

**GENDER GAP IN SMOKING: A NONLINEAR DECOMPOSITION ANALYSIS FOR
TURKEY****Dr. Öğr. Üyesi Didem PEKKURNAZ** * **Dr. Öğr. Üyesi Zeynep ELİTAŞ** * **ABSTRACT**

This paper aims to analyze the determinants of gender gap in smoking and compare the results between 2008 and 2012, the period of National Tobacco Control Action Plan. We apply the extended Blinder-Oaxaca decomposition using the Global Adult Tobacco Survey. We find that the percentage of the smoking differential explained is sensitive to the choice of the reference coefficients. Moreover, an inclusion of attitude toward tobacco law and tax variables increases the percentage of the explained differential when females and males differ only with respect to the differences in the observed characteristics. Results show that females and males respond differently to the changes in the factors of smoking. In addition, decomposition analysis reveals that contributions of the significant factors associated with gender gap in smoking differ between 2008 and 2012.

Keywords: Turkey, Smoking, Gender differences, Blinder-Oaxaca decomposition, Nonlinear regression models

JEL Classification: C25, I10, I12

**SİGARA İÇME DAVRANIŐI CİNSİYET FARKLILIĐI: TÜRKİYE İÇİN DOĐRUSAL
OLMAYAN BİR AYRIŐTIRMA YÖNTEMİ****ÖZ**

Bu çalıřmanın amacı, sigara içme davranıřındaki cinsiyet farklılıđının belirleyicilerini analiz etmek ve Ulusal Tütün Kontrol Eylem Plan periyodu olan 2008 ve 2012 için sonuçları karşılařtırmaktır. Çalıřmada, Küresel Yetiřkin Tütün Arařtırma Anketi verileri ile genişletilmiş Blinder-Oaxaca ayırıtırma yöntemi uygulanmaktadır. Açıklanan farklılıđın yüzdesinin referans katsayısı seçimine hassas olduđu görülmektedir. Ayrıca, kadın ve erkekler sadece gözlemlenebilir özelliklerine göre farklılařtıđında, modele tütün yasası ve vergisine yaklařım deđiřkenlerinin eklenmesi açıklanan

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farklılığı artırmaktadır. Sonuçlar ayrıca kadın ve erkeklerin belirleyici faktörlerdeki değişimlere farklı tepki verdiklerini ve cinsiyetler arası sigara içme davranış farklılığına ilişkin anlamlı faktörlerin etkilerinin 2008 ve 2012 yılları arasında değiştiğini göstermektedir.

Anahtar Kelimeler: *Türkiye, Sigara içme davranışı, Cinsiyet farklılıkları, Blinder-Oaxaca ayrıştırması, Doğrusal olmayan regresyon modelleri*

JEL Kodları: *C25, I10, I12.*

1. INTRODUCTION

There are remarkable differences between males and females regarding the prevalence of smoking (e.g., Bauer, Gohlmann, and Sinning, 2007: 896-897; Chung, Lim and Lee, 2010: 1966-1968; WHO, 2007; Samet and Yoon, 2010:12; Pampel, 2001: 388-389; Kilic and Ozturk, 2014: 208). The decline in prevalence rates has occurred primarily among males while it has shown an increasing trend among females (e.g., Chung et al., 2010: 1967; WHO, 2007; Samet and Yoon, 2010: 2; Pampel, 2001: 388; Kilic and Ozturk, 2014: 207; Chaloupka, 1990: 3). Previous studies of smoking suggest several hypothesis to explain different smoking behavior across genders. First focuses on “gender equality” thesis arguing that an increasing gender equality and female independence have promoted the smoking behavior for women (Flandorfer, Wegner and Buber, 2010: 2; Waldron, 1991). Second relies on a “cigarette diffusion” idea that a more similar smoking behavior of men and women is observed in nations that have the longest history of cigarette use rather than the greatest gender equality (Pampel, 2001: 389). There are also economic approaches which mainly focus on differences in time preferences and risk attitudes (Becker and Murphy, 1988; Dohmen, Falk, Huffman, Sunde, Schupp and Wagner, 2005).

There are several other differences associated with biological factors and women experience risks that are unique to them such as cervical and breast cancer, coronary heart disease who use oral contraceptives containing estrogen. Moreover, they face additional health risks complicated by pregnancy (Chollat-Traquet, 1992: 37). External factors such as tobacco marketing also have an effect on gender differences. Women are a prime target group of the tobacco industry in many countries. Tobacco control policies may not be equally or similarly effective on men and women since their responses are different. Therefore, anti-smoking strategies have to be designed in such a way that they recognize and take into account gender norms, differences and responses to smoke.

Almost half of adult Turkish males (47.9%) smoke, while about one in six adult women (15.2%) smoked cigarettes in 2008 (Erten and Aslan, 2008: 100). The smoking prevalence rate of women has increased nearly 40% between 1997 and 2009, from 10.9% to 15.2%. This fact indicates a considerable gender difference in smoking. Changing status of economic dependence of Turkish women may provide a possible explanation to this trend (Erten and Aslan, 2008: 100-110). Turkish tobacco market structure targeting females also contributes to the increased prevalence of women. In 2004, Turkey signed and

