Exploration of the effect of smoking ban in catering places on the wholesale sales for cigarettes, rolled tobacco and cigars in Norway

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SUMMARY

This Master thesis researches the relationship between implementation of the smoking ban in catering places and wholesale sales of tobacco products in Norway. It is assumed that along with the increase of taxes and price for tobacco, as well as rising population of snus, the ban should decrease sales of tobacco products significantly. The assumption has been tested by multiple and simple regression models. Regression models have been subdivided by the type of dependent variable and a span of one period. Dependent variables have been following: cigarette wholesales sales only; cigarette, rolled tobacco and cigar wholesale sales; and rolled tobacco and cigar wholesale sales. Span of one period has been one month in one type of models and six months (June-November, December-May) in another. Independent variables have been following: cigarette real CPI for the current, previous and following periods, tobacco real CPI for the current, previous and following periods, snus wholesale sales for the current period, and dummy variables for smoking ban in catering places and display ban for tobacco products. Results show significance of the ban in most simple regression models, but not in the multiple regression models. Thesis ends with the discussion of the results, other factors that may affect sales and consumption of tobacco, thesis limitations and suggestions for further researches.

ACNOWLEDGEMENTS

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1. INTRODUCTION

1.1. Background

Smoking is one of the most serious problems in the world. It is the cause of death of around six million people each year, and is one of the main reasons for development of dangerous diseases, such as lung cancer, diabetes or cardiovascular diseases (World Health Organization, 2012). In order to stop, or at least minimize the deadly effect of tobacco consumption, many states introduced and implemented different laws that restrict the consumption and/or supply of tobacco products. One type of such restrictions is a smoking ban. Supporters of this ban state that it will decrease the number of active and passive smokers. Opponents believe that such ban is useless and will only hurt sales at the points of retail.

Overall, smoking ban is believed to be a good preventive measure among policymakers, because it not only protect people from hazardous substances of cigarette smoke, but also encourage smokers to minimize the intake of tobacco, or even quit smoking (Emont, Choi, Novotny, Giovino, 1992). It is assumed that such restrictions may be associated with 4-20% decrease in smoking prevalence (Levy, Friend, 2003; Godfrey, Joossens, Raw, 2004), or even up to 29% (Fichtenberg, Glantz, 2002). Calculations showed that to achieve similar reduction a tax on a pack of cigarettes should be increased approximately from $0.76 to $3.05 in United States, and from £3.44 to £6.59 in United Kingdom (Fichtenberg, Glantz, 2002). It was also calculated that a clean air law could decrease non-smokers' exposure to toxins by 80-95%. Besides, it is assumed that such laws decrease consumption by around 3 cigarettes per day (Warner, Mendez, 2010).

Ireland was the first country in the world to ban smoking in public places, which also included catering places. A study, done in this country few years later, reported that after the ban, cigarette consumption dropped significantly among male workers of bars and restaurants. In this study, independent sample t-test was used to examine the differences in consumption. Nevertheless, it is said that sample of bar workers were younger and had more males than in general population (Allwright, Greiner, Mullally, Paul, Perry, 2009). Thus, application of the results to the general population might be difficult.

1.2. Smoking habits in Norway

The peak of smoking prevalence in Norway was seen during 1945-1955 (76-78% of male population born between 1915 and 1934). Afterwards the smoking prevalence was

declining. However, it peaked again in the period around 1970, but the peak was not as high, as previous one (52% of women born between 1940 and 1949). After that, smoking began declining (Rønneberg, Lund, Hafstad, 1994).

Lavik and Scheffels in their rapport (2011) show that systematic decrease in smoking prevalence began roughly from 1998. Great change was noticed in young people of age 16-24. The data from Statistics Norway show decrease both for young men (30% of daily smokers in 1998 against 11% in 2010) and young women (30% of daily smokers in 1998 against 14% in 2010). Overall the decrease of smoking prevalence among Norwegian population between 16 and 74 year old was from 33% in 1998 to 19% in 2010. On the other hand, the number of snus users has increased during the last years (Lavik, Scheffels, 2011).

