THE EFFECT OF THE RECENT ANTI-TOBACCO POLICIES ON CURBING SMOKING IN KAZAKHSTAN

by

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Abstract

This paper analyzes the effects of recent tobacco control policies on smoking behavior in Kazakhstan. Exploiting data on cigarette smoking from the Global Adults Tobacco Survey (GATS) collected in 2014 and the Multiple Indicator Cluster Survey (MICS) collected in 2011 and 2015, I examine the effectiveness of anti-tobacco policies using a two-part model. In particular, I analyze smoking participation and intensity separately for men and women. Due to differences in sample distributions across surveys, I implement Propensity Score Matching (PSM) to balance the data. My findings suggest that the recent tobacco control policies indeed reduced both smoking participation and intensity for men, but not for women.

Content

1 Introduction

Tobacco smoking represents a major health concern leading to conditions such as cardiovascular disease, respiratory condition, and cancer. The annual mortality from smoking is estimated to be 7 million deaths per year that is expected to increase to more than 8 million by 2030. Smoking also has a substantial negative externality: Secondhand smoking causes more than 600,000 annual deaths (WHO, 2013). Given the drastic health consequences of smoking, governments all around the world actively combat tobacco smoking via policy interventions such as tobacco taxation, clean indoor air laws, pictorial health warnings on cigarette packs, advertising restrictions, and cessation support services. Such policy interventions are found to significantly reduce smoking prevalence (Chaloupka et al., 2011; Wasserman et al., 1991, etc.).

Kazakhstan joined the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in 2006 which aims to decrease tobacco use through implementing higher taxes on tobacco products. Since then, the government has steadily increased the tax rate per cigarette pack from 5 Kazakh tenge (KZT) in 2006 to 150 KZT in 2018. Since cigarette producers pass a great portion of taxes onto consumers (Keeler et al., 1996), this huge increase in taxes should have contributed greatly to the increase in cigarette prices: the mean real price per pack of filtered cigarettes increased from 77 KZT to 195 KZT from 2009 to 2018 (Krasovsky, 2017). If one were to assume that cigarette taxes are entirely passed onto consumers in Kazakhstan, as it is the case in the U.S. (Evans et al., 1991), this recent increase in the taxes would explain around 42% of the increase in cigarette prices. The growth in cigarette prices indeed surpassed income growth making cigarettes less affordable over the time in Kazakhstan according to Tobacco Affordability Index (WHO, 2017). Despite that cigarette prices increased relative to income level, Kazakhstan is still characterized by the lowest cigarette taxes and prices among Post-Soviet countries (WHO, 2016). The average price per pack of cigarettes in Kazakhstan in 2016 was 0.91 USD, significantly lower than in the Russian Federation, Turkmenistan, and Uzbekistan where mean prices were 1.54 USD, 2.86 USD, and 2.18 USD respectively.

Hopkins et al. (2001) find that concurrently adopting a group of policies is more effective in decreasing smoking prevalence. In addition to increasing excise cigarette taxes, the Kazakhstani government introduced policies such as clean indoor air laws in most of the public spaces, partly or fully covering the costs of smoking-cessation support programs, requiring pictorial health warnings on cigarette packs covering 40 percent of the packaging, and bans on

direct forms of tobacco advertisement and promotion. Since prices and years are perfectly collinear, I cannot analyze the effects of prices and the above-mentioned tobacco control policies separately.

According to the Global Adults Tobacco Survey (GATS) conducted by the World Health Organization (WHO), the most recent nationally representative survey, 40.5% of men and 4.3% of women in Kazakhstan were everyday smokers in 2014 corresponding to more than 4 million people. In this paper, I analyze the effects of the recent tobacco control policies on smoking participation and intensity of individuals in Kazakhstan using a two-part model. Due to the sizeable gender differences in smoking prevalence, I examine the effectiveness of these anti-tobacco policies separately for men and women. Smoking participation or smoking status of an individual is defined by a dichotomous variable indicating whether (s)he is an everyday smoker. Smoking intensity is measured via quantity of cigarettes consumed per day by everyday smokers. For my analyis, I utilize Global Adults Tobacco Survey (GATS) collected in 2014 and Unicef Multiple Indicator Cluster Survey (MICS) in collected in 2011 and 2015. To obtain comparable samples across these surveys, I also implement Propensity Score Matching (PSM). Specifically, I employ one-to-one nearest-neighbor matching without replacement after estimating propensity scores from a logistic model. Since propensity score matching uses a treatment-control approach to balance the data, I assign the survey with the smallest amount of observations as the "treatment" group and the rest as the "control" groups. The distribution of men and women within different demographic groups, especially by educational attainment, show better comparability after implementing the PSM.

The regression estimates from the balanced sample suggest that the recent anti-tobacco policies reduced smoking participation of men by 5.5 percentage points and intensity by 0.6 to 1 cigarette a day on average. These policies, on the other hand, are estimated to have been ineffective on curbing smoking for females.

The paper proceeds as follows. Section 2 discusses the existing literature on tobacco consumption, paying special attention to studies conducted in Kazakhstan. Section 3 provides the data and descriptive statistics. Section 4 lays out the methodology. Section 5 presents the findings from the estimation. Section 6 concludes.

2 Literature review

Tobacco taxes are estimated to be effective in reducing smoking prevalence (Chaloupka et al., 2011; Wasserman et al., 1991, etc.). While some studies discover that 100 percent or

even more of the increase in tobacco taxes is passed onto consumers (Evans et al., 1991, Keeler et al., 1996, Hanson & Sullivan, 2009), other studies find that the tax burden is somewhat split between cigarette producers and consumers (Chiou & Muehlegger, 2012; Harding et al., 2012). Chiou and Muehlegger (2012) find that consumers in Chicago bear around 80 percent of excise tobacco taxes. They suggest that this relatively lower pass-through rate compared to the literature is driven by the proximity of a lower tax border, Indiana. The finding for the geographic incidence of cigarette taxation depending on lower-tax borders is also confirmed by Harding et al. (2012).