ratified the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC). The final phase of the complete smoking ban entered into force in 2009. All of these anti-tobacco activities and efforts was a part of a National Tobacco Control Action Plan (NTCP) for 2008-2012 (Yurekli, Onder, Elibol, Erk, Cabuk, Fisunoglu, Erk and Chaloupka, 2010: 1-53; Erguder, Çakır, Aslan, Warren, Jones, and Asma, 2008: 1-7; Erguder, Polat, Arpad, Khoury, Warren, Lee and Lea, 2012: 87-91). There are various studies on smoking in Turkey mostly examining the economics of tobacco control including taxation, income, price and expenditure elasticity of cigarette demand and supply (e.g., Erguder et al., 2008: 1-7;6; Erguder at al., 2012: 87; Erbaydar, Lawrence, Dagli, Hayran and Collishaw, 2005: 404-410; Ertas, 2006: 155-161; Arslanhan, Caner, Helvacioğlu, Sağlam, and Teksoz, 2012: 149). There is only one study examining smoking behavior with special emphasis on gender differences. Kilic and Ozturk (2014) examines the potential factors associated with both likelihood of daily smoking and the level of cigarette consumption from a gender perspective using the Zero-inflated Negative Binomial models. There are several other studies investigating gender differences in smoking for other countries (Chaloupka and Pacula, 1999; Yen, 2005; Ali, Chaix, Merlo, Rosvall, Wamala and Lindstrom, 2009). Bauer et al. (2007) and Chung et al. (2010) are the only studies that use a Blinder–Oaxaca decomposition (Blinder, 1973; Oaxaca; 1973) in order to decompose gender differences.

There is a considerable gap in the existing literature on gender differences in smoking for Turkey. The aim of this study is to estimate separate contributions of sets of factors affecting the smoking behavior of males and females. Contrary to Kilic and Ozturk (2014), we analyze the smoking patterns of “current smokers” which includes both daily and occasional smokers and apply the extended Oaxaca-Blinder decomposition method for nonlinear models using the Global Adult Tobacco Survey (GATS) data for years 2008 and 2012 (TurkStat, 2008; TurkStat; 2012). The contribution of the study is twofold. First, the decomposition method enables us to understand to what extent gender smoking differential is resulted from differences in observable characteristics and effects of those characteristics. Percentage explained may be sensitive to which set of coefficients are used in the analysis. Chung et al. (2010) applies a similar decomposition technique without any comparison to see whether their results are robust to the selection of the reference coefficients. Moreover, Bauer et al. (2007) applies decomposition analysis for count data models without showing separate contributions of the explanatory variables. A deeper understanding of factors that contribute to differences across gender is crucial to design a more efficient anti-smoking policies that address specific target groups as well as to evaluate the diverse effects of such policies. Second, this study is a first attempt to provide a comparison of the magnitude and significance of the determinants of smoking behavior at the beginning and the ending of the implementation of a recent Turkish tobacco control action plan. The year 2008 is important as it represents the beginning of the control program. However, tobacco use is addictive, i.e. it may take time for people to change their smoking behavior and give responses to changing tobacco laws. In this regard,

we also use 2012 survey to be able to compare changes in, if any, predictors of smoking by gender over the four years.

The rest of the paper is as follows. Section 2 introduces the data along with the summary statistics. Methodology is explained in Section 3. Section 4 presents the results and conclusion is provided in Section 5.

2. DATA

This study uses 2008 and 2012 releases of GATS conducted by the Turkish Statistical Institute (TurkStat). The survey interviewed 4269 males and 4761 females in 2008 and 4470 males and 5381 females in 2012 about the use of and exposure to tobacco products, incentives to quit tobacco use, attitudes towards tobacco laws and perceptions on media and advertisement about smoking cigarettes for individuals who are at the age of 15+. Explanatory variables are education level, employment status, age, a proxy for income and urban/rural location of the individual, cigarette prices, the presence of smokers at home, any noticed advertisements promoting cigarette smoking and knowledge about serious health effects of tobacco use. The highest education level completed by the individual has 5 categories: no education degree, elementary school graduation, primary or secondary (or equivalent) school graduation, high school and equivalent degree and at least college education. Employment status variable has 3 levels: not employed, employed and self-employed. Age variable is available in 4 groups: age between 15 and 24 years, 25 and 44 years, 45 and 64 years and at least 65 years. 2012 survey also asks about individuals' attitudes toward smoking prohibition in indoor places and increasing the tax on tobacco products. If the individual favors these actions, variables take values of 1 and 0 if the individual opposes the actions.

Neither individual nor household income variable is available in data. However, the survey asks about 10 items that a household may own: electricity, flush toilet, home phone, cell phone, television, radio, refrigerator, washing machine, car and motorcycle. We apply principal component analysis on these items to obtain factor scores of the first component. Then, we divide it into 5 quintiles. If an individual's factor score belongs to lowest (highest) quintile, this means that the household which the individual belongs to is in the lowest (highest) income group. The other binary variables take values of 1 if the individual lives in the urban area, there are smokers at home, the individual has noticed any advertisement promoting smoking and knows about health effects of tobacco use and 0 otherwise.

There are some missing observations for some of the explanatory variables. For the education variable missing cases are included in no degree category. Not employed category of the employment status variable includes cases of undetermined employment status. Price variable is continuous and its natural logarithm is used. However, cigarette prices are not available for non-users. Therefore, we impute those cases with the sample average of the prices in the data. Missing observations for the binary

explanatory variables are imputed as 1 if the average is at least 0.5 and 0 otherwise. Imputed missing observations are just 3.4% of total observations (9030) in 2008 and 3.3% of the total observations (9851) in 2012.