Figure 1 shows prevalence of daily smokers in Norway for the period of 1990-2012, separated by the age groups. As it can be seen the decreasing trend has appeared roughly from 1998-2000. Overall, the most significant change can be seen in the age group of 35-44 years old (prevalence decreased by 27%), while the smallest change is in the age group of 65-74 years old (9%).
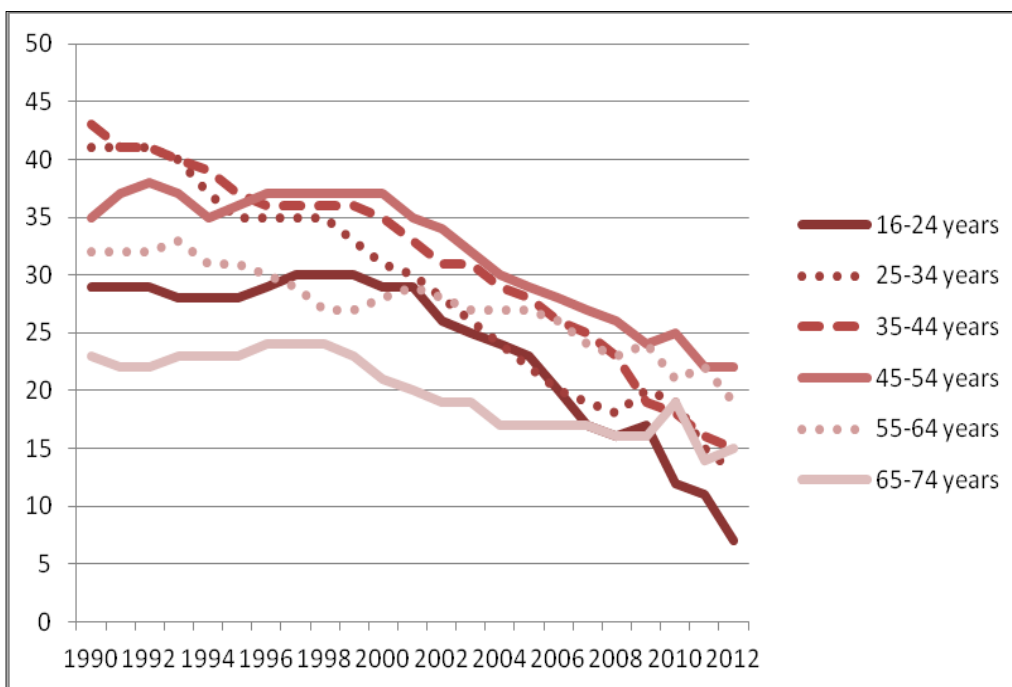
Figure 1. Change in prevalence of daily smokers in Norway, divided by the age groups. Source: Statistics Norway.

Figure 2 shows prevalence of daily snus-users in Norway for the period of 2008-2012 separated by the age groups. Even though, the overall trend for snus-users is said to be increasing for the last years, it can be seen from the figure that the highest increase is only in