A wide variety of socio-economic factors are also found to be correlated with the smoking behavior: age, income level, educational attainment, marital status, employment status, ethnicity, race, and gender (Chaloupka et al., 1999; Farrelly et al., 1998). There are significant differences in smoking prevalence of people from different age groups. For instance, Hosseinpoor et al. (2011) find that respondents aged 50–59 are 6 times more likely to smoke compared to those aged 18–29. Farrrely et al. (2001) find that young adults aged 18-24 are more responsive to increased prices than older adults. This result is consistent with the postulation that older smokers are more likely to be addicted to cigarettes and therefore less responsive. Income and cigarette consumption are found to be inversely related (Wasserman et al., 1991; Townsend et al., 1994). Additionally, smokers having low (high) income are found to be relatively more (less) responsive to changes in prices. (Townsend et al., 1994; Farrelly et al., 1998; Gruber & Koszegi, 2004). Individuals with lower education levels are more likely to smoke than those with higher education. Hosseinpoor et al. (2011) finds that respondents with no education are 3 times more likely to smoke than those with higher education. Gruber and Koszegi (2004) find that less educated individuals also exhibit higher price sensitivity.

The relationship between marital status and smoking varies with cultural background, but, in general, married individuals have lower smoking rates (Cox et al., 2005; King et al., 1998). Cho et al. (2008) find that smoking prevalence among not-married women is 2–8 times higher than among married women depending on the age. There is a substantial evidence on the effect of employment status on smoking rates (Waldron & Lye,1989; Lee et al.,1991). Waldron and Lye (1989) find that smoking prevalence is considerably higher among unemployed individuals. Lee et al. (1991) find that unemployed smokers begin to smoke at a younger age. Ethnicity has been found to be an important predictor of smoking behavior (Wagenknecht et al.,1990). King et al. (1998) find significantly higher smoking prevalence among French female smokers compared to American.

Race is another important determinant of cigarette smoking. Farrelly et al. (2004) find that African-Americans and Hispanics smoke fewer cigarettes per day compared to whites. Chaloupka & Pacula (1999) show that black males are significantly more responsive to price changes than white men. Farrelly et al. (2001) find that African-Americans and Hispanics are more than two and six times as price responsive as whites in the U.S. Some studies have found association between smoking and residential area (Idris et al.,2007; 1998; Shohaimi et al.,2003). Idris et al. (2007) find that smoking is more prevalent among urban residents, with rates being higher in larger cities. Regarding gender, men smoke more than women both in terms of participation and intensity (Guindond et al., 2003; Pirie et al., 1991). Several studies find that men are more responsive to price increases (Lewit et al., 1981; Farrelly et al.,1998; Chaloupka et al., 1999), but Stehr (2007), employing state fixed effects, finds the opposite: females in the US are almost twice as responsive as males to tax policies, regardless of their income level. There is no need to utilize regional fixed effects in my study, as in Stehr (2007), since taxes are uniform all over Kazakhstan. Among the determinants of smoking discussed so far, I utilize age, education level, marital status, ethnicity, place of residence, and gender in my analysis. I cannot control for income level and employment status due to data limitations. I also cannot control for some other determinants of smoking discussed in the literature such as religion (Madden et al., 1999), veteran status (McKinney, et al.,1997), exposure to secondhand smoking in the household (Wang et al.,2011), and alcohol use (Burton et al., 2006) due to lack of data.

The literature on tobacco consumption in Kazakhstan is very limited. Cockerham et al. (2014) find that males, younger adults, non-Muslims, and married respondents are more likely to smoke while education and income do not the alter probability of being a smoker. Denisova and Kuznetsova (2014) estimate that smoking participation and tobacco-related mortality among males are expected to decrease by 4 % and 55 % in response to a 200 % excise growth. Wang and Mati (2019), using the Global Adults Tobacco Survey from 2014, find that around 76 % of smokers in Kazakhstan have intentions to quit, but only 48% are aware of least half of the 12 common tobacco-related diseases.

Most previous literature, employing a two-part model where the analysis of smoking participation preceeds the analysis of smoking intensity, discover that smoking participation but intensity respond to prices (Lewit et al, 1981; Wasserman et al; 1991, Chaloupka & K.Warner, 2000; Evans et al, 1999; etc.). The lack of the effect of tobacco taxes on smoking intensity might be explained through substitution towards cheaper alternatives, under the assumption that cigarettes are homogeneous products. There are papers in the literature going

beyond this assumption considering cigarette characteristics and behavioral differences in smoking cigarettes. Evans and Farrelly (1998) and Farrelly et al. (2004) find that smokers compensate for tax hikes by substituting towards cigarettes with higher nicotine yields. Adda and Cornaglia (2006), considering cigarettes are heterogeneous with respect to size, nicotine concentration, and tar, show that smokers compensate for higher cigarette prices by extracting more nicotine from cigarettes through increased length of inhalation and number of puffs. This finding raises questions for effectiveness of tobacco taxation in reducing smoking prevalence. Since the Kazakhstani data do not have information on nicotine intake, I measure smoking intensity via average number of cigarettes smoked per day.

3 Data and methods

The data employed in my analysis come from the Global Adult Tobacco Survey (GATS) collected in 2014 and the Multiple Indicator Cluster Survey (MICS) collected in 2010-2011 and 2015. The GATS is a representative household survey designed by the WHO to monitor the smoking prevalence of adults aged 15 and above. The GATS sample was selected via a stratified three-stage clustering approach. In the first stage, "settlements" ranging from 50 to 8,226 households in rural areas and from 179 to 128,646 households in urban areas were chosen. In the second stage, sampling units were residential household addresses taken from the National Housing Registry which is updated by the Agency of Statistics of the Republic of Kazakhstan. In the third stage, one eligible individual was interviewed randomly from each selected address provided that household members agreed to be surveyed. MICS is an international household survey collected by UNICEF that provides information on key life indicators of the adult population and children. The sample in MICS was also selected in three stages. In the first stage, 840 enumeration areas from the 2009 Census covering urban and rural areas in each region and two cities of republican significance, Astana and Almaty, were selected. In the second stage, lists of households from these enumeration areas were randomly selected. Then, in the final stage, a random sample of 20 households were drawn from each list.