Table 1 shows the summary statistics. 44% of males and 13% of females in 2008 while 37% of males and 11% of females in 2012 are current cigarette smokers. This shows that smoking rates for both males and females decrease within 4 years- with the largest decline in smoking rate for males. Proportions of males who (1) have at least an elementary level of education, (2) belong to highest income group, (3) are employed (both employed and self-employed) and (4) have seen the promotion of cigarettes on media are higher than the proportions of females in both years. On the other hand, proportions of females who belong to the lowest income group in both years and agree with smoking laws and taxation of tobacco products in 2012 are higher than the proportions of males.

Table 1. Summary statistics

	2008		2012	
	Male	Female	Male	Female
Current smoker	0.444 (0.497)	0.132 (0.338)	0.372 (0.483)	0.112 (0.315)
ln(cigarette price)	-1.845 (0.192)	-1.844 (0.104)	-1.275 (0.185)	-1.273 (0.099)
No education	0.090 (0.287)	0.301 (0.459)	0.077 (0.267)	0.280 (0.449)
Elementary education	0.478 (0.500)	0.428 (0.495)	0.407 (0.491)	0.385 (0.487)
Primary/secondary education	0.153 (0.360)	0.100 (0.299)	0.187 (0.390)	0.124 (0.330)
High school education	0.180 (0.384)	0.114 (0.318)	0.190 (0.392)	0.126 (0.331)
At least college education	0.099 (0.298)	0.058 (0.233)	0.139 (0.346)	0.085 (0.279)
Not employed	0.326 (0.469)	0.883 (0.321)	0.384 (0.486)	0.846 (0.361)
Employed	0.377 (0.485)	0.092 (0.290)	0.422 (0.494)	0.112 (0.316)
Self employed	0.297 (0.457)	0.025 (0.155)	0.194 (0.396)	0.042 (0.201)
Income group1	0.182 (0.386)	0.217 (0.413)	0.308 (0.462)	0.354 (0.478)
Income group2	0.223 (0.416)	0.221 (0.415)	0.087 (0.283)	0.088 (0.283)
Income group3	0.180 (0.385)	0.182 (0.386)	0.190 (0.393)	0.190 (0.393)
Income group4	0.209 (0.407)	0.210 (0.407)	0.261 (0.439)	0.240 (0.427)
Income group5	0.205 (0.404)	0.171 (0.376)	0.153 (0.360)	0.128 (0.334)
Urban	0.508 (0.500)	0.507 (0.500)	0.499 (0.500)	0.500 (0.500)
Age 15-24	0.123 (0.329)	0.148 (0.355)	0.132 (0.339)	0.128 (0.334)
Age 25-44	0.437 (0.496)	0.443 (0.497)	0.414 (0.493)	0.391 (0.488)

Age 45-64	0.319 (0.466)	0.284 (0.451)	0.307 (0.461)	0.301 (0.459)
Age 65+	0.120 (0.325)	0.124 (0.330)	0.147 (0.354)	0.181 (0.385)
Media promotion	0.072 (0.259)	0.052 (0.223)	0.111 (0.314)	0.086 (0.281)
Smoking knowledge	0.980 (0.141)	0.982 (0.134)	0.967 (0.178)	0.968 (0.176)
Smokers at home	0.675 (0.468)	0.708 (0.455)	0.436 (0.496)	0.425 (0.494)
Smoking law			0.950 (0.219)	0.981 (0.137)
Tax on tobacco			0.692 (0.462)	0.832 (0.374)
N (sample size)	4269	4761	4470	5381

Standard deviations are in parentheses. Income group1 corresponds to the lowest income quintile while income group5 represents the highest quintile. Smoking law is whether the person favors laws that prohibit smoking in indoor places. Tax on tobacco is whether the person favors increasing tax on tobacco products.

3. METHODOLOGY

An extended Blinder-Oaxaca approach for nonlinear regression models is implemented to decompose the smoking differential between genders into its components. Latest updated version of the ‘Oaxaca’ command in Stata is used. Updated Oaxaca command supports the nonlinear decomposition for binary dependent variables proposed by Yun (2004) and also provides normalized effects of categorical variables suggested by Yun (2005). The traditional Blinder-Oaxaca method has been used for linear models, especially, to study gender differential in earnings. The extended version of the method used in this paper overcomes two important problems in a detailed decomposition: path-dependency and identification problems. Path-dependency problem which arises in a nonlinear decomposition refers to the case where the contributions of explanatory variables to the differential depends on the order in which the variables enter into the decomposition (Yun, 2004). A solution proposed by Yun (2004) is used in this extended version. Identification problem refers to the case where the detailed decomposition results vary with the choice of the base category when categorical variables are used in the regression. Thus, the decomposition based on normalized effects are calculated for the categorical variables as suggested by Yun (2005).

Dependent variable (Y) takes 1 when an individual is a current cigarette smoker and 0 otherwise. Y is a function (F) of a linear combination of the explanatory variables (X’s) and the regression coefficients (β ’s) and F is nonlinear in our case. The probability of being a current smoker (Y=1) is defined as follows:

$$Y = F(X\beta) = \frac{e^{X\beta}}{1 + e^{X\beta}} \quad (1)$$

F is the cumulative logistic distribution function, Y is an Nx1 vector, X is an NxK matrix of explanatory variables and β is a Kx1 vector of regression coefficients. For the logit model average probability of being a current cigarette smoker is $\bar{Y} = \overline{F(X\beta)}$, where “over bar” means the average. We define the difference between the average probability of being a current smoker for males (\bar{Y}^A) and females (\bar{Y}^B) as below:

$$\bar{Y}^A - \bar{Y}^B = \frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^A) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^B) \quad (2)$$

where X^A , $\hat{\beta}^A$ and N^A (X^B , $\hat{\beta}^B$ and N^B) are the explanatory variables, estimated regression coefficients and sample size for males (females) respectively.

