will be probably most effective in reducing cigarette consumption. These actions should include health warnings and posters and their frequent change to be effective, restrictions on smoking in public places, prohibiting sales to minors and educational programs in schools. Tax proceeds could be used to sponsor the educational campaigns, as was done in Norway.

VI. CONCLUSION

This paper examines the characteristics of cigarette demand in Turkey using annual data for the 1960-88 period. As expected, demand is a negative function of price and a positive function of income. Further, demand is both price and income inelastic. The 1982 health warning and the 1986 and 1988 anti-smoking campaigns all had a significantly negative effect on demand. The average decline is found to be about 9 percent over the 1982-1988 period. It needs to be examined further as new data becomes available whether the decline will continue or it will be arrested by the cigarette advertisements that started in 1984. Educational attainments are found to be negatively related to cigarette demand but are insignificant except at the university level. The results suggest that public education about the health effects of smoking may be more effective in reducing consumption than raising the price of cigarettes. Public education may also be less regressive in its impact on consumer incomes than taxes because education exerts its primary effect on the smoking behavior of the less educated who are currently less well informed about the health consequences of smoking.

NOTES

1. Cigarettes provide a major source of government revenue in many countries. Its share ranges from 1-2 percent in Italy and Japan to 3-4 percent in Greece and the United Kingdom (Organization for Economic Cooperation and Development, 1985). Although expected to be large in Turkey, an estimate of the government revenue from cigarette and tobacco products could not be made because of the reporting practices of the State Monopoly.
2. Imports are handled by the State Monopoly. Cigarette and tobacco imports as percent of total imports increased five fold from 0.26 in 1984 to 1.24 in 1988. The cash outflow due to these imports were 173 million dollars in 1988 (State Institute of Statistics, 1990).
3. Throughout the period of 1960-84 the State Monopoly had difficulty in satisfying the filter-tip cigarette demand. The illegal entry of foreign brands and their sale in the black market started in the early 1960s and reached a maximum of an estimated 5 thousand tons in 1983 and disappeared when foreign brands were imported and sold legally starting in 1984. Two pricing policy concerns of the period were on the one hand keeping a high margin between filter and non-filter cigarette prices to balance the demand and on the other not losing the market share to the black market filter-tip. The State Monopoly experienced capacity utilization problems due to strikes during the period of 1977-1980 and production was carried out in the neighboring countries of Bulgaria and Yugoslavia. Capacity utilization has improved since then.
4. Ground tobacco is used by rolling it with a cigarette paper right before smoking.
5. The writing of the health warning on cigarette packages started in September 1981. There were two anti-smoking campaigns: One was in 1986 and the other in 1987. Advertisement of cigarettes started in 1984.
6. The dummy variable D82-88 takes a value of 1 in 1982 and in the subsequent years and zero otherwise. Similarly, the dummy variable D86-88 takes a value of 1 during 1986-88 and zero otherwise. Each of these variables represent a once and for all shift in the intercept of the smoking trend and imply that the health warning and the anti-smoking campaign have constant effects over time. This restriction is relaxed in the formulation given in note 8.

7. The partial adjustment model which is used in many cigarette demand studies assumes that the desired consumption of cigarettes (Q_t^*) is a function of its price and the disposable income of the consumer. The consumer approaches this desired level gradually via a partial adjustment process given by $\Delta Q_t = \lambda(Q_t^* - Q_{t-1})$, $0 < \lambda < 1$, which states that the actual change in consumption is a fraction λ of the desired change. Combining the two equations leads to a model (like model 7) in observable quantities with one period lagged value of consumption among the regressors with a coefficient equal to $(1-\lambda)$.
8. To observe the impact of the 1982 health warning over time and the impacts of the 1986 and 1988 anti-smoking campaigns following specification is estimated. In this formulation the dummy variables $D82, D83, D84, \dots, D88$ each take the value of 1 for the years they represent and zero for all other years.