the age group of 16-24 years old (from 11% to 19%). Figure 3 shows the overall expenditures on tobacco by households. As it can be seen from the figure, people spend relatively the same amount of money on tobacco, but overall percentage from total consumption is going down.
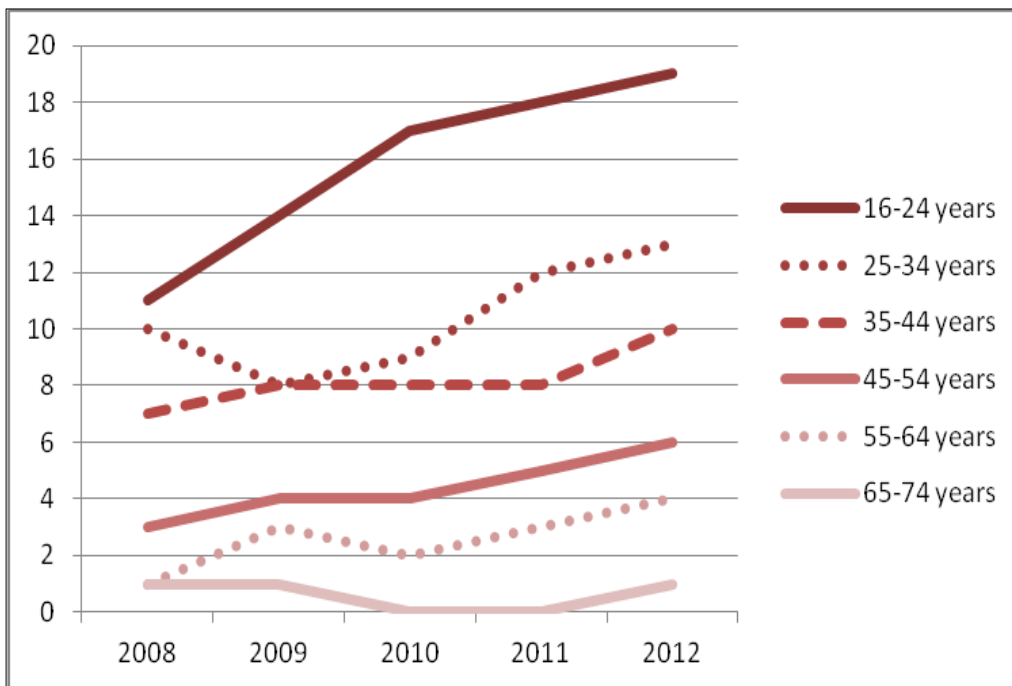
Figure 2. Change in prevalence of daily snus-users in Norway, divided by the age groups. Source: Statistics Norway.
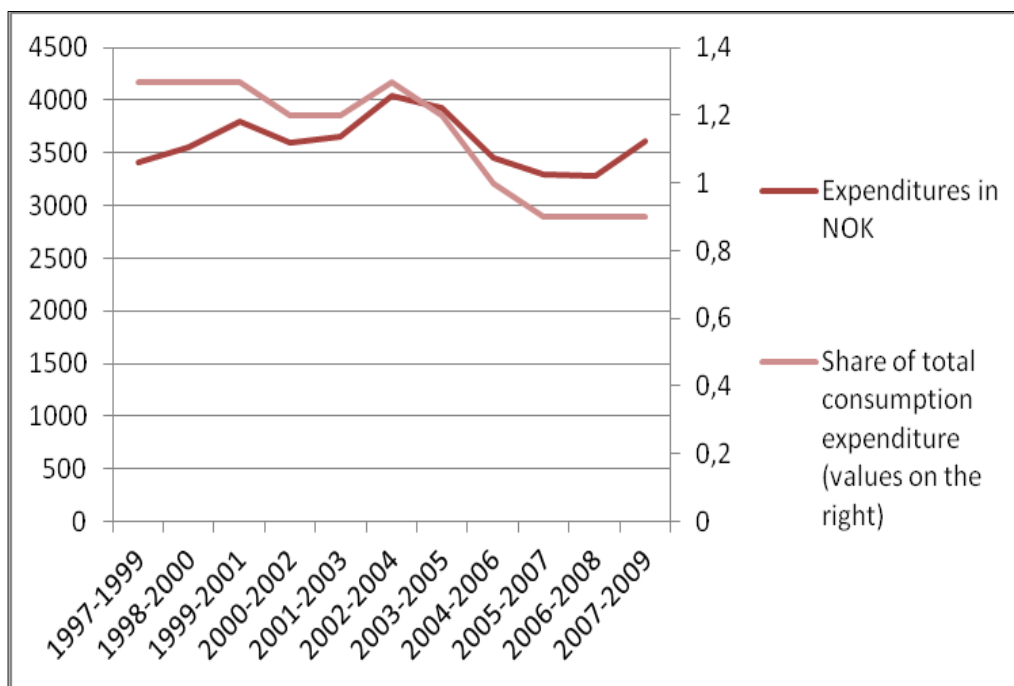
Figure 3. Expenditures on tobacco and alcohol by households. Source: Statistics Norway.