We can rewrite equation (2) as below:

$$\bar{Y}^A - \bar{Y}^B = \left[\frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^A) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^A) \right] + \left[\frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^A) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^B) \right] \quad (3)$$

In equation (3) the expression in the first square bracket, explained part, represents the portion of the smoking differential between genders attributable to the difference in characteristics while using the coefficients from the regression on males. The expression in the second square bracket, unexplained part, shows the portion of the smoking differential between genders due to the difference in regression coefficients while using the values of explanatory variables from the female sample.

We can interpret the first part as the difference between the predicted probabilities of smoking status between males and females if females behave or response to X's exactly the same way as males do. Second part reflects the difference in the predicted probabilities of smoking status between males and females if the observed characteristics are fixed at the levels of females (or put it differently, if males have the same observed characteristics as females). Alternative to the equation (3), coefficients from the regression on females can be used as reference coefficients in the explained part while values of the explanatory variables are from the male sample as shown in equation (4).

$$\bar{Y}^A - \bar{Y}^B = \left[\frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^B) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^B) \right] + \left[\frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^A) - \frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^B) \right] \quad (4)$$

Since there is no particular reason to assume coefficients from one group as the reference coefficients, coefficients from a pooled regression ($\hat{\beta}^*$) can be used³¹. However, with this approach, some of the unexplained part of the differential might be improperly transferred to the explained part.³²

Thus, Jann³² suggests to include a group dummy (gender dummy in our case) to the pooled regression and get coefficients from it. Equation (5) represents the use of $\hat{\beta}^*$ as the reference coefficients to construct the smoking differential between males and females.

$$\begin{aligned} \bar{Y}^A - \bar{Y}^B = & \left[\frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^*) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^*) \right] + \left\{ \left[\frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^A) - \frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^*) \right] \right. \\ & \left. + \left[\frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^*) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^B) \right] \right\} \end{aligned} \quad (5)$$

To obtain the contribution of each explanatory variable to the explained and unexplained parts of the differential for the equation (3), the weighting component for the kth variable shown in (6) is used in the explained part and the weighting component for the kth variable shown in (7) is used in the unexplained part.

$$W_{\Delta X_k} = \frac{(\bar{X}_k^A - \bar{X}_k^B) \hat{\beta}_k^A}{(\bar{X}^A - \bar{X}^B) \hat{\beta}^A} \quad (6)$$

$$W_{\Delta \beta_k} = \frac{\bar{X}_k^B (\hat{\beta}_k^A - \hat{\beta}_k^B)}{\bar{X}^A (\hat{\beta}^A - \hat{\beta}^B)} \quad (7)$$

where $\sum_{k=1}^K W_{\Delta X_k} = \sum_{k=1}^K W_{\Delta \beta_k} = 1$.g

Hence, a detailed decomposition of equation (3) can be written as below:

$$\begin{aligned} \bar{Y}^A - \bar{Y}^B = & \sum_{k=1}^K W_{\Delta X_k} \left[\frac{1}{N^A} \sum_{i=1}^{N^A} F(X_i^A \hat{\beta}^A) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^A) \right] \\ & + \sum_{k=1}^K W_{\Delta \beta_k} \left[\frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^A) - \frac{1}{N^B} \sum_{i=1}^{N^B} F(X_i^B \hat{\beta}^B) \right] \end{aligned} \quad (8)$$

Detailed decomposition results for the equations (5) and (6) can be obtained in a similar way.

4. RESULTS

4.1. Logit Models

Table 2 shows the average marginal effects (AMEs) of the variables that explain the probability of being a current cigarette smoker in 2008 and with and without the attitude toward tobacco law and tax variables in 2012. AME of cigarette prices on the likelihood of smoking is higher for females than that for males and shows a considerable decrease in 2012. AMEs of education categories differ across genders and are different than each other. None of the education levels is statistically significant for males while females are more likely to smoke at every education level than non-educated females in 2008. At least college educated males are less likely to smoke than non-educated males in all years (though not significant) while at least college educated females are 4 to 8.9 percentage points more likely to smoke than non-educated females. However, the lowest three education levels become significant for males in 2012, which means that males with these education levels are more likely to smoke than non-educated males. Hence, these findings indicate that males and females behave differently at different education levels.

Employment (self-employed or not) is associated with an increase in the likelihood of smoking for both genders in both years. However, the smallest effects are observed for females. Income group categories do not show consistent patterns across both genders and years. Females from income groups 3, 4, 5 are almost 2 percentage points more likely to smoke than females from income group 1 in 2012. Living in an urban area is associated with an increase in smoking for both genders- with the largest impact for females. This variable is not an important predictor of smoking for males in 2012.

