# THE DRIVERS OF SMOKING IN UKRAINE: THE IMPACT OF SOCIAL INTERACTIONS, ALCOHOL EXPENDITURES, AND COVID-19

By

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Kyiv School of Economics

Abstract

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In 2020, approximately 25.8% of Ukraine's population used tobacco. Controlling the spread of tobacco use and comprehending the underlying reasons for smoking are vital public health priorities with significant economic consequences. The presence of smokers in the environment is found to be a significant factor in the spread of smoking, with individuals more likely to smoke if they are surrounded by smokers. Additionally, the relationship between alcohol consumption and smoking indicates that drinkers and smokers often engage in both behaviors, and heavier drinkers tend to be heavier smokers. Furthermore, the impact of the COVID-19 outbreak on smoking behavior is discussed, with studies showing that smokers, including former smokers, are at a higher risk of adverse outcomes related to the virus.

This study examines the factors influencing smoking behavior in Ukraine, with a particular focus on the association between smoking and socioeconomic variables, the COVID-19 outbreak, social interactions, and alcohol expenditures. Findings suggest that individuals with smoking spouses are more likely to smoke, and a social multiplier effect is observed. Alcohol and tobacco use are closely linked, with drinkers and smokers often engaging in both behaviors. The impact of the COVID-19 pandemic was not significant in reducing the number of smokers in Ukraine.

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# LIST OF ABBREVIATIONS

**IHME.** Institute for Health Metrics and Evaluation.

**WDI.** World Development Indicators.

**WHO.** World Health Organization.

*Chapter 1*

# INTRODUCTION

Smoking has emerged as a significant public health concern with far-reaching economic implications. In recent decades, extensive research has demonstrated the detrimental effects of smoking on individual health, including increased risks of various chronic diseases, such as cancer, cardiovascular diseases, and respiratory disorders. These health consequences result in human suffering and impose a substantial economic burden on society through healthcare costs, lost productivity, and premature mortality. Understanding the economic dimensions of smoking is crucial for formulating effective policies and interventions to address this pervasive issue.

The economic impact of smoking extends beyond healthcare costs and productivity losses. Smoking-related illnesses impose a considerable financial strain on healthcare systems, requiring substantial treatment, rehabilitation, and long-term care resources. Moreover, smoking contributes to a reduced quality of life, limiting individuals' abilities to fully participate in the workforce and leading to diminished productivity. The associated absenteeism, presenteeism, and disability resulting from smoking-related illnesses compound the economic consequences at both the individual and societal levels.

Additionally, smoking-induced premature mortality exacts a heavy toll on economic development. Premature deaths are attributable to smoking rob societies of productive individuals who could contribute to economic growth and innovation. Moreover, the loss of productive years due to premature mortality disrupts intergenerational transfers, impacting future economic prospects. The financial burden stemming from smoking-related premature deaths extends beyond healthcare expenses and encompasses various indirect costs, such as lost tax revenues, decreased consumer spending, and increased reliance on social welfare programs. Addressing the economic consequences of smoking requires a comprehensive understanding of these multifaceted impacts and underscores the urgency for evidence-based interventions to curb tobacco use.

As of 2020, 22.3% of the population worldwide were tobacco users. According to World Health Organization (WHO 2021) estimation, as of July 2021 more than 8 million deaths worldwide were caused by direct smoking, including 1.2 million non-smokers that were exposed to secondhand smoke.

In Ukraine this indicator in 2020 according to the World Development Indicators (WDI 2020) database is not far from the global average, however, it is somewhat below most of its neighbors – 25.8% of Ukraine's adult population are tobacco users.

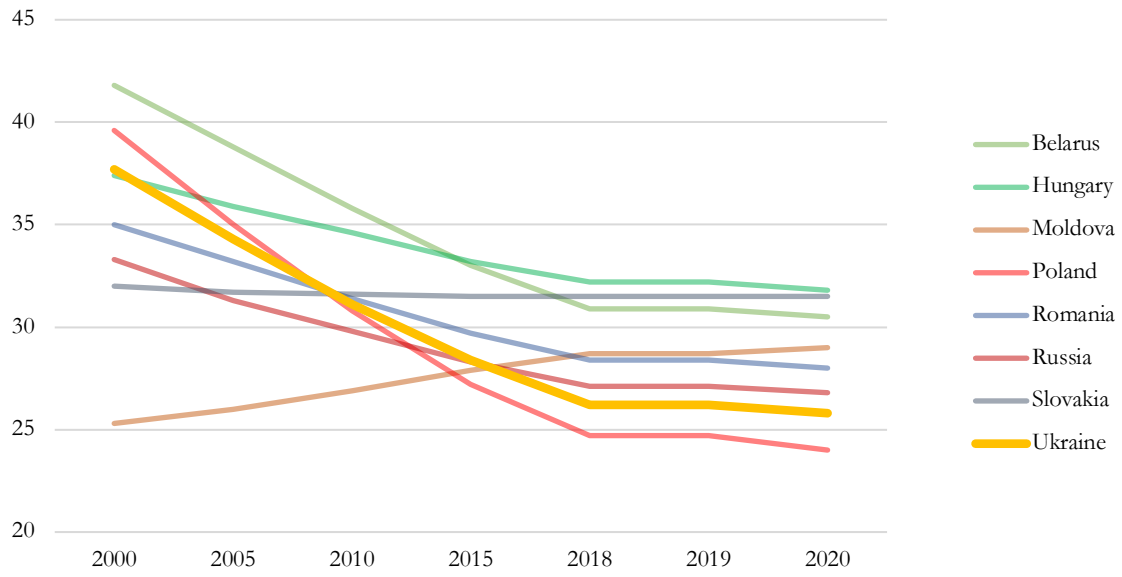


Figure 1. Prevalence of current tobacco use in Ukraine and its' neighbors (% of adults 15 y.o. and older)
Source: World Development Indicators

The Institute for Health Metrics and Evaluation (IHME 2019) estimates showed that in 2019 15.26% of deaths worldwide were caused by smoking or secondhand smoke. In Ukraine, this indicator is higher than worldwide – 17.56%, meaning that almost 1 of 6 deaths resulted from tobacco consumption.

Sex differences in tobacco consumption are a significant factor that affects smoking habits among the population. According to the estimates of the World Bank in 2019 (WDI, 2019), the share of male smokers is predominantly higher than the share of female smokers on the world level, and for most counties in particular. This is also the case for Ukraine, where the share of male tobacco consumers is more than twice higher that of female ones.

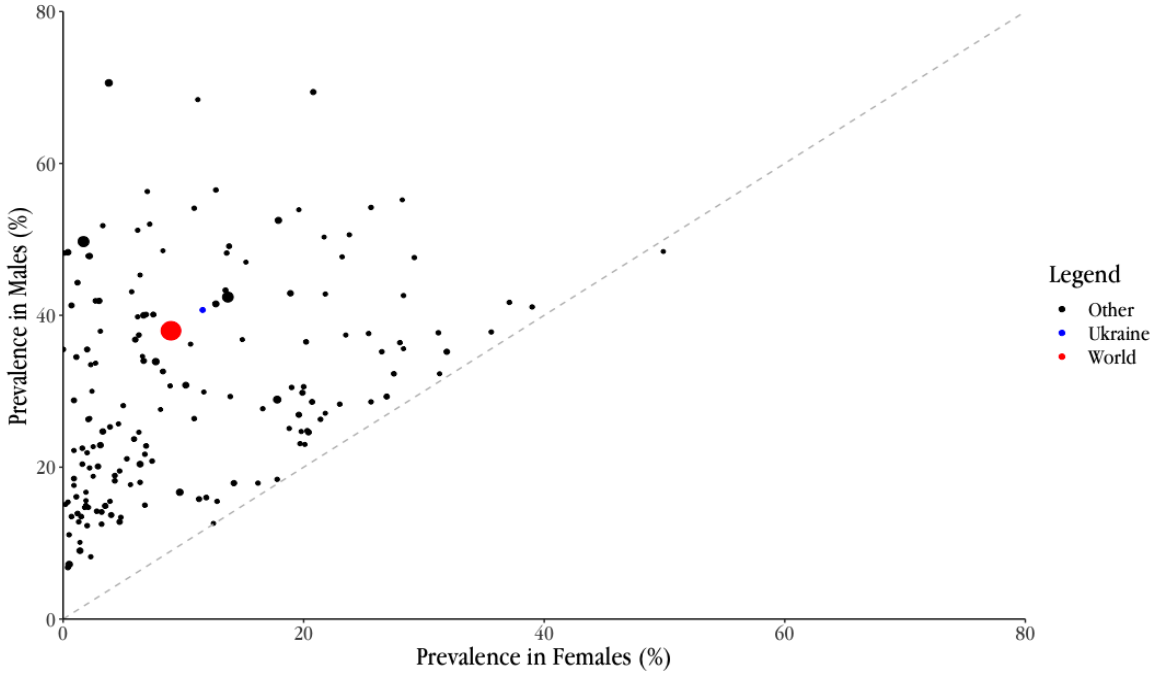


Figure 2. Smoking prevalence in men vs. women, 2019 (%)

Source: World Development Indicators

Besides sex differences, socioeconomic factors, such as educational level, income, and occupation play a significant role in the likelihood of being a smoker. Laaksonen et al. (2005), study of Finland's case showed that respondents with lower socioeconomic advantages are more associated with smoking than other respondents. Similar results were also obtained in Bonevski et al. (2014) study for the US case.