MICS 2015 did not sample males, therefore my analysis for males consists of only years 2010-2011 and 2014. The difference in the number of observations in female and male sample in 2010-2011 can be explained by the specifics of MICS. Since MICS has its main focus on women and children, only men living in every third household were surveyed. I restrict the GATS sample to 15-49 years aged women and to 15-59 aged men complying with the age

restriction in MICS. The working dataset consist of 5,701 male and 28,639 female observations.

I include various socioeconomic factors affecting smoking behavior of individuals in my analysis such as age, education level, marital status, ethnicity, place of residence, and gender. I use variables age and agesq to control for changes in smoking behavior of individuals associated with their age.

The data on educational attainment in MICS and GATS samples are collected via questions that are not directly comparable. I construct the comparable levels of education in the the following way:

- The MICS data have the following questions: "What is the highest level of school you attended?" and “What is the highest grade you completed at that level?”. I assign those who obtained primary education, less than 11 years of secondary education, and less than 3 years of secondary specialized education into the “less than secondary” category. I include respondents that completed 11 years of secondary school, 3 or 4 years of secondary specialized school, and less than 4 years of higher education into the “secondary education” category. Respondents that completed 4 years or more of tertiary education are assigned into the “higher” education group.
- The GATS data have the following question: “What is the highest level of education you have completed?”. I assign individuals having no formal schooling, primary education, and incomplete basic education into the “less than secondary” education group. I assign respondents that completed secondary general education, secondary technical education, and some college into the “secondary education” category. Those who completed university and post graduate degree are assigned into the "higher" education group.

My specification therefore includes three dummy variables to control for education, one for those who completed less than secondary school, one for high school graduates, and one for university graduates. I use the "secondary education" as the base group in my analysis.

I utilize a dummy variable capturing the marital status of respondents where "1" corresponds to married or cohabitating respondents. I control for the ethnicity using variables Kazakh share, Russian/European share, and Other share. These variables indicate region- and gender-specific ethnicity shares in the 2019 Census. The Kazakh share forms the base group in my analysis. The place of residence of respondents is also captured via a dummy variable, urban, that is equal to “1” for urban residents.

The educational attainment, marital status, ethnic composition of the region, and residence area can have different effects on smoking behavior when considered jointly. I therefore consider all pairwise interaction terms among these variables. Eventually, I include only the highly significant interaction terms in my analyses.

Despite the steady increase in real cigarette prices from 77 KZT in year 2009 to 195 KZT in 2018, smoking prevalence in Kazakhstan remained high. To address this issue, the government implemented smoke-free policies in indoor public places, fully and partly covered the costs of smoking cessation services at health clinics, introduced mandatory health warnings on cigarette packages, and banned direct tobacco advertisement and promotion. To capture the effects of the increase in cigarette prices, partly caused by the growth in tobacco taxation, along with the introduction of the other tobacco control policies, I utilize year dummies as main variables of interest. I analyze the smoking behavior of respondents in Kazakhstan using two dependent variables: 1) *smoking status* of a respondent indicating whether (s)he is an (almost) everyday smoker; 2) *smoking intensity* of an everyday smoker given by the number of cigarettes (s)he consumes in a day.

The MICS data have the question: "During the last one month, on how many days did you smoke cigarettes?". I assign those who answer to this question as 30 or almost 30 days as (almost) everyday smokers. In the GATS data, I construct this variable utilizing several questions. I first consider the question “Do you currently smoke tobacco on a daily basis, less than daily, or not at all?”. Remark that both daily and non-daily smokers might be classified as (almost) everyday smokers. I assign "daily smokers" answering to the question “On average, how many manufactured cigarettes do you currently smoke each day?” with a positive number as (almost) everyday smokers. I then consider the question “How many manufactured cigarettes do you currently smoke during a usual week?” for "non-daily smokers" and assign those who answer more than 7 as (almost) everyday smokers, since this implies more than one cigarette a day on average.

The second variable representing smoking behavior of a respondent is *cigamount*, the amount of cigarettes smoked per day by (almost) everyday smokers. This information is obtained from the question in MICS “In the last 24 hours, how many cigarettes did you smoke?”. In GATS, the question “On average, how many manufactured cigarettes do you currently smoke each day?” provides the amount of cigarettes for "daily smokers." For "non-daily smokers" the answer to the question “How many manufactured cigarettes do you currently smoke during a usual week?” divided by 7 is utilized as the daily amount of cigarettes consumed.

Table 1 - Weighted summary statistics for key variables for men 2011-2014

	Men			
	MICS 2011		GATS 2014	
	No.	**%**	**No.**	**%**
Age				
15-24	823	21.5	350	27.6
25-34	995	25.6	484	25.5
35-44	962	25.8	466	22.1
45-54	793	20.6	343	17.9
55-59	269	6.5	135	6.9
Total	**3842**	**100**	**1778**	**100**
Education level				
Less than secondary	1360	35.8	96	6.4
Secondary	1658	43.3	1105	62
Higher education	820	20.9	574	31.6
Total	**3842**	**100**	**1775**	**100**
Marital status				
Not married	1230	32.6	612	38.7
Married	2612	67.4	1162	61.3
Total	**3842**	**100**	**1774**	**100**
Residence				
Rural	1676	46.5	887	42.5
Urban	2243	53.5	891	54.8
Total	**3923**	**100**	**1778**	**100**
Smoking status				
Not everyday smoker	1963	50.6	1023	59.5
Everyday smoker	1956	49.4	755	40.5
Total	**3919**	**100**	**1778**	**100**
Cigarettes per day				
1 - 10	685	40	343	48.2
11 - 20	1166	55.5	374	47.8
21 or more	105	4.5	38	4
Total	**1956**	**100**	**755**	**100**

Tables 1 and 2 provide summary statistics of variables of interest, by gender, from all three surveys. The distributions of age categories, marital status, place of residence, but education are somewhat similar across surveys. The distributions of education levels significantly differ across surveys, especially in the “less than secondary category.” Men