Table 2. Average marginal effects

	2008		2012		2012 ^a	
	Male	Female	Male	Female	Male	Female
ln(cigarette price)	-0.178*** (0.039)	-0.584*** (0.042)	-0.138*** (0.037)	-0.386*** (0.035)	-0.165*** (0.034)	-0.299*** (0.031)
Elementary education	0.030 (0.030)	0.041*** (0.011)	0.104*** (0.031)	0.042*** (0.010)	0.088*** (0.028)	0.034*** (0.010)
Primary/secondary education	0.017 (0.035)	0.063*** (0.018)	0.086** (0.034)	0.109*** (0.017)	0.062** (0.032)	0.088*** (0.016)
High school education	0.036 (0.035)	0.146*** (0.019)	0.076** (0.034)	0.097*** (0.015)	0.063** (0.031)	0.076*** (0.014)
At least college education	-0.055 (0.038)	0.089*** (0.023)	-0.031 (0.035)	0.054*** (0.016)	-0.042 (0.032)	0.040*** (0.015)
Employed	0.081*** (0.020)	0.046*** (0.016)	0.114*** (0.018)	0.054*** (0.014)	0.103*** (0.017)	0.049*** (0.013)
Self employed	0.084*** (0.020)	0.061* (0.034)	0.084*** (0.020)	0.053** (0.024)	0.076*** (0.019)	0.040* (0.021)
Income group2	0.022 (0.024)	0.028* (0.016)	0.010 (0.026)	0.011 (0.014)	0.015 (0.024)	0.012 (0.013)
Income group3	0.065** (0.025)	0.009 (0.016)	0.001 (0.020)	0.024** (0.011)	0.004 (0.018)	0.026** (0.011)
Income group4	0.012 (0.025)	0.038** (0.016)	0.002 (0.019)	0.024** (0.011)	-0.001 (0.017)	0.026*** (0.010)
Income group5	0.004 (0.026)	0.029* (0.017)	0.034 (0.022)	0.016 (0.013)	0.031 (0.020)	0.024** (0.012)

Urban	0.029*	0.124***	0.031**	0.073***	0.014	0.058***
	(0.016)	(0.010)	(0.014)	(0.008)	(0.013)	(0.008)
Age 25-44	0.151***	0.051***	0.127***	0.097***	0.103***	0.085***
	(0.027)	(0.013)	(0.025)	(0.009)	(0.023)	(0.009)
Age 45-64	0.031	0.019	0.039	0.078***	0.024	0.066***
	(0.027)	(0.014)	(0.025)	(0.011)	(0.023)	(0.011)
Age 65+	-0.164***	-0.069***	-0.108***	-0.000	-0.073***	-0.006
	(0.032)	(0.016)	(0.029)	(0.012)	(0.028)	(0.012)
Media promotion	0.014	-0.021	-0.028	-0.003	-0.029	-0.006
	(0.028)	(0.017)	(0.021)	(0.013)	(0.019)	(0.012)
Smoking knowledge	-0.080	-0.067	0.023	0.016	0.056*	0.029
	(0.052)	(0.043)	(0.037)	(0.021)	(0.032)	(0.018)
Smokers at home	0.161***	0.092***	0.230***	0.122***	0.145***	0.092***
	(0.015)	(0.009)	(0.014)	(0.008)	(0.013)	(0.008)
Smoking law supporter					-0.116***	-0.083***
					(0.035)	(0.029)
Tax on tobacco supporter					-0.384***	-0.184***
					(0.016)	(0.013)

^a 2012 analysis with attitude toward tobacco law and tax variables. *p<0.10, **p<0.05 ***p<0.01. Standard errors are in parentheses. Omitted categories in regressions are no education, not employed, income group 1 and age 15-24.

Males (females) aged between 25 and 44 are 15 percentage points (5 percentage points) more likely to smoke than males (females) aged between 15 and 24 in 2008 while the effect of this age group decreases for males and increases for females in 2012. Females aged between 45 and 64 are also more likely to smoke than females from the youngest group in 2012. Both genders are less likely to smoke at the age of 65+ than the youngest group in 2008 while only males are less likely to smoke at this age group in 2012. This may indicate that females are inclined to smoke at higher age groups while health effects of smoking dominate for males by the age of 65 and they tend to quit smoking. Having smokers at home increases the likelihood of smoking for both genders- with the largest impact for males in both years. Males who favor indoor smoking prohibition and tobacco taxes are 11.5 and 38.4 percentage points, respectively, less likely to smoke. These effects for females are 8.3 and 18.4 percentage points, respectively.

4.2. Decomposition Results

In Table 3, model 1, model 2, model 3 and model 4 refer to the decomposition results by using male coefficients (i.e. coefficients from the regression on males), female coefficients (i.e. coefficients from the regression on females), coefficients from the pooled regression and coefficients from the pooled regression with a gender dummy, respectively. Since interaction effects are not statistically significant for threefold decomposition for both years, those results are not shown in this paper. Explained % in Table 3 indicates the percentage of the smoking gap explained by differences in the observable characteristics and unexplained % means the percentage of the smoking gap that is attributable to the differences in regression coefficients. Explained percentage differs considerably when the reference coefficients are changed as shown in Table 3.

Table 3. Aggregate decomposition analysis

	2008		2012		2012 ^a	
	Explained %	Unexplained %	Explained %	Unexplained %	Explained %	Unexplained %
Model 1	14.35	85.65	25.80	74.20	44.50	55.50
Model 2	20.10	79.90	22.46	77.54	34.26	65.74
Model 3	53.26	46.74	48.50	51.50	59.96	40.04
Model 4	14.90	85.10	17.90	82.10	33.04	66.96

^a 2012 analysis with attitude toward tobacco law and tax variables. Model 1, model 2, model 3 and model 4 refer to the decomposition results by using male coefficients (i.e. coefficients from the regression on males), female coefficients (i.e. coefficients from the regression on females), coefficients from the pooled regression and coefficients from the pooled regression with a gender dummy respectively.

The use of female coefficients as the reference coefficients enables us to explain more of the smoking differential due to the differences in characteristics in 2008 (20.10%) while percentage explained is greatest when we use male coefficients in 2012 (25.80%). Moreover, explained percent of the smoking differential due to the differences in observable characteristics increases to 44.5% when attitude toward smoking law and tax variables are included. The use of pooled coefficients without a gender dummy in the regression, on the other hand, transfers improperly some portion of the unexplained part into the explained part as noted by Jann (2008).