1.3. Smoking restrictions in Norway

In Norway, "The law on protection against harm of tobacco" (in Norwegian "Lov om vern mot tobakksskader" or "tobakksskadeloven") was implemented on the 9th of March 1973. The goal of this law is to reduce harm imposed by consumption of tobacco products (Lovdata, 2012). Among other regulations, two has brought much discussion recently: the ban to smoke in catering places (cafés, bars, pubs and restaurants), and the ban of displaying tobacco products. First has been in power from the 1st of June 2004 and the second has been in power from the 1st of January 2010. Even though, it was proven that these bans do not harm the sales in restaurants (Lund, Melberg, 2009), or violate sellers rights (Helse- og omsorgsdepartementet, 2012), the discussion is not over.

Unfortunately, there is not much research done in Norway, in order to see whether clean air laws are a good preventive measure. Therefore, the main aim of this thesis is explore more the relationship between smoking and implementation of ban to smoke in catering places (ban 2004).

1.4. Study objectives and research question

Because smoking ban is a very discussed and debatable topic, yet which is not explored much in Norway, it makes sense to focus more on it. The goal is to explore the relationship between implementation of the ban 2004 and change in sales of tobacco products (cigarettes, cigars and rolled tobacco). The research question is following:

Was the change in wholesale sales of tobacco products significantly altered by the implementation of smoking ban on 1st June 2004?

Wholesale sales, should not be confused with sales on the point of retail, as wholesalers sell tobacco to retailers, while sales on the point of retail are sales to final users. Yet, it is assumed in the study that wholesale sales reflect the general demand for tobacco goods from retailers, which in its turn reflect the demand for tobacco from final customers. Thus, the wholesale sale level can be expressed through a general demand function. It is important to take Norway as an example, because Norway was the second country in the world, which implemented the ban. Enough time has passed after the implementation, in order to see the effects of the ban.

However, one should keep in mind that smoking and tobacco sales are also dependent on other factors, such as price, availability of substitutes for cigarettes, education, income and

other restrictions, as well as the general change in smoking habits. Among other factors that influence sales and consumption, price is the most discussed. Besides, due to the increased popularity of snus, some of the researchers state that it may be a substitute for cigarettes and other tobacco products. It is also noticeable from Figure 1 that decrease in smoking prevalence had begun before a smoking ban 2004 was implemented. Therefore, it is important to distinguish, what change in sales is attributable to the ban and which to other factors.

2. THEORY AND ASSUMPTIONS

2.1. Factors that influence tobacco consumption and sales: price and snus

Like for any other good, it is assumed that demand for tobacco depends mainly on its price, presence of adequate substitutes, attitude towards tobacco and other factors that may be unknown to a researcher. Interventions in tobacco consumption and sales may include taxes and tobacco price increase, smoking restrictions and various bans, cessation therapies, educational programs, such as lectures, films and counseling. (Chaloupka, Corrao, Jacob, Jha, 2006; Elixhauster, 1990). Without doubt, using snus as a part of intervention program is controversial, but because of its increased popularity, it should be considered as one of the factors that affect the demand for cigarettes.

It is assumed in this research that price for tobacco and snus sales are most important factors that along with smoking ban will affect the wholesale sales of cigarettes and other tobacco products. These assumptions are supported by the evidences from relevant researches. There are other factors that are considered to affect sales of tobacco. However, because of their unavailability, controversy, or difficulty to measure, these factors have not been included in the study, but are discussed further in the thesis.

2.1.1. Cigarette price and taxes.

Chaloupka, Gitchell and Levy (2004) show that a cigarette price is an effective factor that influence tobacco consumption. The government may significantly influence the price of tobacco goods by imposing taxes and, thus, reduce smoking prevalence. In the statistical analyses price and taxes usually are significant and have a negative effect on consumption (Chaloupka, Saffer, 1992; Barnett, Hu, Keeler, Manning, 1993; Chaloupka, Saffer, 2000). Generally, a 10% increase in price result in approximately 3-5%, or even 10% decrease in tobacco consumption (Chaloupka, Gitchell, Levy, 2004; Godfrey, Joossens, Raw, 2004). In

EU countries and countries that were classified by WHO as "pertaining to the European region" price elasticity of cigarettes was similar: -0.4 on local and -0.85 on foreign brand (Gallus, Schiaffino, La Vecchia, Townsend, Fernandez, 2006). Keeler et al. (1993) also suggested to look at the consumption level during Christmas time and early winter. Because taxes are usually implemented in January, cigarette sales rise greatly at the end of the year (November/December) and fall down dramatically in January (Keeler et al, 1993).