Table 2 - Weighted summary statistics for key variables for women 2011-2014

	Women					
	MICS 2011		**GATS 2014**		**MICS 2015**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Age						
15-24	4182	30	351	30.9	3087	24.6
25-34	4020	28.7	493	30.3	4132	32.8
35-44	3833	27.2	433	25.7	3744	29.5
45-49	1979	14.1	226	13.1	1705	13.1
Total	**14014**	**100**	**1503**	**100**	**12668**	**100**
Education level						
Less than secondary	4335	31.5	71	5.4	2072	16.8
Secondary	5966	42.4	756	50.5	6416	50.7
Higher	3687	26.1	676	44.1	4172	32.5
Total	**13988**	**100**	**1503**	**100**	**12660**	**100**
Marital status						
Not married	5588	39.8	571	41.1	4372	34.1
Married	8426	60.2	919	58.9	8296	65.9
Total	**14014**	**100**	**1490**	**100**	**12668**	**100**
Residence						
Rural	5887	42.5	698	41.8	4984	43.7
Urban	8341	57.5	805	58.2	7924	56.3
Total	**14228**	**100**	**1503**	**100**	**12908**	**100**
Smoking status						
Not everyday smoker	13432	94.2	1430	95.7	12065	93.4
Everyday smoker	796	5.8	73	4.3	843	6.6
Total	**14228**	**100**	**1503**	**100**	**12908**	**100**
Cigarettes per day						
1-5	342	43.3	26	35.4	310	35.6
6 -10	312	39.5	28	38.2	371	44
11-15	57	6.8	10	15.2	72	8.2
16 and more	85	10.4	9	11.2	90	12.2
Total	**796**	**100**	**73**	**100**	**843**	**100**

having less than secondary degree account of 35.8% of the sample in 2011 and 6.4 % in 2014 while female respondents that obtained less than secondary degree constitute to 31.5 % in 2011, 5.4% in 2014, and 16.8 % in 2015. According to data on educational attainment from the 2009

Table 3 - Summary statistics for key variables for men (balanced sample)

	Men			
	Control MICS 2011		**Treatment** GATS 2014	
	No.	**%**	**No.**	**%**
Age				
15-24	346	20.5	340	20.1
25-34	494	29.2	443	26.2
35-44	435	25.7	454	26.9
45-54	301	17.8	339	20.1
55-59	114	6.7	114	6.7
Total	**1690**	**100**	**1690**	**100**
Education level				
Less than secondary	96	5.7	96	5.7
Secondary	1045	61.8	1096	64.8
Higher	549	32.5	498	29.5
Total	**1690**	**100**	**1690**	**100**
Marital status				
Not married	593	35.1	573	33.9
Married	1097	64.9	1117	66.1
Total	**1690**	**100**	**1690**	**100**
Residence				
Rural	808	47.8	805	47.6
Urban	882	52.2	885	52.4
Total	**1690**	**100**	**1690**	**100**
Smoking status				
Not everyday smoker	863	51.1	967	57.2
Everyday smoker	827	48.9	723	42.8
Total	**1690**	**100**	**1690**	**100**
Cigarettes per day				
1-10	319	38.6	322	44.5
11-20	466	56.3	364	50.4
21 or more	42	5.1	37	5.1
Total	**827**	**100**	**723**	**100**

Census, 27 % of males and 26 % of females completed less than secondary degree, which is comparable to percentages from 2011 MICS data. According to tables presented above, 5.8 %, 4.3 %, and 6.6 % of female respondents identified themselves as (almost) everyday smokers in 2011, 2014, and 2015. Regarding males, smoking participation decreased from 49.4% in 2011

Table 4 - Summary statistics for key variables for women (balanced sample)

	Women					
	Control MICS 2011		Treatment GATS 2014		Control MICS 2015	
	No.	%	No.	%	No.	%
Age						
15-24	351	23.6	351	23.6	351	23.6
25-34	490	32.9	490	32.9	490	32.9
35-44	428	28.7	428	28.7	428	28.7
45-49	221	14.8	221	14.8	221	14.8
Total	**1490**	**100**	**1490**	**100**	**1490**	**100**
Education level						
Less than secondary	71	4.8	71	4.8	71	4.8
Secondary	750	50.3	750	50.3	750	50.3
Higher	669	44.9	669	44.9	669	44.9
Total	**1490**	**100**	**1490**	**100**	**1490**	**100**
Marital status						
Not married	571	38.3	571	38.3	571	38.3
Married	919	61.7	919	61.7	919	61.7
Total	**1490**	**100**	**1490**	**100**	**1490**	**100**
Residence						
Rural	694	46.6	694	46.6	694	46.6
Urban	796	53.4	796	53.4	796	53.4
Total	**1490**	**100**	**1490**	**100**	**1490**	**100**
Smoking status						
Not everyday smoker	1424	95.6	1420	95.3	1414	94.9
Everyday smoker	66	4.4	70	4.7	76	5.1
Total	**1490**	**100**	**1490**	**100**	**1490**	**100**
Cigarettes per day						
1- 5	37	56.1	25	35.7	32	42.1
6 -10	21	31.8	26	37.1	33	43.4
11-15	3	4.6	10	14.3	6	7.9
16 and more	5	7.6	9	12.9	5	6.6
Total	**66**	**100**	**70**	**100**	**76**	**100**

to 40.5% in 2014 and average number of cigarettes smoked per day for everyday smokers from 15 to 13.

Observing differences in distributions of many variables of interest, most strikingly for

Table 5 - Percentage of smoking population within each demographic category, men

	MICS 2011		GATS 2014	
	weighted	**balanced**	**weighted**	**balanced**
Age				
15-24	22.7	28	15.3	17.1
25-34	55	54.3	44.8	45.6
35-44	59.4	56.8	56.2	55.3
45-54	56.5	55.5	54.2	49.3
55-59	52.5	42.1	40	39.5
Education level				
Less than secondary	50.9	50	30.2	36.5
Secondary	52.6	52.7	38.8	42
Higher	40	41.5	45.8	45.8
Marital status				
Not married	36.1	41.8	27.2	34
Married	55.8	52.8	48.9	47.3
Residence				
Rural	49.9	49.6	33.2	39.5
Urban	48.9	48.3	46.6	45.8

education levels, I employ PSM to obtain comparable samples that matches respondents in groups with similar respondents in the control groups with respect to the covariates provided in Tables 1 and 2. Such matches are identified using the propensity scores, values showing the probability of being assigned to the treated group conditional on the observed control variables associated both with the outcome and treatment selection (Rosenbaum & Ruben,1983). To that end, I employ one-to-one nearest-neighbor matching without replacement with propensity scores estimated by a logistic model with common support condition. I set the caliper equal to 0.2 of the standard deviation of the logit of the propensity score following Stuart and Rubin (2008). The common support condition requires that control observations whose propensity score fall outside of the interval between minimum and maximum propensity scores of the treatment observations are dropped out of the analysis. Due to the range of the covariates I employ, there are many observations in my samples that are exact matches. Using replacement option forces such treatment observations to match with only one control observation. I instead utilize no replacement option to increase the sample size of the control observations.