Table 4. Detailed decomposition analysis

	2008				2012			
	Model 1		Model 2		Model 1		Model 1 ^a	
	Coefficient	%	Coefficient	%	Coefficient	%	Coefficient	%
Explained	0.045*** (0.012)	14.35	0.063*** (0.012)	20.10	0.067*** (0.010)	25.80	0.116*** (0.009)	44.50
Unexplained	0.267*** (0.015)	85.65	0.249*** (0.014)	79.90	0.193*** (0.012)	74.20	0.144*** (0.010)	55.50
<i>Difference explained</i>								
ln(cigarette price)	0.000 (0.001)	0.02	0.000 (0.003)	0.09	0.000 (0.000)	0.08	0.000 (0.001)	0.11
No education	0.001 (0.005)	0.36	0.021*** (0.004)	6.76	0.009* (0.005)	3.61	0.008 (0.005)	2.91
Elementary education	0.001* (0.001)	0.40	-0.001** (0.001)	-0.46	0.001** (0.001)	0.47	0.001** (0.001)	0.49
Primary/secondary education	0.001 (0.001)	0.21	0.000 (0.001)	0.05	0.003** (0.001)	0.97	0.002*** (0.001)	0.79
High school education	0.002* (0.001)	0.65	0.006*** (0.001)	1.92	0.002** (0.001)	0.74	0.002*** (0.001)	0.82
At least college education	-0.003*** (0.001)	-0.82	0.001* (0.001)	0.44	-0.004*** (0.001)	-1.67	-0.005*** (0.001)	-1.83
Not employed	0.031*** (0.007)	9.86	0.025*** (0.008)	8.09	0.030*** (0.005)	11.36	0.030*** (0.005)	11.60
Employed	0.007** (0.003)	2.39	0.004 (0.006)	1.30	0.014*** (0.003)	5.45	0.014*** (0.003)	5.52
Self employed	0.008** (0.003)	2.53	0.008 (0.007)	2.72	0.003 (0.002)	1.07	0.003* (0.002)	1.11
Income group1	0.001	0.23	0.001	0.35	0.000	0.16	0.000	0.19

	(0.001)		(0.001)		(0.001)		(0.001)	
Income group2	0.000	0.00	0.000	0.01	-0.000	-0.00	-0.000	-0.00
	(0.000)		(0.000)		(0.000)		(0.000)	
Income group3	-0.000	-0.02	0.000	0.01	-0.000	-0.00	-0.000	-0.00
	(0.000)		(0.000)		(0.000)		(0.000)	
Income group4	0.000	0.00	-0.000	-0.00	-0.000	-0.06	-0.000	-0.10
	(0.000)		(0.000)		(0.000)		(0.000)	
Income group5	-0.001	-0.18	0.000	0.14	0.001	0.23	0.001	0.22
	(0.001)		(0.000)		(0.000)		(0.000)	
Urban	0.000	0.01	0.000	0.04	-0.000	-0.01	-0.000	-0.00
	(0.000)		(0.001)		(0.000)		(0.000)	
Age 15-24	-0.000	-0.02	-0.000	-0.15	-0.000	-0.02	-0.000	-0.02
	(0.001)		(0.001)		(0.000)		(0.000)	
Age 25-44	-0.001	-0.27	-0.001	-0.17	0.003**	0.97	0.002**	0.88
	(0.001)		(0.001)		(0.001)		(0.001)	
Age 45-64	0.001**	0.37	0.002**	0.53	0.000	0.07	0.000	0.04
	(0.001)		(0.001)		(0.000)		(0.000)	
Age 65+	0.001	0.22	0.001	0.19	0.004***	1.71	0.004***	1.37
	(0.001)		(0.001)		(0.001)		(0.001)	
Media promotion	0.000	0.05	-0.000	-0.10	-0.000	-0.13	-0.000	-0.15
	(0.000)		(0.000)		(0.000)		(0.000)	
Smoking knowledge	0.000	0.03	0.000	0.03	-0.000	-0.00	-0.000	-0.01
	(0.000)		(0.000)		(0.000)		(0.000)	
Smokers at home	-0.003***	-0.86	-0.003***	-0.82	0.001	0.46	0.001	0.33
	(0.001)		(0.001)		(0.001)		(0.001)	
Smoking law supporter							0.002***	0.72
							(0.001)	
Tax on tobacco supporter							0.024***	9.30
							(0.002)	

^a 2012 analysis with attitude toward tobacco law and tax variables. *p<0.10, **p<0.05 ***p<0.01. Standard errors are in parentheses. We do not show decomposition results for the other category of binary variables since the results are the same as the included category in the table.

Table 4 presents the detailed decomposition results associated with differences in the observable characteristics (i.e. explained part) for 2008 and with and without the attitude toward tobacco law and tax variables for 2012. Gender differences in the proportions of not employed explain 8-9.8% of the differential for 2008 while it explains almost 11-12% of the gap in 2012. Other employment categories have significant contributions to the differential except for model 2. Next biggest contributors to the smoking gap in the explained part are the tobacco law and tax variables together, which keeps the effects of other variables almost the same when they are included in 2012. Differences in proportions of tobacco law and tax variables explain 10% of the differential. No education category is highly significant in 2008 (model 2) and gender differences in proportions of non-educated explain 6.76% of the differential. The significance of primary/secondary and at least college education categories increases in 2012. At least college education category contributes 1-2% reduction in the smoking gap except for model 2, which means that if college and higher educated females behave like males the gap is reduced. This result makes sense since college and higher educated male population is larger than that of females in Turkey and males tend to smoke less at this level of education compared to non-educated ones. On the other hand, the other education categories have positive contributions to the gap except for model 2. In 2008,

'age 45-64' category positively contributes to the gap while in 2012 categories 'age 25-44' and 'age 65+' have positive contributions to the differential. Gender differences in the proportions of smokers at home negatively contribute to the gap only in 2008 in which the proportions of males with smokers at home is smaller than that of females. Differences in the proportions of cigarette prices, income groups, living in an urban area, media promotion and smoking knowledge variables do not have significant power to explain the smoking gap.