An important factor that the spread of smoking is the presence of smokers in the environment. The paper by Cutler and Glaeser (2007) explores the concept of peer effects on smoking and investigates whether individuals are more likely to smoke when they are surrounded by smokers.

The findings indicate that individuals with spouses who smoke are 40 percent more likely to smoke themselves. The study also identifies the presence of a social multiplier effect, which becomes stronger at higher levels of aggregation. This effect could explain the significant decrease in smoking among certain demographic groups over time.

Another factor that complements the spread of tobacco usage is alcohol consumption. Shiffman and Balabanis (1996) discussed in their article that drinkers and smokers are likely to engage in both behaviors and that heavier drinkers tend to be heavier smokers. The relationship between alcohol and tobacco use can occur in two ways: between-person interaction, where individuals who drink may also smoke (and vice versa), and situational interaction, where people who use both drugs may use them together in the same situations. Also, the authors highlighted that alcohol-tobacco interactions are prominent in the maintenance phase of addiction. Authors note that most smokers drink alcohol, and smokers are more likely to drink than non-smokers while smoking prevalence is higher among drinkers than among nondrinkers. In Ukraine's case, Serhieieva (2021) found out that a higher share of expenses on alcohol is linked with smoking.

An important issue related to smoking is the outbreak of COVID-19. In July 2022 an article by Poudel (2022), and colleagues showed that smokers had a higher likelihood of adverse outcomes than non-smokers, such as the need for mechanical ventilation, admission to the ICU, and death. Moreover, the study found that former smokers were also at a higher risk of severe illness due to COVID-19.

The research aim of the thesis is to estimate, what factors affect the likelihood of a person being a smoker in Ukraine. Controlling the effects of socioeconomic factors (age, employment, education, income) the aim is also to study the association of smoking with the outbreak of COVID-19, the presence of other smokers in the environment, and the share of the expenditures on alcohol.

The thesis addresses the literature's limitation on social interactions and alcohol expenditures that lead to the prevalence of smoking in Ukraine. For similar studies in Ukraine, most research focused predominantly on the demographic and socioeconomic conditions that affect the

likelihood of smoking (Pomerleau et al., 2004; Gilmore et al., 2004; Andreeva, Krasovsky 2007; and Sreeramareddy et al., 2015), or smoking initiation (Webb et al., 2007; Andreeva et al., 2007).

The data source for the research is the annual survey of the State Statistical Service of Ukraine "Survey of living conditions of households" pooled cross-sectional data "Anonymous microdata on basic indicators of income, expenditure and living conditions of households" for 2018-2021 years. The dataset includes more than 200 criteria, including demographic (e.g., age, gender, education, occupation, etc.), economic (e.g., income, household expenditures, presence of subsidies, etc.), and use of the Internet that are going to other controlling variables. The dataset contains data only for tobacco consumption, so other tobacco smoking substitutes, such as e-cigarettes, snus, and vapes will be not considered in this work.

The thesis is organized in the following way: Next, we delve into the examination of pertinent literature concerning the prevalence of smoking and the factors affecting it. Moving forward, Chapter 3 is devoted to providing a detailed description of the data. Chapter 4 focuses on the empirical analysis of the likelihood of a person being a smoker in Ukraine. Lastly, Chapter 5 encompasses the presentation of conclusions and policy implications.

*Chapter 2*

# LITERATURE REVIEW

The literature examining smokers' behavior and determinants of smoking is present in healthcare studies and the economic literature.

One of the most prominent researchers of tobacco, alcohol, and illicit drugs is Chaloupka. In his and his colleague Hana Ross's work (2004), they discussed the demand for cigarettes among high school students and the impact of various policies on smoking behavior. They examined the socioeconomic and demographic determinants of cigarette demand and found that age, race, religiosity, and living arrangement are important factors. The analysis showed that age is a significant determinant of cigarette demand, with older individuals being more likely to smoke and consume more cigarettes per month. The living arrangement is also an important determinant of cigarette demand, those who live alone are more likely to start smoking and smoke in higher amounts than those who live with parents. Having an incomplete family, such as parents who were never married or are separated/divorced, or if one of them is deceased, is an additional factor that influences youth smoking initiation. The parental educational attainments, which serve as indicators of family income, show varied signs and significance in different parts of the model. Personal income, measured by factors like hours worked and pocket money demonstrates a noteworthy and positive impact on cigarette demand.

The other article that investigated similar problems was the work of Jin-Tan, and Hsieh (1995) for the Taiwan case. They used the results of a survey conducted in Taiwan in 1993 to investigate the relationship between consumer perceptions of smoking risks and smoking behavior. The results show that younger individuals have a higher risk perception of smoking compared to older individuals. Males have a lower risk perception than females, possibly due to their greater likelihood of engaging in risky activities or being in contact with smokers. Education and exposure to warning labels on cigarettes are positively correlated with risk perception. Individuals who have heard that smoking is likely to shorten a person's life have a significantly higher risk perception. Basic demographic variables such as age and gender also have a

significant influence on smoking behavior. Respondents in the middle age group and males have a higher smoking propensity than average, while education is negatively correlated with smoking probability. Respondents from smoking families also have a higher probability of smoking. Finally, positive attitudes toward smoking are positively correlated with smoking probability, while negative attitudes are negatively correlated.

In Ukraine were conducted several studies that examined the smoking prevalence and its' changes over time. Pomerleau et al. (2004), conducted a cross-sectional study in eight countries of the former Soviet Union to examine the determinants of smoking in males and females. The study found that the likelihood of smoking in men varied significantly between countries, with those living in Ukraine, Georgia, Kyrgyzstan, and Moldova being significantly less likely to smoke than those living in Russia. Among women, a significantly lower likelihood of smoking was observed in all countries except Belarus, with the difference in Ukraine with no statistical significance. Socioeconomic status was found to be associated with smoking rates in both men and women. Among men, smoking tended to be more common among those with lower education and economic position, while in women, smoking rates were associated with socio-economic hardship. Lack of social support was associated with a greater risk of smoking in men, but not in women.

Andreeva and Krasovsky (2007) examined trends in smoking prevalence in Ukraine using data from three surveys conducted between 2001 and 2005. The study found that smoking prevalence was increasing in most population groups, with the highest smoking prevalence observed in the medium-deprivation group of men with secondary education. Among women, tobacco use was highest among the most educated, young, and those living in larger cities, but other groups were also increasing their tobacco use. The study also found that tobacco promotion efforts appeared to have been significantly more effective than smoking control efforts in Ukraine.

In the economic literature, alcohol and tobacco products are considered as complementary goods. Consequently, the impact of alcohol consumption on smoking can be considered a significant factor. Decker and Schwartz (2000) conducted a study on cigarette and alcohol

consumption in the United States, estimating own and cross-price elasticities. The results indicated that increasing the price of cigarettes led to an increase in both the prevalence of drinking and the amount consumed by drinkers. In addition, increasing the price of beer resulted in increased smoking among smokers, but decreased smoking participation. The study found that changes in smoking and drinking participation, rather than changes in consumption among continuing smokers and drinkers, accounted for most of the price response. Surprisingly, the study revealed that while alcohol and cigarettes were shown to be substitutes in the consumption equations, increases in the price of cigarettes led to increased drinking participation, while increases in the price of alcohol led to decreased smoking participation.

Tauchman et al. (2008), addressed a similar issue using German survey data. In Germany, the prices of tobacco and alcohol did not exhibit significant variation over time, across regions, or at the individual consumer level. To tackle the issue of inadequate price variation, the empirical analysis conducted in this study opted not to use prices as explanatory variables. Instead, a structural and interdependent model of consumption for both tobacco and alcohol was employed. The estimation outcomes indicated that tobacco and alcohol were consumed together, acting as complements, as evidenced by the positive impact of tobacco consumption on alcohol consumption. This conclusion was derived from employing a Tobit specification for estimation. Less constrained model specifications did not provide definitive evidence either supporting or contradicting this finding, but were limited by a smaller sample size.