Since propensity score matching uses treatment-control approach to balance the data,

Table 6 - Percentage of smoking population within each demographic category, women

	MICS 2011		GATS 2014		MICS 2015	
	weighted	balanced	weighted	balanced	weighted	balanced
Age						
15-24	2.8	3.1	2.4	2.8	3.4	1.7
25-34	7.8	6.3	5.7	6.1	7.1	6.7
35-44	7.4	4.9	5.5	5.8	8.8	4.9
45-49	4.9	1.4	2.7	2.3	6.5	7.2
Education level						
Less than secondary	5.9	9.9	1	1.4	7.6	7
Secondary	7	4.8	5.3	6	7.1	5.7
Higher	3.7	3.4	3.5	3.6	5.3	4.2
Marrital status						
Not married	6.7	6.8	5	6.5	9.3	6.7
Married	5.2	2.9	3.6	3.6	5.2	4.1
Residence						
Rural	2.9	3.2	2.1	2.7	3.7	4.9
Urban	7.9	5.5	5.8	6.4	8.8	5.3

I assign the sample with the smallest amount of observations as the "treatment" group (GATS 2014) and the rest as the "control" groups (MICS 2010 and MICS 2015). After computing propensity scores and performing the matching, my male sample is composed of 3,380 observations and female sample of 4,470 observations. Tables 3 and 4 provide descriptive statistics of variables of interest from the balanced samples. The distributions of age categories, education, marital status, and place of residence by gender are very similar across surveys. Smoking participation of men in the balanced sample decreased from 48.9 % in 2011 to 42.8% in 2014 whereas 4.4%, 4.7 %, and 5.1% of female respondents identified themselves as everyday smokers in 2011, 2014, and 2015.

The proportions of smoking population for various demographic groups of interest by gender are given in Tables 5 and 6. The smoking participation is highest among men who are aged 25-54 and married. There are not sizeable differences in smoking behavior of men by education and area of residence. Differently for women, smoking participation decreases for those who are aged 45-49, having more education, are married, and reside in rural areas.

4 Empirical Model

I utilize a two-part model to study the effect of tobacco control policies on smoking behavior in Kazakhstan. Smoking behavior of an individual is determined via smoking participation, the binary decision to smoke (almost) everyday that I estimate using a Probit model, and smoking intensity, measured by amount of cigarettes smoked by (almost) everyday smokers that I estimate using OLS. The two-part framework is used to analyze mixed discrete-continuous outcomes. It was first used by Cragg (1971) in Economics, as an extension of the Tobit model, and has been extensively used in the literature to model the demand for smoking (Lewit et al.,1982; Evans et al., 1999) It coincides with the Heckman selection model under the assumption of no selection on unobservables.

I analyze the effect of cigarette taxes and other tobacco control policies using year dummy variables as main variables of interest. The regression model for smoking participation is presented below in Model I. The dependent variable is a latent variable for the binary outcome to be an everyday smoker, *smoke*. The set of control variables consists of various socio-economic characteristics such as age, educational attainment, marital status, ethnicity, residence area. Due to the data availability discussed earlier, the female regression includes year dummies for 2014 and 2015, but the male only 2014.

Model I : The determinants of smoking participation

$$smoke^{*} = \beta_0 + \beta_1 age + \beta_2 age^2 + \beta_3 lessthansecondary + \beta_4 higher + \beta_5 married + \beta_6\, Russian/European\, share + \beta_7 othershare + \beta_8 urban + \beta_9 higher * married + \beta_{10} lessthansecondary * married + \beta_{11} higher * Russian/European\, share + \beta_{12} higher * othershare + \beta_{13}\, lessthansecondary * Russian/European\, share + \beta_{14} lessthansecondary * othershare + \beta_{15} higher * urban + \beta_{16} lessthansecondary * urban + \beta_{17} married * Russian/European\, share + \beta_{18} married * othershare + \beta_{19} married * urban + \beta_{20}\, Russian/European\, share * urban + \beta_{21} othershare * urban + \beta_{22} year2014 + \beta_{23} year2015 + \varepsilon,\ \varepsilon \in N\ (0,1)$$

smoke=1, if smoke>0*

The regression model for smoking intensity is presented below in Model II. The dependent variable*, cigamount,* measures the daily cigarette consumption among everyday smokers. The set of covariates is the same with the Model I.

Model II : The determinants of smoking intensity of everyday smoker

$$cigamount = \alpha_0 + \alpha_1 age + \alpha_2 age^2 + \alpha_3 lessthansecondary + \alpha_4 higher + \alpha_5 married + \alpha_6\, Russian/European\, share + \alpha_7 othershare + \alpha_8 urban + \alpha_9 higher * married + \alpha_{10} lessthansecondary * married + \alpha_{11} higher *$$

$Russian/European\ share + \alpha_{12} higher * othershare + \alpha_{13}\ lessthansecondary *$
$Russian/European\ share + \alpha_{14} lessthansecondary * othershare + \alpha_{15} higher *$
$urban + \alpha_{16} lessthansecondary * urban + \alpha_{17} married * Russian/European\ share +$
$\alpha_{18} married * othershare + \alpha_{19} married * urban + \alpha_{20}\ Russian/European\ share *$
$urban + \ \alpha_{21} othershare * urban + \alpha_{22} year2014 + \alpha_{23} year2015 + \epsilon$

I include all 13 pairwise interactions among education, marital status, ethnicity, and place of residence in both smoking participation and smoking intensity models. I eventually set the interaction terms $\alpha_9, \alpha_{13-17}, \alpha_{19-21}$ in Model I, and the interaction terms $\alpha_9\ , \alpha_{10}, \alpha_{12-14}, \alpha_{16-18}$ in Model II equal to 0 as they are estimated to be insignificant (p-value>0.05).