In all models, differences in the coefficients of price variables (i.e. differences in responses to changes in the price variable) explain an overwhelming amount of smoking gap with negative contributions but differences in gender-specific constant terms almost offset the negative effects of price variables (see Table A1). Gender differences in the effects of education levels contribute significantly to the smoking differential in both years (see Table A1). Income groups 3 and 4 significantly contribute to the smoking gap only in 2008 and three age categories have significant effects on the unexplained part only in 2012 (see Table A1). Differences in the coefficients of smokers at home variable (urban variable) positively contribute to the gap with the largest effect for 2012 (for 2008) (see Table A1).

5. CONCLUSION

There are 7 and 2 percentage points decreases in smoking rates for males and females, respectively, between 2008 and 2012 during which the national tobacco control action plan was in effect. Our purpose is to provide a solid understanding of factors explaining the gender gap in smoking and compare the results between 2008 and 2012. Based on logit models, we can say that females and males behave differently to the changes in the determinants of smoking. Moreover, decomposition results show that significant factors associated with the gender gap in smoking changes between 2008 and 2012.

Our results indicate that we can explain the smoking differential by (1) the gender differences in the proportions of variables such as employment and attitudes toward tobacco law and tax, (2) the gender differences in behaviors toward variables such as smokers at home, cigarette prices and living in an urban area and (3) both the gender differences in the proportions of and behaviors toward variables such as education and age. Therefore, anti-smoking policies should not only provide means for changing the composition of variables in the population (e.g. increasing the number of college graduated females) but also focus on ways to change the behaviors of individuals to reduce smoking (e.g. college graduated females should be less likely to smoke).

Similar to Kilic and Ozturk (2014), we find that increase in education level is associated with higher probability of smoking for females. However, our logit model results for both years (significant only for the year 2012) indicate that males with high school education and below are also more likely to smoke as education level increases. That is, smoking prevalence increases with an increase in the education level lower than college for both genders. This result cannot be derived from findings

confirmed by Kilic and Ozturk (2014), since they use a continuous education variable which masks these important differences across genders. By using a categorical measure of the education variable, we are able to see the education level(s) at which the responses of males and females differ. Decomposition results show that gender gap decreases as long as college and higher educated females behave like males. Hence, health education policies should be developed on high educated females as well as males with high school and low education. These results about education variable contradict with the finding by Chung (2010), that a decreasing effect on the smoking prevalence of higher education is larger for females than that for males. It implies that the relationship between education and smoking by gender in South Korea and Turkey are quite different.

Our study reveals two important results. First, the percentage of the explained gap by differences only in the observable characteristics changes when we change the reference coefficients. We can explain 20% of the differential using female coefficients while 14% of the differential can be explained by using male coefficients in 2008. Second, the percentage of the explained smoking differential increases considerably with an inclusion of attitude toward tobacco law and tax variables. However, Chung (2010) uses only male coefficients as the reference coefficients and they also lack variables about attitudes toward tobacco law and tax. Our study is also different from the mentioned study in the sense that we apply separate decompositions for 2008 and 2012 whereas they pool two years of data. Comparison of the beginning and the ending of the tobacco action plan provide a considerable increase in the percentage of the explained smoking differential. A quite small (%2) composition effect found in Chung (2010) might be the result of all these factors.

Moreover, gender difference in the proportions of not employed is the largest contributor to gender gap in smoking, which is also observed in South Korea (Chung, 2010). Contrary to the finding by Kilic and Ozturk (2014), decreasing the effect of being at the age of 65+ on the probability of smoking is larger for males than that for females and its effect become insignificant for females in 2012. It seems that females are reluctant to change their smoking habits even if they get older. Differences in the proportions of age groups “age 25-44” and “age 65+” positively contribute to smoking differential in the year 2012. These results imply that anti-smoking policies should target gender-specific age groups and consider to raise the legal age to buy tobacco products in Turkey. Although the presence of smokers at home is positively associated with smoking for both genders in both years, gender differences only in the responses to have smokers at home can significantly explain the differential. This implies that anti-tobacco programs are able to indirectly affect the smoking behavior of one individual through its effects on the behaviors of others. On the other hand, differences in the proportions of tobacco law and tax variables significantly explain the differential while differences only in the responses to cigarette prices have significant power to explain gender gap. Media promotion, income group variable and knowledge about health effects of smoking do not have significant power to explain the differential.

This study has some limitations. Firstly, income data is not available and our income group variable is not a very good proxy as it does not provide significant marginal effects for all models and have significant power to explain gender gap. Secondly, marital status and social network variables are missing in the data, which are expected to have effects on smoking behavior. Thirdly, there may be other unobservable characteristics (e.g. IQ level) which are correlated with both smoking and explanatory variables such as education and employment. Thus, we are not able to obtain causality. Further research should focus on obtaining causal estimates using other techniques like instrumental variables.