In the literature, it is discussed that social interactions play a significant role in smoking initiation and continuation. An important insight into the effect of social interactions on smoking prevalence was given by Cutler and Glaeser (2007). In their study, the authors focused on investigating the presence of social interactions in smoking behavior. These interactions can arise from direct social interactions, the social formation of beliefs, and supply-side interactions resulting from market creation with fixed costs. The findings revealed that the variation in smoking rates among states and metropolitan areas was approximately seven times greater than it would have been in the absence of social interactions and any exogenous variables that vary across different locations. This suggests the existence of social interactions in smoking. The

paper examined the impact of the peer groups and spouses on the probability of smoking of the respondents. The smoking spouse increases the probability of smoking by 21%. In case of the increase of the share of smokers in the peer group by 10%, the probability of smoking among respondents increases by 8%. The authors found that respondents, whose spouses faced restrictions on smoking at work, are less likely of being a smoker, and there is a 40% reduction in the probability of smoking if the spouse of the respondents quits from it. Also, The authors concluded that the effect of a smoking spouse is higher for men than for women. Cutler and Glaeser concluded that policy interventions that impact an individual's smoking habit would have both direct and indirect effects on the smoking of peers.

Also, the impact of social interaction on smoking choice was examined by Fletcher (2010) from the perspective of classmates' smoking decisions. The study reveals noteworthy and reliable evidence indicating that the smoking choices made by peers exert a significant and moderate impact on the decisions of adolescents to engage in smoking behavior. This empirical evidence indicates that policies targeting the smoking behavior of an individual are likely to influence the decision-making of their classmates through social interactions.

In recent years also appeared literature on the impact of COVID-19 on smoking cessation. The study by Koczkodaj et al. (2022), explores the impact of the COVID-19 pandemic on smoking cessation decisions using data from the Polish National Quitline. The study collected anonymized data from 4072 callers between April 15, 2020, and May 31, 2021, assessing their decisions regarding smoking continuation or cessation during the pandemic.

The findings indicate that smokers are highly responsive to communication regarding COVID-19 and smoking risks, likely due to the immediate health consequences associated with smoking and COVID-19 infection. Emphasizing short-term health consequences of smoking may lead to better smoking cessation outcomes. Continuous education on tobacco-related health risks is necessary. The study suggests that widespread communication on health consequences can be highly effective in smoking cessation. Segmenting communication to focus on specific health risks at a time may be more effective than presenting multiple risks simultaneously.

The study sample consisted primarily of young men, with the highest proportions in the 15-19 and 20-29 age groups. Most callers were active smokers, and a significant number expressed the intention to quit smoking. The majority of smokers had been exposed to tobacco smoke for 1-10 years, with the frequency of smoking varying between 10-20 cigarettes per day for men and less than 10 cigarettes per day for women. Most participants started smoking between the ages of 15 and 19.

Regarding the impact of the pandemic on quitting decisions, a substantial proportion of male smokers reported that it had no influence. Among heavy smokers, the desire for a less severe course of COVID-19 disease and a reduced risk of infection were important factors for quitting. Notably, heavy smokers were more likely to be uncertain about the connection between smoking and COVID-19 risks. Among women, smoking-related health risks were the most important factor influencing quitting decisions, followed by the risk of infection and hopes for a less severe course of COVID-19. The majority of women intended to continue their abstinence after the pandemic.

A similar goal was examined in the paper by Jinyoung Kim and Sungkyu Lee (2022). The authors in the paper examined the impact of the COVID-19 pandemic and the Korean government's response to tobacco sales and national smoking cessation services in Korea. The study used multiple data sources, including tobacco sale data from the Ministry of Finance, records from national smoking cessation clinics, and online search results to gather information on smoking behavior during the pandemic.

Due to the unavailability of smoking prevalence data for 2020 at the time of the study, the researchers utilized alternative data sources to assess the impact of COVID-19 on tobacco sales. They obtained quarterly tobacco sales data from 2011 to 2020 from the official website of the Ministry of Finance. The data included sales of conventional cigarettes and heated tobacco products (HTPs). The sales of conventional cigarettes had been decreasing from 2016 to 2019 but experienced a slight increase in 2020 after the emergence of COVID-19. HTPs were introduced in 2017 and saw a rapid increase in sales, continuing to rise in 2020.

In terms of national smoking cessation services, the study found a significant decrease in the number of smokers visiting smoking cessation clinics in the first half of 2020. Compared to 2017, the number of clinic visitors sharply declined, and the six-month success rate of quitting decreased from 38.5% to 22.3% during the same period. This decline was attributed to the temporary suspension of face-to-face consultations in smoking cessation clinics due to the pandemic. The services were replaced with phone and text message support.

The researchers also conducted an online search to gather public opinions on smoking behavior during the pandemic. They found that some smokers expressed a desire to quit smoking after learning about the association between smoking and the severity of COVID-19. Others reported hesitancy to smoke in public areas or smoking rooms due to concerns about infection and mask removal. Some smokers mentioned increased tobacco consumption while working from home, leading to a shift from conventional cigarettes to HTPs. The tobacco industry promoted HTPs as suitable for indoor use due to their minimal odor.

Based on their findings, the researchers emphasized the importance of adapting smoking cessation services to alternative delivery options, such as e-health and telemedicine consultations, in line with WHO recommendations. They suggested expanding internet and telephone-based smoking cessation services to effectively support smokers in quitting during the pandemic and beyond. Despite the challenges posed by the pandemic, the study highlights the need to sustain and strengthen tobacco control policies and national smoking cessation services in Korea.

*Chapter 3*

# METHODOLOGY

Estimating the probability of a person being a smoker can be performed in three ways: logit, probit, or linear probability models. Given, the literature on smoking reasons in different countries focuses mostly on probit and logit models, they will be considered for further investigation.

While the mathematical expressions of the logistic and probit models differ, they both aim to capture the same underlying relationship between the explanatory variables and the binary response variable. In practice, the estimated coefficients in both models can be used to interpret the effects of the explanatory variables on the probability of success.

Furthermore, logistic and probit models often yield similar results when applied to the same dataset. This is because both models make similar assumptions about the distribution of the error term and produce similar predicted probabilities for a given set of explanatory variables.

However, the presence of extreme outliers in independent variables in the dataset is an important issue to consider. Extreme values can significantly impact the results of statistical analysis and cause problems with model estimation and inference. Hahn and Soyer (2005) in their paper considered the different outcomes of multivariate probit and logit model estimation and find out that in the case of the presence of extremely independent variables (extreme outliers in independent variables in their terms), the logit approach provides a better fit.

Given that the dependent variable is the binary response on whether the respondent smokes, or not ("1" in the case of "Yes", and "0" in the case of "No") it is not the case in the multivariate case. Therefore, there are no reasons to prefer one model to another. Consequently, the logit model will be used in this work.

The logit form is specified as follows:

$$logit(Smoking_i) = log\,[P - \left(\frac{1}{P}\right)] = \beta_1 COVID19_i + \beta_2 Alcexp_i +$$
$$\beta_3 Several\ smokers_i + \beta_4 DEM_i + \beta_5 SE_i + \beta_6 X_i, \quad (1)$$

For the variable $COVID19_i$ stands for the year of observation. In the dataset, there is no information, on whether the respondent was infected by the COVID-19 disease. Therefore, the proxy variable for 2020 and 2021 are used to capture the potential effect that the virus might have on the being a smoker for the respondents. It is expected that the sign for this variable is going to be negative since there is a clear indication of the declining trend in smoking prevalence over the years.

$Alcexp_i$ is the variable that reflects the expenditures of the household of the respondent on alcohol. As it was shown before, this variable is categorical, and make up of 4 quartiles. Here the signs are expected to be positive, from the literature and from the data description it is clear that higher expenditures are associated with higher smoking prevalence.

$Several\ smokers_i$ is the variable that shows whether there is more than one smoker in the household. It is a binary variable, taking the value "1" in the case of the household with 2 or more smokers, and "0" otherwise. This variable allows us to measure the impact of social interactions with smokers, and the impact the smokers share in the dataset. However, this variable does not cover all social integrations with smokers for respondents, as the study of (Cutler and Glaeser, 2007) shows that a smoking spousal is a strong predictor of being a smoker. Therefore, the expected sign of the variable is positive.

$DEM_i$, and $SE_i$ stand for demographic and socioeconomic variables (age, sex, education, occupation, income, etc.). Vector $\boldsymbol{X_i}$ stands for other controlling variables.

An important part of the work is the robustness check, which involves examining the sensitivity of the regression results to changes in the specification of the model or the data used in the analysis.

Among the most spread methods are checking for multicollinearity; checking functional form; checking specification errors; checking for sample selection bias; and checking for robustness to alternative estimators.

Multicollinearity occurs when two or more predictor variables are highly correlated with each other, which can lead to unstable regression coefficients. Checking for multicollinearity is performed by calculating the variance inflation factor (VIF) for each predictor variable and looking for values greater than 5 or 10.