5 Results

The estimates of the smoking participation model, using the original samples, along with the average marginal effects (AMEs) are provided in Table 7. Smoking probability of men is estimated to have decreased by 5.3 percentage points in 2014 compared to 2010-2011. On the other hand, while the year dummy for 2014 is estimated to be insignificant for females, the 2015 dummy is estimated to be positive and significant. The relevant AME estimate suggests that the probability of smoking of women in 2015 compared to 2010-2011 increased by 1.1 percentage points. The AME estimates of the socioeconomic determinants of interest are of expected sign. Being older, having less education except for less than secondary education for males, being not-married, Russian ethnicity, and living in urban areas are found to be positively associated with smoking participation regardless of gender. While male respondents from regions with greater amount of other ethnicities have lower probability of being smokers, females from these regions have higher probability. Interaction term estimates suggest that married men having less than secondary education are more likely to be smokers, an exception to average relationships discussed above. Additionally, the positive association found between Russian/European (Other) share and smoking probability for females is estimated to be less pronounced for university graduates (married). Finally, the positive probability of smoking found for respondents in regions with greater proportion of people from other ethnicities is estimated to be more pronounced for university graduates.

Table 8 provides the estimates of the smoking intensity model for everyday smokers using the original samples. The results on year dummies indicate that while

Table 7 - Probit regression results

Smoking participation				
	Males (N=5609)		Females (N=28138)	
	Estimate	AME	Estimate	AME
age	0.194***	0.069***	0.243***	0.026***
	0.011	0.004	0.012	0.001
agesq	-0.002***		-0.003***	
	0.0001		0.0002	
less than secondary	-0.144*	-0.052*	0.035	0.004
	0.075	0.027	0.05	0.005
higher	-0.262***	-0.094***	-0.322***	-0.034***
	0.043	0.015	0.099	0.011
married	-0.089*	-0.032*	-0.352***	-0.038***
	0.050	0.018	0.047	0.005
Russian/European share	0.38***	0.137***	1.634***	0.175***
	0.101	0.036	0.084	0.009
other share	-1.619***	-0.582***	2.482***	0.265***
	0.292	0.104	0.457	0.048
urban	0.078**	0.028**	0.269***	0.029***
	0.046	0.016	0.031	0.003
less than secondary* married	0.336***		0.183***	
	0.089		0.063	
married*other share			-1.755**	
			0.522	
higher*Russian/European share			-0.551***	
			0.169	
higher*other share			1.923***	
			0.649	
y2014	-0.149***	-0.053***	-0.029	-0.003
	0.039	0.014	0.063	0.007
y2015			0.101***	0.011***
			0.027	0.003
intercept	-3.531***		-6.184***	
	0.202		0.199	

*significant at 10%; **significant at 5%; ***significant at 1 %

smoker men decreased number of cigarettes they smoked per day by almost 1 on average, the effect for females are positive but not precisely estimated. Regardless of gender, smokers who are young or university graduates smoke less cigarettes per day. The effect of the place of residence depends on the ethnicity composition. While smoker men residing in rural areas with higher proportion of Russian/European population are associated with smoking more cigarettes per day, smoker women from rural areas with

Table 8 - OLS regression results

Smoking intensity		
	Males (N=2704)	Females (N= 1709)
	Estimate	Estimate
age	0.285***	0.526***
	0.096	0.138
agesq	-0.002**	-0.007***
	0.001	0.002
less than secondary	0.093	0.389
	0.331	0.336
higher	-1.751***	-1.348***
	0.341	0.354
married	0.046	0.652
	0.333	0.570
Russian/European share	4.598***	-4.940***
	1.044	1.839
othershare	-2.198	-14.258**
	2.753	6.267
urban	1.239*	-1.541
	0.727	1.246
Russian/European share*urban	-3.344**	5.591***
	1.463	2.103
other share*urban	-13.499***	16.134**
	5.18	7.709
married*urban		-1.427**
		0.646
year2014	-0.963***	0.748
	0.312	0.702
year2015		0.459
		0.283
intercept	7.544***	0.159
	1.799	2.481

* significant at 10%; **significant at 5%; ***significant at 1 %

prevailing Russian/European population with less cigarettes on average. Finally, while smoker men living in urban areas with higher share of other ethnicities are estimated to have less smoking intensity, smoker women living in urban areas with higher proportion of other ethnicities are estimated to have higher smoking intensity.

I next estimate both smoking participation and smoking intensity models on balanced samples to check the robustness of my findings given the observed differences in distributions of covariates of interest, especially education, among surveys utilized.

Table 9 - Probit regression results (balanced sample)

Smoking participation				
	Males (N=3380)		Females (N= 4470)	
	Estimate	AME	Estimate	AME
age	0.212***	0.077***	0.232***	0.021***
	0.015	0.005	0.033	0.003
agesq	-0.002***		-0.003***	
	0.0002		0.0004	
less than secondary	-0.037	-0.014	-0.212	0.021
	0.141	0.051	0.164	0.015
higher	-0.093	-0.034	-0.563***	-0.051***
	0.087	0.032	0.128	0.012
married	-0.125**	-0.045**	-0.462***	-0.042***
	0.059	0.021	0.073	0.007
Russian/European share	0.615***	0.224***	1.508***	0.136***
	0.157	0.057	0.239	0.022
other share	-1.241***	-0.451***	1.009	0.091
	0.371	0.134	1.055	0.095
urban	0.123**	0.045**	0.153**	0.014**
	0.059	0.018	0.078	0.007
higher*Russian/European share	-0.527**	-0.192**		
	0.248	0.09		
higher* other share			4.282***	0.387***
			1.445	0.132
y2014	-0.151***	-0.055***	-0.033	-0.003
	0.045	0.016	0.087	0.008
y2015			0.041	0.004
			0.084	0.008
intercept	-3.979***		-5.838***	
	0.274		0.545	