Funding: This research was supported by an Anadolu University Publication and Research Incentive Project fund, 1605E279.

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Appendix A

Table A1. Detailed Decomposition Analysis (Difference Unexplained)

	2008				2012			
	Model 1		Model 2		Model 1		Model 1 ^a	
	Coefficient	%	Coefficient	%	Coefficient	%	Coefficient	%
ln(cigarette price)	-1.360*** (0.131)	-435.59	-1.471*** (0.130)	-471.15	-0.571*** (0.069)	-219.72	-0.365*** (0.057)	-140.51
No education	0.030*** (0.007)	9.48	0.010*** (0.002)	3.09	0.018*** (0.006)	6.97	0.013** (0.005)	4.94
Elementary education	0.019*** (0.006)	5.94	0.022*** (0.007)	7.18	0.019*** (0.004)	7.23	0.016*** (0.004)	6.06
Primary/secondary education	0.000 (0.002)	0.13	0.001 (0.003)	0.22	-0.005** (0.002)	-1.82	-0.004** (0.002)	-1.47
High school education	-0.009*** (0.002)	-2.73	-0.014*** (0.003)	-4.64	-0.004** (0.002)	-1.54	-0.002 (0.001)	-0.89
At least college education	-0.004*** (0.001)	-1.32	-0.008*** (0.003)	-2.45	-0.004** (0.002)	-1.42	-0.003** (0.001)	-1.23
Not employed	0.011 (0.014)	3.64	0.005 (0.006)	1.45	0.007 (0.010)	2.51	0.002 (0.009)	0.74
Employed	0.000 (0.002)	0.04	0.001 (0.008)	0.17	0.000 (0.002)	0.14	0.000 (0.001)	0.04
Self employed	-0.000 (0.001)	-0.11	-0.005 (0.009)	-1.46	-0.000 (0.001)	-0.18	0.000 (0.001)	-0.05
Income group1	0.004 (0.004)	1.33	0.004 (0.004)	1.21	0.006 (0.004)	2.21	0.006 (0.004)	2.42
Income group2	-0.002 (0.003)	-0.76	-0.003 (0.003)	-0.83	0.000 (0.002)	0.17	0.001 (0.001)	0.32
Income group3	0.008*** (0.003)	2.53	0.008*** (0.003)	2.72	-0.003 (0.003)	-1.18	-0.003 (0.002)	-0.97
Income group4	-0.006** (0.003)	-1.99	-0.007** (0.003)	-2.14	-0.004 (0.003)	-1.51	-0.004 (0.002)	-1.53
Income group5	-0.004 (0.003)	-1.22	-0.005 (0.004)	-1.59	0.001 (0.002)	0.55	0.000 (0.002)	0.13
Urban	0.041*** (0.005)	13.07	0.044*** (0.005)	14.10	0.021*** (0.004)	8.16	0.017*** (0.003)	6.36

Table A1. (Continued)

	2008				2012			
	Model 1		Model 2		Model 1		Model 1 ^a	
	Coefficient	%	Coefficient	%	Coefficient	%	Coefficient	%
Not urban	-0.042*** (0.005)	-13.44	-0.046*** (0.005)	-14.58	-0.021*** (0.004)	-8.14	-0.016*** (0.003)	-6.35
Age 15-24	-0.003 (0.003)	-0.83	-0.002 (0.003)	-0.75	0.009*** (0.003)	3.39	0.006*** (0.002)	2.32
Age 25-44	-0.002 (0.008)	-0.55	-0.002 (0.008)	-0.59	-0.009** (0.005)	-3.63	-0.009** (0.004)	-3.40
Age 45-64	-0.008 (0.005)	-2.63	-0.010 (0.006)	-3.19	-0.014*** (0.004)	-5.49	-0.013*** (0.003)	-4.86
Age 65+	0.006 (0.005)	2.00	0.007 (0.005)	2.10	0.000 (0.004)	0.19	0.003 (0.003)	1.22
Media promotion	-0.019 (0.015)	-6.23	-0.021 (0.016)	-6.60	0.005 (0.10)	1.90	0.004 (0.008)	1.49
No media promotion	0.001 (0.001)	0.34	0.002 (0.001)	0.51	-0.000 (0.001)	-0.18	-0.000 (0.001)	-0.14
Smoking knowledge	-0.000 (0.001)	-0.10	-0.000 (0.001)	-0.12	0.000 (0.001)	0.06	0.000 (0.001)	0.06
No smoking knowledge	0.017 (0.028)	5.50	0.019 (0.030)	5.93	-0.005 (0.019)	-1.81	-0.005 (0.016)	-1.83
Smokers at home	0.009*** (0.003)	2.79	0.010*** (0.004)	3.35	0.013*** (0.004)	4.82	0.011*** (0.003)	4.30
No smokers at home	-0.021*** (0.007)	-6.76	-0.022*** (0.008)	-6.96	-0.009*** (0.003)	-3.56	-0.008*** (0.002)	-3.18
Smoking law supporter							-0.000 (0.000)	-0.09
Not smoking law supporter							0.012 (0.014)	4.67
Tax on tobacco supporter							0.000 (0.001)	0.15
Not tax on tobacco supporter							-0.002 (0.005)	-0.74
Constant	1.602*** (0.135)	513.11	1.733*** (0.130)	554.89	0.743*** (0.073)	286.09	0.487*** (0.061)	187.54

^a 2012 analysis with attitude toward tobacco law and tax variables. * p<0.10, ** p<0.05*** p<0.01. Standard errors are in parentheses.