$$Q = -5.024 + .736 Y - .390 P + .002 D82 - .059 D83 \\
\begin{matrix} (10.38) & (11.34) & (4.13) & (.05) & (1.85) \end{matrix} \\
-.167 D84 - .133 D85 - .237 D86 - .145 D87 - .107 D88 \\
\begin{matrix} (5.16) & (3.56) & (6.96) & (3.66) & (2.04) \end{matrix}$$

$$R^2 = 0.946 \quad F = 34.76 \quad SER = 0.0302 \quad DW = 2.23$$

$$AR(2) = 2.48 \quad AR(1) = .54 \quad ARCH(2) = .84 \quad ARCH(1) = 1.09$$

$$Normality = .481 \quad Reset(4) = 1.08$$

$$Time \text{ period} = 1960-1988.$$

The absolute value of the t -ratios are in parentheses and the rest of the notation is as defined in the text. All coefficient estimates are significant at 1 percent level except those for $D82$ which is insignificant and for $D83$ which is significant at the 5 percent level. The coefficients of the dummy variables represent changes in the intercept terms in each of the indicated years relative to an average relationship based on the 1960-1981 period. In this specification the coefficients of the dummy variables also represent the forecast errors for the prediction of the per adult tobacco consumption in each of the respective years based on the estimates for the period 1960-1981. The corresponding t -ratios represent the significance of the forecast errors. See Salkever (1976) on this.

9. According to the Organization for Economic Cooperation and Development (1990), during the 1980-85 period per adult tobacco consumption declined by 3.4 percent in the United Kingdom, 3.2 percent in Australia, 3.0 percent in Norway, 2.6 percent in Canada

and 2.5 percent in the Netherlands. It increased by 7.0 percent in Portugal, 3.7 percent in Greece and 0.7 percent in France.

DATA APPENDIX

Appendix Table 1

Year	Cigarette Tobacco Consumption (tons)	Cigarette Tobacco Consumption Including Black Market (tons)	Population Over 15 (thousands)	Tobacco Consumption per Adult (kilograms)	Per Capita Real GNP (1968 prices)	CPI (1975 = 100)
1960	30,371	30,371	16,328	1.860	2,561	24.1
1961	32,002	32,002	16,694	1.917	2,560	24.7
1962	33,806	33,806	17,069	1.981	2,652	25.7
1963	33,732	33,813	17,452	1.937	2,840	27.3
1964	34,147	34,339	17,843	1.924	2,882	27.3
1965	35,200	35,511	18,243	1.947	2,900	28.6
1966	39,090	38,157	18,717	2.039	3,167	31.0
1967	37,400	38,114	19,203	1.985	3,220	35.3
1968	38,700	39,754	19,702	2.018	3,350	37.5
1969	39,500	40,745	20,214	2.016	3,443	40.1
1970	42,630	43,851	20,739	2.114	3,546	42.4
1971	44,520	45,800	21,357	2.144	3,826	50.6
1972	47,310	48,890	21,993	2.223	4,014	58.4
1973	51,480	53,380	22,648	2.357	4,109	66.6
1974	57,820	60,030	23,323	2.574	4,304	82.5
1975	55,310	57,720	24,018	2.403	4,526	100.0
1976	57,700	60,530	24,642	2.456	4,784	117.5
1977	60,500	63,640	25,282	2.517	4,869	148.0
1978	63,800	67,270	25,939	2.593	4,906	239.6
1979	68,700	72,460	26,614	2.723	4,786	391.8
1980	60,000	64,070	27,303	2.347	4,638	761.1
1981	66,700	71,080	28,123	2.527	4,714	1,039.8
1982	65,200	69,890	28,967	2.413	4,808	1,360.4
1983	65,000	70,000	29,837	2.346	4,844	1,808.2
1984	65,800	67,800	30,731	2.206	5,006	2,683.0
1985	64,700	66,700	31,654	2.107	5,132	3,889.3
1986	66,000	66,000	32,604	2.024	5,409	5,235.6
1987	72,700	72,700	33,583	2.165	5,672	7,269.8
1988	70,000	72,000	34,585	2.082	5,723	12,750.4