The relationship between the dependent variable and the independent variables may not be linear, so it's important to check whether a nonlinear functional form (such as a quadratic or logarithmic relationship) fits the data better. Given that all independent variables in the model are presented as binary variables, or as categorical, there is no way to apply a nonlinear relationship to the model.

There may be other factors that influence the dependent variable that are not included in the model. One way to check for this is to add additional variables to the model and see whether they affect the regression coefficients. Also, Wald tests were performed to test the statistical significance of individual coefficients in the regression model and checking of AIC to measure model fit and selection.

If the sample used in the regression is not representative of the population of interest, the regression results may not be generalizable. In our work, we used the whole available sample, which is unweighted due to the absence of reliable and consistent data on smoking prevalence in Ukraine. The original weights provided by the State Statistical Service of Ukraine were applied to make the samples representative of the household distribution in Ukraine, and do not account for the smoking prevalence on household, and population levels. The only other source of data is World Bank estimations; however, their data contains information only for the 2018-2020 years and includes a population aged 15+, which is different from the general population that is considered in this work. Therefore, there is no optimal way to use a different sample or to use a different data source and compare the results.

*Chapter 4*

# DATA

The data is taken from an annual state survey of the living conditions of households performed in 2018-2021. The dataset contains cross-sectional data on the key variables at the level of households and household members such as income, labor force employment status, education, expenditures, etc.

The survey data consists of anonymous de-identified microdata, which has undergone protection methods such as global recoding, aggregation, and masking. These methods aim to minimize the risk of indirectly identifying specific statistical units. To ensure confidentiality, the data includes only a selected subset of variables from the primary database. Not all variables can be disclosed without violating confidentiality rules.

During data preparation, masking methods, including non-adjusting techniques, were applied to individual variables. These methods safeguard the privacy of the microdata without altering the original information. In the household file, the level of detail has been reduced through global recoding and aggregation. This process transformed the variables into interval ranges, maintaining privacy while providing useful insights.

For specific expenditure variables, masking techniques involving adjustments were employed. The approach used was local suppression, which involves replacing the highest values with the mean value for that variable within the designated household group. To mitigate the risk of disclosure, information regarding individuals in large-sized households (6 or more individuals) was excluded from the final data. This decision was made considering the unique and infrequent distribution of households of such size.

Following the consolidation of household and individual data, a risk assessment was conducted to evaluate the potential disclosure of confidential information for each individual. The assessment considered household-level data, including monetary and aggregate expenditures,

total income and resources, and indicators of differentiation and inequality in material well-being. The calculated average indicators derived from the anonymous microdata files deviated by no more than 3 percentage points from the corresponding published levels in 2018 and 2019. In 2020 and 2021, the deviations did not exceed 2 percentage points.

The dataset for all years does not cover some groups of the population (military servicemen, persons in prison, persons permanently living in boarding houses, homes for the elderly), marginal parts of society (homeless, etc.), as well as the population living on the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in the Donetsk and Luhansk regions. The data for each year was weighted to be nationally representative at the household level. For this research unweighted observations for each year were used because the weights produced by State Statistical Service make the sample representative on the household level. In this paper, the data will be used on the individual level.

The dummy variable for smoking takes a value of "1" in case the respondent is a smoker, and "0" in case it is not. The number of respondents without smoking status is 8000, which is 11.94% of all observations. Predominantly, the respondents that have no information on their smoking status, are respondents up to 18 years old. They make up 96.7% of all respondents that don't have this status. Also, for this age group, the number of respondents, for whom it was not mentioned that they smoke, or not, is 65.98%. According to the latest update of methodological regulations "Survey of living conditions of households" of the State Statistical Service of Ukraine (SSSU) the respondents were asked about tobacco consumption among persons aged 12 years and older. Therefore, a significant part of the respondents does not have information on their smoking status. Also, given that adolescent smoking is affected by many other psychological factors (Tyas and Pederson 1998; Won Choi et al., 2001), that are not covered in the dataset, all respondents of this age have been excluded from the dataset.

Table 1. Smoking Status of Respondents by Age (column total)

| Age | Smoking status | | | |
|---|---|---|---|---|
| | **Smoke** | **Do not smoke** | **Missing** | **Total** |
| <18 y.o. | 0.4% | 7.8% | 96.7% | 17.5% |
| 18-35 y.o. | 24.3% | 17.3% | 1.5% | 16.3% |
| 36-59 y.o. | 55.3% | 37.1% | 1.7% | 35.2% |
| 60 y.o> | 19.5% | 37.5% | 0.1% | 30.7% |
| Missing | 0.5% | 0.3% | 0.0% | 0.3% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% |

Source: Survey of living conditions of households by State Statistical Service of Ukraine

After the data cleaning procedure, the dataset consists of 40193 respondents. The share of smokers is 14.98%. This number is significantly lower than the estimate provided by WDI (WDI 2020), in total, and for both sex groups. Though there is a discrepancy in the data, the WDI estimation includes people aged 15 y.o. and older. Therefore, the dataset is not weighted since the general populations differ.

The relationship between smoking prevalence and alcohol expenditure is one of the key objectives of the study. The distribution of smokers among different quartiles of alcohol expenditures revealed a notable association between the two variables. Among individuals with no alcohol expenditures, the smoking prevalence was observed to be 10.0%. As alcohol expenditure increased, the smoking prevalence exhibited an upward trend. In the first quartile (Q1), corresponding to the lowest alcohol expenditure, the smoking prevalence was 17.0%. Similarly, in the second quartile (Q2), representing slightly higher alcohol spending, the smoking prevalence remained relatively consistent at 16.9%. Moving to the third quartile (Q3), with further increased alcohol expenditure, the smoking prevalence increased to 20.9%. Finally, in the fourth quartile (Q4), corresponding to the highest alcohol expenditure range, the smoking prevalence reached its highest point at 24.3%.

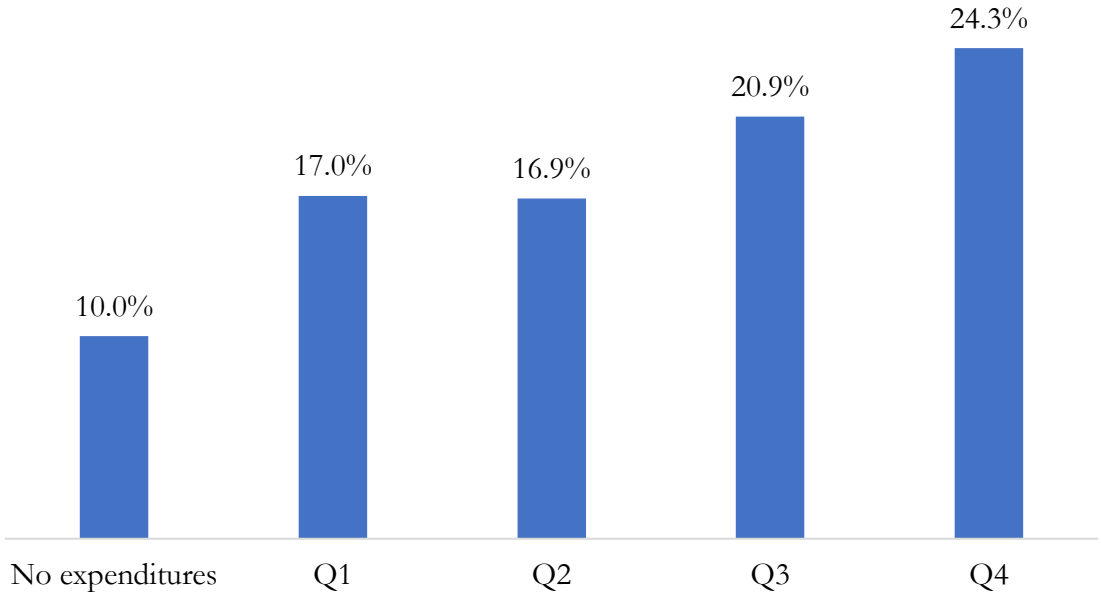


Figure 3. Smoking prevalence among alcohol expenditure quartiles

Source: Survey of living conditions of households by State Statistical Service of Ukraine

Another important factor is social interactions, e.g., the presence of several smokers in the household in the paper. There is a substantial difference in smoking prevalence between households with multiple smokers and those with one smoker or none. In households with several smokers, the prevalence of smoking was observed to be 76.4%. In contrast, households with only one smoker or no smokers exhibited a significantly lower smoking prevalence of 12.5%.