* significant at 10%; **significant at 5%; ***significant at 1%

The results of these regressions are reported in Tables 9 and 10. The probit regression results obtained from the balanced sample are mainly similar to the estimation results from the original samples, except that AMEs of education for males and share of other race for females turn out to be statistically insignificant. The estimated decrease in the smoking probability of men is 5.5 percentage points, 0.2 points higher than the finding from the original sample. The year dummy estimates in the female regression are statistically and economically insignificant suggesting that the recent tobacco control policies failed to alter smoking behavior of women similar to the findings from the original sample. It is

Table 10 - OLS regression results (balanced sample)

Smoking intensity		
	Males (N=1446)	Females (N=137)
	Estimate	Estimate
age	0.284**	1.017*
	0.142	0.595
agesq	-0.003	-0.014
	0.002	0.009
less than secondary	0.661	7.475**
	0.859	3.051
higher	-1.241	-2.614***
	0.853	1.002
married	0.176	-0.389
	0.446	0.903
Russian/European share	6.473***	0.812
	1.312	3.347
othershare	-3.283	3.512**
	3.152	1.405
urban	-2.613***	1.182
	0.489	1.021
higher*urban	2.720***	
	0.930	
higher*Russian/European share	-6.623***	
	2.126	
y2014	-0.639*	1.817
	0.364	1.129
y2015		-0.544
		1.069
intercept	7.894***	-12.548
	2.729	9.939

* significant at 10%; **significant at 5%; ***significant at 1%

then possible to interpret the PSM estimates as a robustness check to the earlier findings on smoking participation. The interaction term estimate *higher*Russian/European share* for males suggest that the positive average association observed between Russians/Europeans and smoking is there only for those who are not university graduates. For females, a positive association between people from other ethnicities and smoking is estimated to prevail only for university graduates. The smoking intensity estimates on main variables of interest, year dummies, obtained from the balanced sample are similar to those from unbalanced sample. The results on year dummies indicate that while men

decreased number of cigarettes smoked per day by 0.6, the effect for females is positive and insignificant in 2014, and negative and insignificant in 2015 suggesting that the recent anti-tobacco policies were ineffective on curbing cigarette consumption of women. The estimates are mainly similar to the ones obtained using the original sample except the following: 1) only Russian/European smoker men who are not university graduates are associated with higher intensity; 2) urban resident smoker men who are university graduates are estimated to smoke less cigarettes per day; 3) smoker women who have less than secondary education have a higher smoking intensity; 4) Russian smoker women do not have a different intensity.

6 Conclusion

In this paper, I examine the effect of cigarette prices and other tobacco control policies on smoking behavior of individuals in Kazakhstan. This study uses individual level data obtained from the Global Adults Tobacco Survey (GATS) in 2014 and the Multiple Indicator Cluster Survey (MICS) in 2011 and 2015. Due to differences in sample distributions across surveys, I implement Propensity Score Matching (PSM) to balance the data.

Since the smoking prevalence significantly differs by gender, I conduct separate analyses. The results indicate that tobacco control policies indeed reduced smoking probability of men by around 5.5 percentage points and participation by around 0.6 to 1 cigarette a day for everyday smokers. Yet, these policies are shown to be ineffective in altering female smoking prevalence in Kazakhstan. More gender-specific research is needed to understand the reasons underlying unresponsiveness of females to increased prices and other anti-tobacco policies in Kazakhstan. The rest of the findings are consistent with previous studies, being older, having higher education, being married are negatively correlated with smoking participation of individuals. I also observe a significant variation in smoking prevalence by ethnicity.

Considering that only a small portion of smokers are female in Kazakhstan, who did not respond to recent anti-tobacco policies, and men responded to these policies by decreasing their smoking participation and intensity by around 10 %, one can conclude that the recent anti-tobacco measures were partly successful. Since the smoking prevalence remains high in Kazakhstan, more drastic policy measures need to be taken to combat smoking. To that end, increasing tobacco taxes further seems like a viable option.

My study cannot utilize many determinants of smoking behavior discussed in the literature due to data limitations. Increasing data collection efforts on tobacco consumption is essential to enrich tobacco studies in Kazakhstan. Specifically, having data on nicotine extraction per cigarette will allow for a better analysis of how smokers alter their behavior in response to anti-tobacco policies by identifying the degree of compensatory behavior present among smokers.

References

Adda, J., & Cornaglia, F. (2006). Taxes, cigarette consumption, and smoking intensity. *American Economic Review*, 96(4), 1013-1028.

Boisclair, D., & Guindon, G. E. (2003). Past, current and future trends in tobacco use *HNP Discussion Paper: Economics of Tobacco Control Paper No. 6*, The World bank, Washington, DC.

Burton, S. M., & Tiffany, S. T. (1997). The effect of alcohol consumption on craving to smoke. *Addiction*, 92(1), 15-26.

Chaloupka, F. J., & Pacula, R. L. (1999). Sex and race differences in young people's responsiveness to price and tobacco control policies. *Tobacco Control*, *8*(4), 373-377.

Chaloupka, F. J., Straif, K., & Leon, M. E. (2011). Effectiveness of tax and price policies in tobacco control. *Tobacco Control*, *20*(3), 235-238.

Chiou, L., & Muehlegger, E. (2014). Consumer Response to Cigarette Excise Tax Changes. *National Tax Journal*, 67(3), 621-650

Cho, H. J., Khang, Y. H., Jun, H. J., & Kawachi, I. (2008). Marital status and smoking in Korea: the influence of gender and age. *Social Science & Medicine*, 66(3), 609-619.

Cockerham, W. C., Hinote, B. P., Abbott, P., & Haerpfer, C. (2004). Health lifestyles in central Asia: the case of Kazakhstan and Kyrgyzstan. *Social Science & Medicine*, *59*(7), 1409-1421.

Cox, L. S., Feng, S., Cañar, J., Ford, M. M., & Tercyak, K. P. (2005). Social and behavioral correlates of cigarette smoking among mid-Atlantic Latino primary care patients. *Cancer Epidemiology and Prevention Biomarkers*, 14(8), 1976-1980.

Cragg, J. G. (1971). Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica: Journal of the Econometric Society,* 829-844.