Appendix Table 2

Year	Cigarette Price	Real Price of Cigarettes	Enrollment Ratios		
			Education	Secondary	Tertiary
1960	32.833	1.362	.065	.112	.026
1961	33.666	1.363	.073	.125	.030
1962	34.988	1.361	.078	.135	.030
1963	39.698	1.454	.082	.142	.032
1964	44.237	1.620	.085	.147	.034
1965	48.264	1.688	.087	.148	.036
1966	51.599	1.664	.095	.163	.040
1967	62.142	1.760	.106	.184	.043
1968	67.967	1.812	.116	.200	.047
1969	79.546	1.984	.125	.217	.051
1970	84.634	1.996	.131	.229	.052
1971	97.477	1.926	.141	.250	.053
1972	109.494	1.875	.147	.264	.052
1973	124.496	1.869	.148	.267	.052
1974	149.570	1.813	.153	.279	.052
1975	200.808	2.008	.162	.287	.074
1976	252.356	2.148	.181	.317	.089
1977	307.082	2.075	.188	.330	.092
1978	562.371	2.347	.191	.337	.090
1979	734.751	1.875	.188	.334	.084
1980	1,632.305	2.145	.189	.349	.067
1981	2,369.743	2.279	.181	.340	.057
1982	3,254.444	2.392	.185	.351	.055
1983	4,032.131	2.230	.189	.357	.063
1984	5,649.318	2.106	.198	.373	.070
1985	10,556.140	2.714	.212	.396	.083
1986	13,294.500	2.539	.222	.414	.091
1987	21,568.430	2.967	.231	.432	.094
1988	50,595.000	3.968	.239	.451	.095

SOURCES

Cigarette Consumption: Total cigarette tobacco consumption in tons. These figures include filter and non-filter cigarette tobacco plus variety tobacco products. Also included are the imported cigarette tobacco consumption after 1984 when imports were allowed. The source is the *Annual Programs* of the State Planning Organization for various years.

Cigarette Consumption including Black Market: Total cigarette tobacco consumption in tons including the estimates for the black market activity. The black market figures are obtained as follows. For the years 1960-1971 the numbers assumed by Türel (1975) are used. For the years 1972-1983 the black market consumption is assumed to increase linearly reaching 5,000 tons in 1983; thereafter declining to 2,000 tons and zero in the following years, and going back up to 2000 tons in 1988.

Population Over 15: Population over 15 years of age in thousands. This is obtained from various issues of the *Statistical Yearbook of Turkey* by the State Institute of Statistics for the census years. The intercensal years are obtained by interpolating the census data.

Tobacco Consumption per Adult: Total tobacco consumption per adult over 15 in kilograms. This is obtained by dividing total cigarette consumption by population over 15.

Per Capita Real GNP: Per capita GNP in 1968 Turkish Liras are obtained from various issues of *Statistical Yearbook of Turkey* by the State Institute of Statistics.

CPI: Consumer Price Index, base 1975 are obtained from various issues of the *International Financial Statistics* of International Monetary Fund.

Cigarettes Price: Nominal price of cigarette tobacco in Turkish Liras per kilogram. This is a composite price index obtained as a weighted average of the prices of filter and non-filter cigarettes, variety tobacco, black market cigarettes and imported cigarettes when applicable. The

weights are the respective consumption shares of different kinds in the total. The formula used is $\Sigma q_i p_i / \Sigma q_i$ where p and q denote the prices and the quantities consumed. The summations are over i which denotes the various kinds considered. The prices for the filter and non-filter tip cigarettes, variety tobacco and imports are obtained by dividing the current value of cigarette tobacco consumed by the weight. The value and weight figures are obtained from the *Annual Programs* of the State Planning Organization for various years. The resulting prices are the average of June of the respective years and include all special taxes. They are further adjusted for the retail agent's shares which differed for filter and non-filter cigarettes from year to year. The percentages used for this adjustment are obtained from the State Monopoly. As for the price of the black market cigarettes the figures for the years 1960-1971 are obtained from Türel (1975). Thereafter the black market prices are assumed to increase in proportion to the CPI until 1984. For the years 1984-88 they are assumed to be the same as the prices of imported cigarettes.

Real Price of Cigarettes: Real price of cigarette tobacco in Turkish Liras per kilogram obtained by dividing the nominal cigarette price by the CPI in Appendix Table 1.

Education: The ratio of the sum of the enrollments in middle schools, high schools and universities to the population in the 12-24 age group. The enrollment figures and 12-24 age group population figures for the census years are obtained from the various issues of the *Statistical Yearbook of Turkey*. The 12-24 age group population for the intercensal years are the interpolation of the corresponding census data.

Secondary: The ratio of the enrollments in middle and high schools to the population 12-17 years age group. The source is the same as in *education*. The census figures for the population aged 12-17 are interpolated to obtain the figures for the intercensal years.

Tertiary: The ratio of the enrollments in universities to the population 20-24 years old. The source is the same as in *education*. The census figures for the population aged 20-24 are interpolated to obtain the figures for the intercensal years.

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