In Norway, the research done by Norwegian Institute for Alcohol and Drug Research (SIRUS) shows that between years 1985 and 2005 prices for cigarettes had 66% increase, whereas consumption fell by 3.6%, which was considered to be small. Such small decrease can be explained by two reasons. First, there was a high demand for self-made cigarettes, as an alternative to manufactured ones. Second, people buy many tobacco products in neighboring countries, specifically in Sweden. In fact, it is stated that in 2005 every fourth cigarette was bought abroad (Melberg, 2007).

2.1.2. Snus

Foulds, Ramstrom, Burke, Fagerström (2003) have stated that usage of snus, as an alternative to cigarettes may actually reduce smoking prevalence. According to the Norwegian statistics, approximately half of all who uses snus daily or from time to time have never smoked. In addition, the rates of snus' usage have been increasing in the recent years, especially among young people, and the usage of common tobacco products is decreasing (Helse- og omsorgsdepartementet, 2012). Therefore, usage of snus might be associated with changes of smoking incidence and prevalence.

Increase in usage of snus can be explained by active anti-smoking campaigns, increased emphasis on passive smoking reduction and willingness of ex-smokers to find an alternative for cigarettes (Lund, 2006). Kozlowsky mentions that snus and other smokeless forms of tobacco become more popular than cigarettes because they are relatively less hazardous. The author states that snus does not produce smoke, which means that it will not turn people around snus-user into passive smokers. In addition, unlike cigarettes, snus imposes no risk of accidental fire. Finally, the author believes that snus is less harmful to a person's health than cigarettes (Kozlowsky, 2002).

A review of studies on relationship between cigarette usage, snus usage and health risks also supports Kozlowsky's statement about snus being less hazardous, as research shows that potential health risks for snus users were lower than for usual smokers. Nevertheless, the

risk for non-smokers and people, who have never used snus were the lowest of all (Roth, Roth, Liu, 2005).

2.2. Overview of methods used to evaluate consumption changes

Various authors use various methods and techniques to evaluate the relationship between cigarette consumption, sales, or smoking prevalence and independent factors. That is why, it is important to give an overview of these methods, as well as researchers' explanations, why they used such methods. The following part of the chapter will give examples of research methods from other studies. Some of the studies have mentioned rational addiction model, so it will also be explained further in this chapter.

2.2.1. Methods used in relative studies

Melberg in his research of relationship between price changes of tobacco goods and its consumption (2007) used multiple regression model as a research method and time-series aggregate data. The explanation was that such data is easy and understandable. Nevertheless, the problem was that researcher could not see clearly which social groups of population had been affected more by interventions.

The author also used three variations of the multiple regression: traditional, habit formation (vanedanningsmodellen) and rational addiction. This was done, in order to make calculations more precise, as every model had its own assumptions. In this case, habit formation assumed that previous experience with tobacco can affect present consumption, thus previous year price is also an important independent factor. Rational addiction model assumed that a person was addicted to the good, but tried to take into account future price or other factors that may increase or decrease user's present utility. In this case not only previous price, but also future price or other factors are important (Melberg, 2007). Melberg used logarithmic model.

Chaloupka and Saffer in their research (1992) used empirical model based on individual's utility maximization at a point of time. However, they did not use previous price or consumption, or future price as independent factors in the model (Chaloupka, Saffer, 1992). Chaloupka in another research (1992) used the Becker-Murphy model of rational addiction which also included "addictive stock" of past cigarette consumption (Chaloupka, 1992).

Keller et al. in their research (1993) used regression model with cigarette consumption per capita as dependent variable. They used Poisson-type model and transformed independent variables into a natural logarithms to make it suitable for the linear regression. They used two

types of regression: traditional (without using of rational addiction model) and Becker-Grossman-Murphy rational addiction model. In the second regression they also include previous and following year's consumption (Keller et al., 1993).