Denisova, I., & Kuznetsova, P. (2014). The Effects of Tobacco Taxes on Health : An Analysis of the Effects by Income Quintile and Gender in Kazakhstan, the Russian Federation, and Ukraine. *HNP Discussion Paper,* The Worldbank, Washington, DC.

Evans, W. N., & Farrelly, M. C. (1998). The compensating behavior of smokers: taxes, tar, and nicotine. *The RAND Journal of Economics*, 578-595.

Evans, W. N., Ringel, J. S., & Stech, D. (1999). Tobacco taxes and public policy to discourage smoking. *Tax Policy and the Economy*, *13*, 1-55.

Farrelly, M. C., Bray, J. W., Pechacek, T., & Woollery, T. (2001). Response by adults to increases in cigarette prices by sociodemographic characteristics. *Southern Economic Journal*, 156-165.

Farrelly, M. C., Nimsch, C. T., Hyland, A., & Cummings, M. (2004). The effects of higher cigarette prices on tar and nicotine consumption in a cohort of adult smokers. *Health Economics*, *13*(1), 49-58.

Global Adult Tobacco Survey (GATS). (2014) The Republic of Kazakhstan, 2014 country report.

Gruber, J., & Köszegi, B. (2001). Is addiction "rational"? Theory and evidence. *The Quarterly Journal of Economics*, *116*(4), 1261-1303.

Hanson, A., & Sullivan, R. (2009). The incidence of tobacco taxation: evidence from geographic micro-level data. *National Tax Journal*, 677-698.

Harding, M., Leibtag, E., & Lovenheim, M. F. (2012). The heterogeneous geographic and socioeconomic incidence of cigarette taxes: Evidence from Nielsen Homescan Data. *American Economic Journal: Economic Policy*, *4*(4), 169-98.

Heath, A. C., Madden, P. A., Grant, J. D., McLaughlin, T. L., Todorov, A. A., & Bucholz, K. K. (1999). Resiliency factors protecting against teenage alcohol use and smoking: influences of religion, religious involvement and values, and ethnicity in the Missouri Adolescent Female Twin Study. *Twin Research and Human Genetics*, 2(2), 145-155.

Hopkins, D. P., Briss, P. A., Ricard, C. J., Husten, C. G., Carande-Kulis, V. G., Fielding, J. E., ... & Woollery, T. A. (2001). Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *American Journal of Preventive Medicine*, *20*(2), 16-66.

Hosseinpoor, A. R., Parker, L. A., d'Espaignet, E. T., & Chatterji, S. (2011). Social determinants of smoking in low-and middle-income countries: results from the World Health Survey. *PloS one*, 6(5), e20331.

Idris, B. I., Giskes, K., Borrell, C., Benach, J., Costa, G., Federico, B., ... & Östergren, P. O. (2007). Higher smoking prevalence in urban compared to non-urban areas: time trends in six European countries. *Health & Place*, 13(3), 702-712.

Keeler, T. E., Hu, T. W., Barnett, P. G., Manning, W. G., & Sung, H. Y. (1996). Do cigarette producers price-discriminate by state? An empirical analysis of local cigarette pricing and taxation. *Journal of Health Economics*, *15*(4), 499-512.

King, G., Grizeau, D., Bendel, R., Dressen, C., & Delaronde, S. R. (1998). Smoking behavior among French and American women. *Preventive Medicine*, 27(4), 520-529.

Krasovsky, K. (2017). Tobacco taxation policy in Kazakhstan, WHO Regional Office for Europe, Copenhagen, Denmark.

Lee, A. J., Crombie, I. K., Smith, W. C., & Tunstall-Pedoe, H. D. (1991). Cigarette smoking and employment status. *Social Science & Medicine*, 33(11), 1309-1312.

Lewit, E. M., Coate, D., & Grossman, M. (1981). The effects of government regulation on teenage smoking. *The Journal of Law and Economics*, *24*(3), 545-569.

McKinney, W. P., McIntire, D. D., Carmody, T. J., & Joseph, A. (1997). Comparing the smoking behavior of veterans and nonveterans. *Public Health Reports*, 112(3), 212.

Pirie, P. L., Murray, D. M., & Luepker, R. V. (1991). Gender differences in cigarette smoking and quitting in a cohort of young adults. *American Journal of Public Health*, 81(3), 324-327.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41-55.

Shohaimi, S., Luben, R., Wareham, N., Day, N., Bingham, S., Welch, A., ... & Khaw, K. T. (2003). Residential area deprivation predicts smoking habit independently of individual educational level and occupational social class. A cross sectional study in the Norfolk cohort of the European Investigation into Cancer (EPIC-Norfolk). *Journal of Epidemiology & Community Health*, 57(4), 270-276.

Stehr, M. (2007). The effect of cigarette taxes on smoking among men and women. *Health Economics*, 16(12), 1333-1343.

Townsend, J., Roderick, P., & Cooper, J. (1994). Cigarette smoking by socioeconomic group, sex, and age: effects of price, income, and health publicity. *Bmj*, *309*(6959), 923-927.

Wagenknecht, L. E., Cutter, G. R., Haley, N. J., Sidney, S., Manolio, T. A., Hughes, G. H., & Jacobs, D. R. (1990). Racial differences in serum cotinine levels among smokers in

the Coronary Artery Risk Development in (Young) Adults study. *American Journal of Public Health*, 80(9), 1053-1056.

Waldron, I., & Lye, D. (1989). Employment unemployment, occupation, and smoking. *American Journal of Preventive Medicine*, 5(3), 142-149.

Wang, M. P., Ho, S. Y., & Lam, T. H. (2011). Parental smoking, exposure to secondhand smoke at home, and smoking initiation among young children. *Nicotine & Tobacco Research*, 13(9), 827-832.

Wang, Q., & Mati, K. (2019). Intention to Quit among Smokers in Kazakhstan: Data from 2014 Global Adult Tobacco Survey. *Journal of Epidemiology and Global Health*, 9(1), 23-28.

Wasserman, J., Manning, W. G., Newhouse, J. P., & Winkler, J. D. (1991). The effects of excise taxes and regulations on cigarette smoking. *Journal of Health Economics*, *10*(1), 43-64.

World Bank Group. 2019. Kazakhstan: Overview of Tobacco Use, Tobacco Control Legislation, and Taxation.