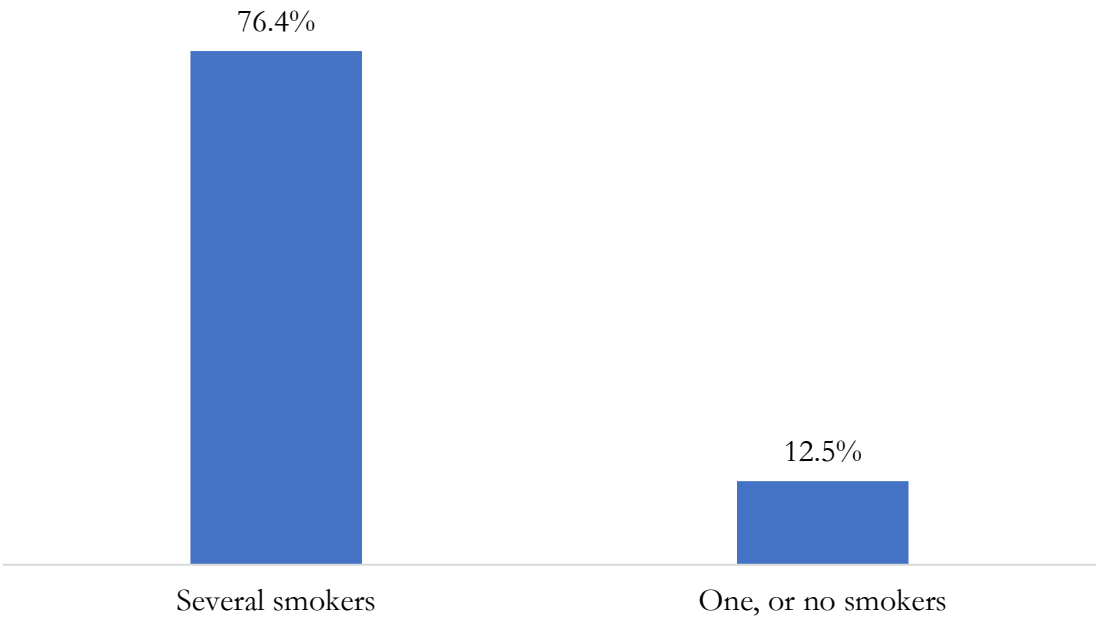


Figure 4. Prevalence of smoking in households with several smokers
Source: Survey of living conditions of households by State Statistical Service of Ukraine

On a year-on-year basis, in the dataset, there is a trend on declining in the number of smokers. Since 2018 the share of smokers declined from 16.66% to 13.45% in 2021. Given that, it is not likely that the COVID-19 pandemic contributed significantly to the decrease in the number of smokers.

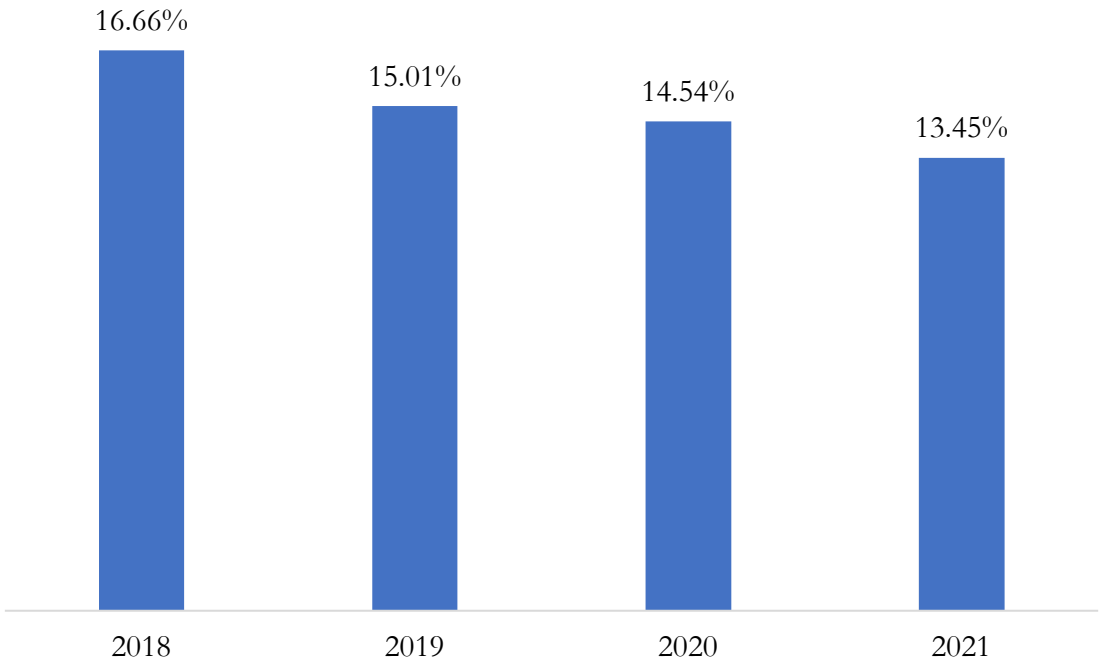


Figure 5. Smoking prevalence by year

Source: Survey of living conditions of households by State Statistical Service of Ukraine

The smoking prevalence generally decreases with age. In 2018, the highest smoking prevalence was observed among individuals aged 36-59 years (23.1%), followed by those aged 18-35 years (20.7%). However, by 2021, the smoking prevalence decreased in all age groups, with the highest prevalence observed among individuals aged 36-59 years (18.7%). The lowest smoking prevalence throughout the years was consistently found among individuals above 60 years old.

Regarding sex, Males consistently exhibited higher smoking prevalence compared to females across all years. In 2018, the smoking prevalence among males was 35.1%, while among females it was significantly lower at 4.5%. This trend continued throughout the years, with the smoking prevalence gradually declining for both sexes, but remaining consistently higher among males.

The data indicates a declining trend in smoking prevalence among individuals with different education levels. In 2018, those with secondary education had the highest smoking prevalence (19.4%), followed by those with higher education (13.4%). However, by 2021, smoking

prevalence decreased across all education levels, with the lowest prevalence observed among individuals with higher education (10.3%).

Self-employed individuals and employers consistently exhibited higher smoking prevalence compared to other employment categories. In 2018, self-employed individuals and employers had the highest smoking prevalence (34.1% and 22.6% respectively). However, by 2021, the smoking prevalence decreased for both groups, with self-employed individuals exhibiting the highest prevalence (23.8%) and employers exhibiting a slightly lower prevalence (18.7%). Pensioners consistently had the lowest smoking prevalence across the years.

Individuals residing in big cities (100k or more) consistently showed higher smoking prevalence compared to those in small cities (less than 100k) and rural areas. In 2018, the smoking prevalence in big cities was 18.9%, while it was 14.9% in small cities and 16.0% in rural areas. This pattern continued in subsequent years, with a gradual decrease in smoking prevalence across all settlement types.

The data suggest that smoking prevalence is inversely related to income levels. In all years, individuals in the lowest income quartile (Q1) had the lowest smoking prevalence, while those in the highest income quartile (Q4) had the highest prevalence. The smoking prevalence decreased gradually as income levels increased across all quartiles.

The descriptive table for all variables of the dataset is provided in Appendix A.

Table 2. Smoking status by main variables and years (%)

| Variable | Smoking prevalence | | | |
|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2021 |
| **Age** | | | | |
| 18-35 y.o. | 20.7% | 19.5% | 18.7% | 17.6% |
| 36-59 y.o. | 23.1% | 20.1% | 20.0% | 18.7% |
| >60 y.o. | 7.8% | 7.6% | 8.2% | 7.6% |
| **Sex** | | | | |
| Female | 4.5% | 3.5% | 3.6% | 3.3% |
| Male | 35.1% | 32.2% | 31.9% | 29.5% |
| **Education** | | | | |
| Higher education | 13.4% | 12.2% | 11.6% | 10.3% |
| Secondary education | 19.4% | 17.2% | 16.9% | 16.0% |
| **Labor force employment status** | | | | |
| Employee (Wage and salaried worker) | 22.6% | 20.2% | 20.4% | 18.7% |
| Employer, self-employed | 34.1% | 26.4% | 21.5% | 23.8% |
| Pensioner | 8.70% | 8.00% | 8.50% | 7.50% |
| Other | 19.4% | 17.8% | 16.0% | 15.6% |
| **Settlement type** | | | | |
| Big city (100k>) | 18.9% | 16.7% | 16.1% | 14.6% |
| Small city (100k<) | 14.9% | 12.8% | 14.0% | 12.7% |
| Rural | 16.0% | 15.2% | 13.8% | 13.1% |
| **Several smokers in the household** | | | | |
| No | 13.9% | 12.6% | 11.8% | 11.3% |
| Yes | 75.5% | 77.0% | 74.7% | 79.2% |
| **Income quartiles** | | | | |
| Q1 (Low income) | 11.2% | 10.5% | 8.6% | 9.0% |
| Q2 | 16.4% | 13.4% | 13.2% | 12.2% |
| Q3 | 19.7% | 18.2% | 18.5% | 15.5% |
| Q4 (High income) | 19.3% | 17.9% | 17.9% | 17.1% |
| **Alcohol expenditures in the household quartiles** | | | | |
| No expenditures | 11.01% | 10.49% | 9.65% | 8.89% |
| Q1 (Low expenditures) | 18.92% | 17.22% | 16.57% | 14.70% |
| Q2 | 17.84% | 16.36% | 17.28% | 15.78% |
| Q3 | 22.49% | 20.14% | 20.65% | 20.18% |
| Q4 (High expenditures) | 27.24% | 22.93% | 24.17% | 22.51% |

Source: Survey of living conditions of households by State Statistical Service of Ukraine

*Chapter 5*

# ESTIMATION RESULTS

Logistic regression models are commonly used in social sciences to model binary outcomes. It is crucial to ensure that the model results are valid and robust to ensure that conclusions are accurate. In this study, we have performed several checks to ensure the validity and robustness of our logistic model.