Not all researchers used econometric model to examine the effect of clean air laws. Mullally et al. (2009) used before and after study and compared mean of smoked cigarettes among bar workers. Gorini et al. (2008) in their research of clean air law effect on passive smoking also used before and after study. The authors measured airborne nicotine concentration before and after the ban and then compared results using Wilcoxon rank sum test (Gorini et al., 2008).

2.2.2. Addiction

Cigarette consumption differs from other good consumption because it creates addiction. Therefore, it is sensible to take into account that individual's consumption of cigarettes would not be affected only by price, restrictions or other factors, but also by inner willingness to smoke which create certain utility.

Becker and Murphy in their theory of rational addiction (Becker, Murphy, 1988; Becker, Grossman, Murphy, 1993) state that utility of addictive good, such as cigarettes, alcohol or drugs depends not only on present, but also on past consumption of such good. This past consumption is called «consumption capital». The greater consumption capital is, the greater future consumption will be. This leads to a vicious cycle when greater past consumption leads to greater present consumption, which in its way leads to the greater future consumption. However, the word *rational* in the model implies that an addicted person still takes response for his/her future action. Therefore, if the price for cigarettes (or other addictive substance) increases in the future, a person tries to minimize present consumption, so the addiction would not become strong.

Suranovic, Goldfarb and Leonard (1999) use a model of addictive behavior, which is similar to Becker-Murphy model, but still has some differences. The authors assume that addiction has three components: current benefits, future losses and adjustment costs. As the researchers explain, current benefits might be the effect of nicotine on the body or a feeling of acceptance among peers. Future losses are associated with detrimental effects of tobacco products on body and reduced life expectancy. Adjustment costs can be either material and measured in monetary terms, or more mental such as dissatisfaction with current dose of nicotine, or irritation when a person quits smoking. Suranovic, Goldfarb and Leonard suggest that a person will still smoke, even if the losses become greater. This is because adjustment

costs are becoming greater at time, so if a person quits smoking his/her utility will be even worse than if he or she continued.

2.3. Study assumptions and expectations

The assumption for this study is that a smoking ban 2004 affects the wholesale level. However, because of other important variables, such as price and snus, the effect of the ban can be diminished. As it is seen from many studies done on smoking, price can be considered as one of the leading factors that prevents people from smoking or reduces the demand level. As for any other good, present price negatively affect present demand. Following rational addiction model, past and future prices are assumed to have a negative effect on demand, as well.

Snus is also expected to be important and negatively affect the demand for tobacco. This is because snus may be considered as a "good" substitute for tobacco products, as it can be used in the catering places. Some of the readers, especially the followers of demand theory might be surprised to see that sales of snus are used, instead of price for it. This is not common for this theory, as it implies that price of the substitute is important. Nonetheless, I believe that using sales as an independent variable is more related to this thesis. To my mind, people use snus not because the price for it might be lower, but because it is associated with greater acceptance in public places or lower perceived hazard than tobacco. Thus an ordinary price cannot reflect it.

Ban can be important, especially when price for tobacco is not so important for a person. It is expected that implementation of the ban can be negatively associated with the consumption and sales.

There is also one factor that affects the consumption of tobacco and especially cigarettes, but is not discussed in this thesis. It is cross-border trade and smuggling. Cross-border trade of cigarettes between Norway and neighboring countries (mostly Sweden) is intensive and this may distort the consumption and sales rates. Unfortunately, this thesis does not have cross-border trade as one of the factors that influence consumption, due to the complex calculation methods that are required. Nevertheless, this factor is mentioned in the *Discussion* chapter of the thesis.

3. RESEARCH METHODOLOGY

3.1. Description

To test the significance of the ban, a certain methodology has been designed. This methodology follows Chaloupka's (1992), Keeler's et al. (1993) and Melberg's (2007) studies. Study design is *time-series* and data range is from January 2003 up to October 2011.