A multicollinearity check is crucial to avoid the problem of correlation among independent variables, which may lead to incorrect parameter estimates. We performed a correlogram with a significance test at a p-value of 99% level to check the correlation among the independent variables. Based on the results, we excluded the variable of internet frequency usage as it was found to be highly correlated with the variable of internet usage. All other variables were not strongly correlated with each other, and thus, they were retained in the model.

Wald tests were performed to test the statistical significance of individual coefficients in the regression model. Based on the results, the self-estimation income, household type, and seeking on the Internet for health information variables were excluded due to insignificance. The differences in the AIC criteria of the new model without these variables to the old model with these variables were not significant. Therefore, the second model results were considered.

Table 3. Wald test results

| Variable | Value | χ2 statistics |
|---|---|---|
| Settlement type | Small city | 0 *** |
| Settlement type | Rural | 0 *** |
| Household type | Withouit children | 0.92 |
| Self income estimation | Enough, no savings | 0.18 |
| Self income estimation | Refused necessities, except food | 0.52 |
| Self income estimation | Insufficient food | 0.05 * |
| Age | 36-59 | 0 *** |
| Age | 60+ | 0 *** |
| Sex | Male | 0 *** |
| Education | Higher education | 0 *** |
| Labor force employment status | Employer, self-employed | 0.01 ** |
| Labor force employment status | Pensioner | 0 *** |
| Labor force employment status | Other | 0 *** |
| Sport activity | Yes | 0 *** |
| Medical help | Yes | 0 *** |
| Internet usage | Yes | 0.23 |
| Searching the Internet for medical information | Yes | 0.44 |
| Several smokers in the household | Yes | 0 *** |
| Years of observation | 2020-2021 | 0.01 * |
| Income quartiles | Q2 | 0 *** |
| Income quartiles | Q3 | 0 *** |
| Income quartiles | Q4 | 0 *** |
| Alcohol expenditures | Q1 | 0 *** |
| Alcohol expenditures | Q2 | 0 *** |
| Alcohol expenditures | Q3 | 0 *** |
| Alcohol expenditures | Q4 | 0 *** |
| Healthcare expenditures | Q1 | 0.14 |
| Healthcare expenditures | Q2 | 0.04 * |
| Healthcare expenditures | Q3 | 0 ** |
| Healthcare expenditures | Q4 | 0 *** |
| Note: | *p<0.1; **p<0.05; ***p<0.01; | |

After estimating the final model, the results indicate that all variables included in the model are statistically significant.

The estimation results revealed notable findings regarding the factors of smoking behavior in Ukraine. The proxy variable for the years 2020-2021, which captured the potential effect of the COVID-19 outbreak on smoking, exhibited a negative coefficient of -0.84%. This suggests a possible decline in smoking prevalence during this period. However, the effect is very small that it will be possible to differentiate the general declining trend in the smoking prevalence in Ukraine.

Furthermore, the analysis demonstrated a positive association between alcohol expenditures and smoking prevalence. Higher expenditures on alcohol were consistently linked to higher smoking rates across different quartiles, with average marginal effects ranging from 2.78% to 6.92%. This finding aligns with previous research and underscores the role of alcohol consumption in shaping smoking behavior.

Additionally, the presence of several smokers in the household exhibited a positive coefficient of 53.66%, indicating the significant impact of social interactions with smokers on an individual's likelihood of being a smoker. The contribution of this variable is the most significant. This finding corroborates previous studies and emphasizes the influence of social integration with smokers in driving smoking behavior.

Among the demographic and socioeconomic variables, age, sex, education, and labor force employment status showed significant associations with smoking. Male individuals were found to have a significantly higher likelihood of being smokers, with an average marginal effect of 25.65%, which is the second largest effect in the estimated model. Moreover, older age groups displayed a lower likelihood of being smokers, with an average marginal effect of -3.97% for the 60+ age group. Higher education and self-employment were also associated with a lower likelihood of smoking, with average marginal effects of -2.94% and -2.62% respectively.

The robustness check conducted in this study did not reveal any issues related to multicollinearity. However, due to the binary and categorical nature of the independent variables, the application of a nonlinear functional form was not feasible in the model, as it was discussed before. The VIF estimation is provided in Appendix B.

Table 4. Estimation results

| Variable | Value | AME (%) | SE |
|---|---|---|---|
| **Settlement type** | | | |
| | Small city | -2.28% | 0.004 |
| | Rural | -3.24% | 0.004 |
| **Age** | | | |
| | 36-59 | 2.96% | 0.004 |
| | 60+ | -3.97% | 0.007 |
| **Sex** | | | |
| | Male | 25.65% | 0.004 |
| **Education** | | | |
| | Higher education | -2.94% | 0.003 |
| **Labor force employment status** | | | |
| | Employer, self-employed | -2.62% | 0.009 |
| | Pensioner | -3.77% | 0.006 |
| | Other | -2.25% | 0.005 |
| **Sport activity** | | | |
| | Yes | -1.29% | 0.004 |
| **Medical help** | | | |
| | Yes | -1.42% | 0.004 |
| **Several smokers in the household** | | | |
| | Yes | 53.66% | 0.012 |
| **Years of observation** | | | |
| | 2020-2021 | -0.84% | 0.003 |
| **Income quartiles** | | | |
| | Q2 | -1.97% | 0.005 |
| | Q3 | -3.53% | 0.005 |
| | Q4 | -6.53% | 0.005 |
| **Alcohol expenditures** | | | |
| | Q1 | 3.17% | 0.005 |
| | Q2 | 2.78% | 0.005 |
| | Q3 | 4.80% | 0.005 |
| | Q4 | 6.92% | 0.005 |
| **Healthcare expenditures** | | | |
| | Q1 | -1.07% | 0.007 |
| | Q2 | -1.56% | 0.008 |
| | Q3 | -2.30% | 0.008 |
| | Q4 | -2.52% | 0.0077 |
| Note: | *p<0.1; **p<0.05; ***p<0.01; | | |

It is also important to discuss the limitation of the results. First is the fact of absence of information on COVID-19 disease in the data. The years of observation are the only proxy variable that potentially could capture some influence of the pandemic on the rate of smoking prevalence. As was shown in the Polish case (Koczkodaj et al., 2022), smokers pay close attention to communication about COVID-19 and smoking risks because of the immediate

health impacts of both. Consequently, additional information on the fact of being infected by COVID-19 could significantly contribute to the results of the study.

Another important limitation is the lack of additional information on social interactions. The impact of social networks, particularly the smoking behavior of friends, peers, or social circles, has been widely studied and found to be a significant factor in influencing an individual's smoking behavior. Examining the association between an individual's social network and their likelihood of being a smoker could provide valuable insights into the role of social influence. The workplace is another important social context where individuals may be exposed to smoking and social interactions with smokers. Research has shown that the prevalence of smoking within the workplace and the influence of colleagues who smoke can contribute to an individual's smoking behavior. Investigating the relationship between the workplace environment and smoking behavior could provide insights into the influence of social interactions in this setting. Peer pressure and the desire to conform to social norms and expectations are known to influence smoking behavior. Investigating the influence of peer pressure and the desire to fit in within various social contexts, such, as universities, or social clubs, could provide insights into the role of social conformity in smoking behavior.

The study has certain limitations in terms of capturing the full spectrum of smoking behavior due to its focus on traditional cigarette smoking. It is important to acknowledge that smoking patterns have evolved, and alternative forms of tobacco consumption, such as heated tobacco products, vapes, and snus, have gained popularity among certain populations. These emerging smoking alternatives have distinct characteristics and potential health implications that differ from traditional cigarette smoking. Therefore, by solely examining the factors influencing traditional cigarette smoking, the study may overlook the impact of these alternative smoking methods on smoking prevalence and associated determinants. Future research should consider incorporating a comprehensive assessment of various smoking modalities to provide a more comprehensive understanding of the evolving landscape of tobacco consumption and its determinants in Ukraine.