In order to see the relationship between cigarette, rolled tobacco and cigar wholesale sales level and independent variables, several multiple and simple regression models are used. Furthermore, natural logarithm of dependent and some independent variables is used, as suggested by Keeler et al (1993) and Melberg (2007). Finally, because tobacco products are addictive, it is assumed that consumption follows rational addiction model. Thus, price for the current *(t),* previous *(t-1)* and following *(t+1)* period is used.

The study examines separately how the wholesale sales for only cigarettes; cigarettes, rolled tobacco and cigars; and only rolled tobacco and cigars has changed for the following periods, and uses monthly and semiannual data. Semiannual data is used, in order to smooth down high sales at the end of the year and low sales in the beginning of the next year. Semiannual data is for the period from June to November and from December to May. The reason to use such division is because the ban was implemented in June, thus year 2004 had five months before implementation and seven after. Therefore, usual division into periods from January to June and from July to December will make it hard to use some independent variables.

Sales are used as a dependent variable, because changes in sales and, as a result in consumption of tobacco, are more visible than changes in prevalence. For example, a person can still be considered a daily or occasional smoker, even if the amount of consumed tobacco has changed. Because smoking rarely occurs in the early age, only population from 15 years old is used. Besides, the assumption in this thesis is that population changes by the same amount of inhabitants every month throughout the year.

Data for the research has been retrieved from *Statistics Norway*. The results are analyzed with *IBM SPSS Statistics 20* © software package.

3.2. Econometric model and data

3.2.1. General information

Sales are examined using, first, multiple regression, and then simple regression. The models differ slightly, when different dependent variables are used. When cigarette sales level

is a dependent variable, *price* variable is a real CPI for the cigarettes. However, when sale level for cigarettes, rolled tobacco and cigars, and sales level only for rolled tobacco and cigars is a dependent variable, real CPI for tobacco is regarded as a *price* variable. In addition, some changes are made to the models, when semiannual data is used instead of monthly data. For example, *Ban 2010* variable is excluded from the regression, as it is impossible to code it right in the semiannual data. General regression equation is following:

$$Y_t = \beta_0 + \sum \beta_n X_{tn} + \varepsilon_t$$

Where:

Y_{1t} Number of cigarettes purchased by retailers at the current period and divided by the population over 15 years old at the current period.

Y_{2t} Amount of cigarettes, rolled tobacco and cigars (in grams) purchased by retailers at the current period divided by the population over 15 years old at the current period.

Y_{3t} Amount of rolled tobacco and cigars (in grams) purchased by retailers at the current period and divided by the population over 15 years old at the current period.

X_{1t} Real price for the cigarettes/tobacco for the current period.

X_{1t-1} Real price for the cigarettes/tobacco for the previous period.

X_{1t+1} Real price for the cigarettes/tobacco for the following period.

X_{2t} Amount of snus (in grams) purchased by retailers at the current period divided by the population over 15 years old at the current period.

X_{3t} Variable for smoking ban 2004.

X_{4t} Variable for display ban 2010.

ε_t Error/noise for the regression at the current period.