*Chapter 6*

# CONCLUSIONS AND POLICY RECOMMENDATIONS

This study aimed to explore the determinants of smoking behavior in Ukraine while controlling for socioeconomic variables within a scientific framework. The findings provided valuable insights into the association between smoking behavior and the COVID-19 pandemic. Although the available proxy variable for the years 2020-2021 captured certain potential effects of the outbreak, indicating a slight decrease in smoking prevalence, the magnitude of this effect was minimal. Therefore, distinguishing this decline from the overall decreasing trend in smoking prevalence observed in Ukraine remains challenging.

Furthermore, this investigation shed light on the connection between alcohol expenditures and smoking prevalence. Consistently, higher expenditures on alcohol were found to be associated with higher smoking rates across various quartiles, emphasizing the influential role of alcohol consumption in shaping smoking behavior. This finding aligns with existing literature on similar topics in other countries.

The presence of multiple smokers within a household emerged as a critical factor influencing an individual's likelihood of being a smoker. The substantial positive coefficient associated with this variable underscores the significant impact of social interactions with smokers on smoking behavior. This finding is in line with prior research, highlighting the importance of social integration with smokers as a contributing factor to smoking behavior.

Among the demographic and socioeconomic variables analyzed, age, gender, education, and employment status demonstrated significant associations with smoking behavior. Male individuals exhibited a significantly higher likelihood of being smokers, corroborating previous studies. Moreover, older age groups displayed a lower likelihood of smoking, suggesting a potential generational shift in smoking behavior. Higher levels of education and self-employment were also found to be associated with a lower likelihood of smoking, indicating the influence of socioeconomic factors on smoking behavior in Ukraine.

However, it is crucial to acknowledge the limitations of this study. Firstly, the absence of information on COVID-19 disease within the dataset restricts a comprehensive understanding of its direct impact on smoking prevalence. Additionally, the lack of additional information on social interactions, such as the influence of social networks and workplace environments, represents another limitation.

The study's focus on traditional cigarette smoking limits its ability to capture the impact of alternative smoking methods, such as heated tobacco products, vapes, and snus. These emerging forms of tobacco consumption have unique characteristics and potential health implications, which may influence smoking prevalence and associated factors. Incorporating an assessment of these alternative smoking modalities would provide a more comprehensive understanding of tobacco consumption patterns in Ukraine.

Based on the findings of this thesis, which aimed to estimate the factors affecting the likelihood of smoking in Ukraine, several policy recommendations can be proposed to address the identified factors and promote public health.

Firstly, it is crucial in the context of anti-smoking campaigns in Ukraine to capitalize on the potential decline in smoking prevalence observed during the COVID-19 pandemic. These campaigns should emphasize the risks of smoking and its negative impact on respiratory health, particularly in the context of the ongoing pandemic.

In addition to anti-smoking campaigns, comprehensive tobacco control measures should be continued to be implemented. In 2017 (Verkhovna Rada, 2018), a comprehensive plan was implemented in Ukraine, approved by the Parliament, and signed by the President, which brought about significant changes to tobacco taxation in Ukraine. The plan included a series of amendments that specifically targeted the taxation of cigarettes. The first notable change occurred in 2018 when the specific excise tax on cigarettes was raised by 30%. Subsequently, in 2019, the excise tax underwent an increase of 29%. Starting from 2020, the excise tax has experienced a steady 20% annual increase as per the existing schedule, which is set to continue for the next five years, until 2025 (Yavorsky, 2020). Integrating alcohol and smoking prevention

strategies is essential. Given the positive association between alcohol expenditures and smoking prevalence, coordinated public health campaigns should address the harmful effects of both alcohol and tobacco use. Policies should aim to reduce alcohol consumption through measures such as increasing alcohol taxes. By addressing both alcohol and smoking simultaneously, a comprehensive approach can be taken to reduce the prevalence of smoking.

Lastly, targeted interventions should be developed for high-risk groups. The study identified certain demographic and socioeconomic factors associated with smoking, such as being male and having lower education levels. By addressing the specific needs and challenges faced by these groups, interventions can be more effective in reducing smoking prevalence.

In conclusion, by implementing a combination of these policy recommendations, Ukraine can work towards reducing smoking prevalence and improving public health outcomes. Enhancing anti-smoking campaigns, implementing comprehensive tobacco control measures, integrating alcohol and smoking prevention strategies, and conducting targeted interventions for high-risk groups can contribute to a further decrease in smoking prevalence, and as it was also discussed in the study, decreasing the number of smokers also reduces social interaction with them, which is a very significant contributor to the level of smoking prevalence in Ukraine.

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# APPENDIX A

Table 5. Descriptive table of the variables

| Variable name | Variable description | Values |
|---|---|---|
| settl_type | Type of settlement | 1=Big city (>100,000)<br>2=Small city (<100,000)<br>3=Rural |
| househld_type | Type of household | 1=With children<br>2=Without children |
| self_inc_est | Self-assessment by the household of the level of its income | 1=Constantly refused the most necessary things, except for food<br>2=It was enough, but no savings were made<br>3=It was not possible to provide even sufficient food |
| age | Age | 1=18-35 y.o.<br>2=36-59 y.o.<br>3=60 y.o. and older |
| male | Sex | 1=Male<br>0=Female |
| education | Education level | 0=Secondary education<br>1=Higher education |
| soc_econ_status | Occupation | 1=Employed<br>2=Employer, self-employed<br>3=Pensioner<br>4=Other (Unemployed / unpaid houseworkers) |
| sport | Sports and physical exercise at least once a week | 1=Yes<br>0=No |
| med_help | Have you sought medical help in the last 12 months? | 1=Yes<br>0=No |
| internet_use | Have you used Internet services during the last 12 months? | 1=Yes<br>0=No |
| sport | Sports and physical exercise at least once a week | 1=Yes<br>0=No |
| med_help | Have you sought medical help in the last 12 months? | 1=Yes<br>0=No |
| internet_use | Have you used Internet services during the last 12 months? | 1=Yes<br>0=No |
| int_use_freq | How often did you use the Internet during the last 12 months? | 1=Yes<br>0=No |
| helth_inf_on_int | Finding health-related information | 1=Yes<br>0=No |
| smoking | Do you smoke? | 1=Yes |

| Variable name | Variable description | Values |
|---|---|---|
| | | 0=No |
| alc_quartiles | Alcohol expenditures quartiles | 1=Q1 |
| | | 2=Q2 |
| | | 3=Q3 |
| | | 4=Q4 |
| inc_quartiles | Income quartiles | 1=Q1 |
| | | 2=Q2 |
| | | 3=Q3 |
| | | 4=Q4 |
| several_smokers | Several smokers in household | 1=Yes |
| | | 2=No |
| health_quartiles | Healthcare expenditures quartiles | 1=Q1 |
| | | 2=Q2 |
| | | 3=Q3 |
| | | 4=Q4 |
| covid_years | Years of observation | 1=2018-2019 |
| | | 2=2020-2021 |

# APPENDIX B

## CORRELOGRAM OF THE VARIABLES

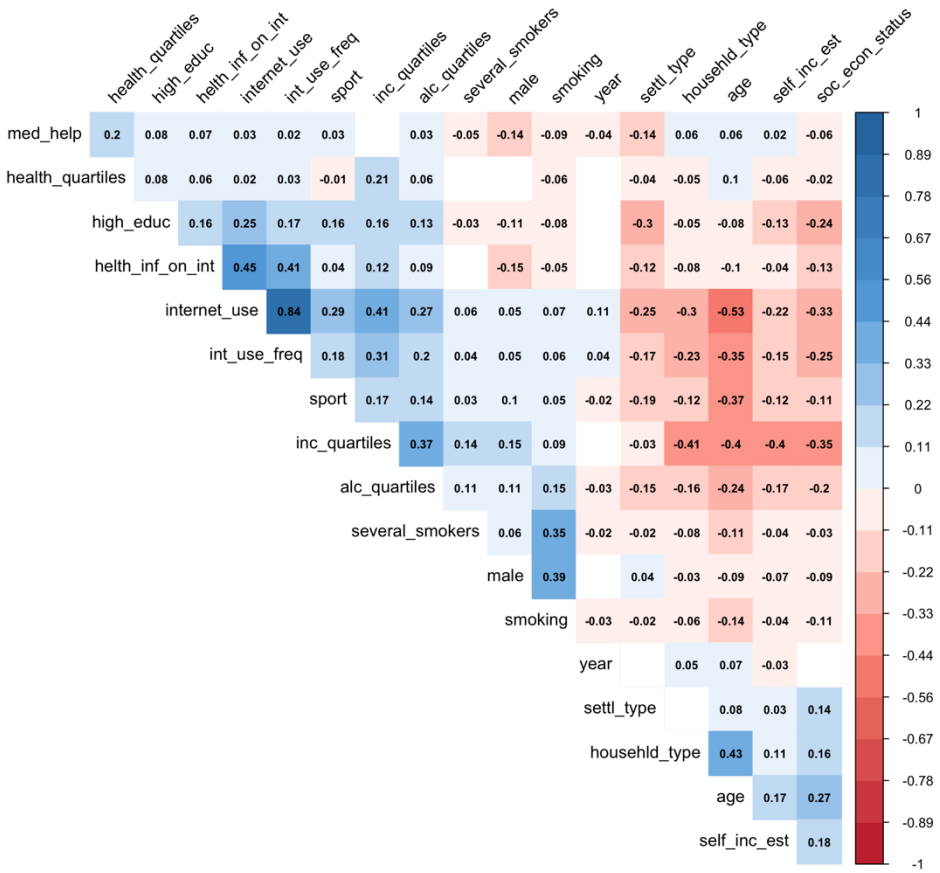

Table 6. VIF of the first model

| Variable | GVIF | Df | GVIF^(1/(2*Df)) |
|---|---|---|---|
| settl_type | 1.31 | 2 | 1.07 |
| househld_type | 1.29 | 1 | 1.14 |
| self_inc_est | 1.25 | 3 | 1.04 |
| age | 4.39 | 2 | 1.45 |
| male | 1.28 | 1 | 1.13 |
| high_educ | 1.24 | 1 | 1.11 |
| soc_econ_status | 4.52 | 3 | 1.29 |
| sport | 1.25 | 1 | 1.12 |
| med_help | 1.11 | 1 | 1.05 |
| internet_use | 1.91 | 1 | 1.38 |
| helth_inf_on_int | 1.22 | 1 | 1.10 |
| several_smokers | 1.25 | 1 | 1.12 |
| covid_years | 1.05 | 1 | 1.02 |
| inc_quartiles | 1.93 | 3 | 1.12 |
| alc_quartiles | 1.19 | 4 | 1.02 |
| health_quartiles | 1.22 | 4 | 1.03 |

Table 7. VIF of the second model

| Variable | GVIF | Df | GVIF^(1/(2*Df)) |
|---|---|---|---|
| settl_type | 1.25 | 2 | 1.06 |
| age | 4.06 | 2 | 1.42 |
| male | 1.25 | 1 | 1.12 |
| high_educ | 1.22 | 1 | 1.11 |
| soc_econ_status | 4.41 | 3 | 1.28 |
| sport | 1.24 | 1 | 1.11 |
| med_help | 1.10 | 1 | 1.05 |
| several_smokers | 1.25 | 1 | 1.12 |
| covid_years | 1.01 | 1 | 1.00 |
| inc_quartiles | 1.57 | 3 | 1.08 |
| alc_quartiles | 1.18 | 4 | 1.02 |
| health_quartiles | 1.20 | 4 | 1.02 |

## APPENDIX C

### ESTIMATION RESULTS

Table 8. Estimation results of the first model

| Variable | Estimate | Std. Error | z value | Pr>\|z\| |
|---|---|---|---|---|
| Intercept | -2.68 | 0.13 | -20.19 | < 2e-16 *** |
| settl_type_2 | -0.25 | 0.05 | -5.36 | 0 *** |
| settl_type_3 | -0.37 | 0.04 | -8.37 | < 2e-16 *** |
| househld_type_2 | 0.00 | 0.04 | 0.10 | 0.92 |
| self_inc_est_2 | -0.08 | 0.06 | -1.34 | 0.18 |
| self_inc_est_3 | -0.04 | 0.06 | -0.65 | 0.52 |
| self_inc_est_4 | -0.21 | 0.11 | -1.99 | 0.05 * |
| age_3 | 0.29 | 0.05 | 6.18 | 0 *** |
| age_4 | -0.51 | 0.08 | -6.10 | 0 *** |
| male_1 | 2.89 | 0.05 | 59.06 | < 2e-16 *** |
| high_educ_1 | -0.33 | 0.04 | -8.58 | < 2e-16 *** |
| soc_econ_status_2 | -0.27 | 0.10 | -2.69 | 0.01 ** |
| soc_econ_status_3 | -0.44 | 0.07 | -6.08 | 0 *** |
| soc_econ_status_4 | -0.25 | 0.05 | -4.76 | 0 *** |
| sport_1 | -0.15 | 0.04 | -3.61 | 0 *** |
| med_help_1 | -0.16 | 0.04 | -4.06 | 0 *** |
| internet_use_1 | -0.06 | 0.05 | -1.20 | 0.23 |
| helth_inf_on_int_1 | -0.04 | 0.05 | -0.77 | 0.44 |
| several_smokers_1 | 3.92 | 0.08 | 48.90 | < 2e-16 *** |
| covid_years_2020-2021 | -0.09 | 0.03 | -2.51 | 0.01 * |
| inc_quartiles_Q2 | -0.20 | 0.05 | -3.61 | 0 *** |
| inc_quartiles_Q3 | -0.37 | 0.06 | -6.23 | 0 *** |
| inc_quartiles_Q4 | -0.74 | 0.07 | -11.09 | < 2e-16 *** |
| inc_quartiles_Q4 | 0.38 | 0.05 | 7.18 | 0 *** |
| alc_quartiles_Q2 | 0.33 | 0.05 | 6.29 | 0 *** |
| alc_quartiles_Q3 | 0.55 | 0.05 | 10.60 | < 2e-16 *** |
| alc_quartiles_Q4 | 0.76 | 0.05 | 14.50 | < 2e-16 *** |
| health_quartiles_Q1 | -0.11 | 0.08 | -1.46 | 0.14 |
| health_quartiles_Q2 | -0.17 | 0.08 | -2.07 | 0.04 * |
| health_quartiles_Q3 | -0.25 | 0.08 | -3.09 | 0 ** |
| health_quartiles_Q4 | -0.28 | 0.08 | -3.38 | 0 *** |
| Observations | | | | 40,193 |
| Log Likelihood | | | | -11,418.89 |
| Akaike Inf. Crit. | | | | 22,899.78 |
| *Note:* | | *p<0.1; **p<0.05; ***p<0.01 | | |

Table 9. Estimation results of the second model

| Variable | Estimate | Std. Error | z value | Pr>\|z\| |
|---|---|---|---|---|
| Intercept | -2.79 | 0.11 | -25.68 | < 2e-16 *** |
| settl_type_2 | -0.25 | 0.05 | -5.39 | 0 *** |
| settl_type_3 | -0.36 | 0.04 | -8.32 | < 2e-16 *** |
| self_inc_est_4 | 0.30 | 0.05 | 6.49 | 0 *** |
| age_3 | -0.49 | 0.08 | -6.00 | 0 *** |
| age_4 | 2.89 | 0.05 | 59.83 | < 2e-16 *** |
| male_1 | -0.34 | 0.04 | -8.81 | < 2e-16 *** |
| high_educ_1 | -0.29 | 0.10 | -2.86 | 0 ** |
| soc_econ_status_2 | -0.43 | 0.07 | -5.96 | 0 *** |
| soc_econ_status_3 | -0.24 | 0.05 | -4.71 | 0 *** |
| soc_econ_status_4 | -0.15 | 0.04 | -3.62 | 0 *** |
| sport_1 | -0.16 | 0.04 | -4.18 | 0 *** |
| med_help_1 | 3.92 | 0.08 | 48.98 | < 2e-16 *** |
| several_smokers_1 | -0.10 | 0.03 | -2.81 | 0.01 ** |
| covid_years_2020-2021 | -0.20 | 0.05 | -3.81 | 0 *** |
| inc_quartiles_Q2 | -0.38 | 0.06 | -6.74 | 0 *** |
| inc_quartiles_Q3 | -0.75 | 0.06 | -12.28 | < 2e-16 *** |
| inc_quartiles_Q4 | 0.37 | 0.05 | 7.11 | 0 *** |
| inc_quartiles_Q4 | 0.33 | 0.05 | 6.22 | 0 *** |
| alc_quartiles_Q2 | 0.54 | 0.05 | 10.52 | < 2e-16 *** |
| alc_quartiles_Q3 | 0.75 | 0.05 | 14.39 | < 2e-16 *** |
| alc_quartiles_Q4 | -0.11 | 0.08 | -1.47 | 0.14 |
| health_quartiles_Q1 | -0.17 | 0.08 | -2.11 | 0.04 * |
| health_quartiles_Q2 | -0.25 | 0.08 | -3.12 | 0 ** |
| health_quartiles_Q3 | -0.28 | 0.08 | -3.38 | 0 *** |
| health_quartiles_Q4 | -2.79 | 0.11 | -25.68 | < 2e-16 *** |
| Observations | | | | 40,193 |
| Log Likelihood | | | | -11,423.070 |
| Akaike Inf. Crit. | | | | 22,896.140 |
| *Note:* | | *p<0.1; **p<0.05; ***p<0.01 | | |