Figures below show changes of variables throughout the monthly periods, starting from January 2003 and finishing with October 2011. It is seen that trend for cigarette, cigar and rolled tobacco sales is downward sloping (Figures 4-6). There are peaks in sales that usually fall on November and December and then are followed by steep downturns in January. Snus monthly sales are upward sloping, but also follow the same pattern, as tobacco sales (peaks in November-December and downturns in January).
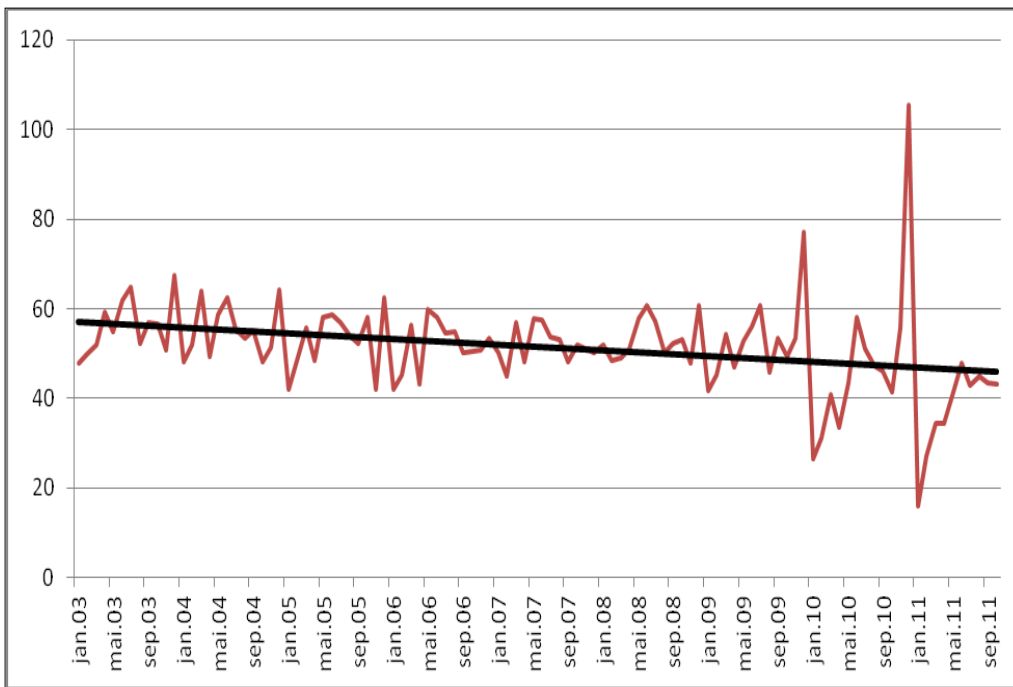
Figure 4. Monthly changes in cigarette sales per capita (units). Source: Statistics Norway.
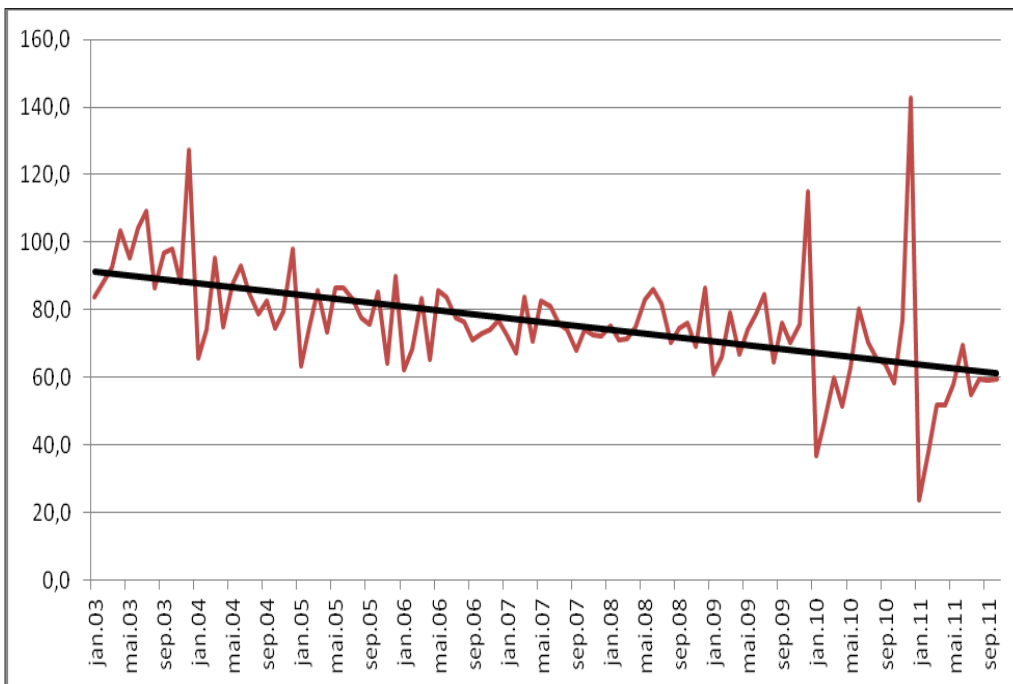
Figure 5. Monthly changes in tobacco (cigarettes, cigars and rolled tobacco) sales per capita (grams).
Source: Statistics Norway.
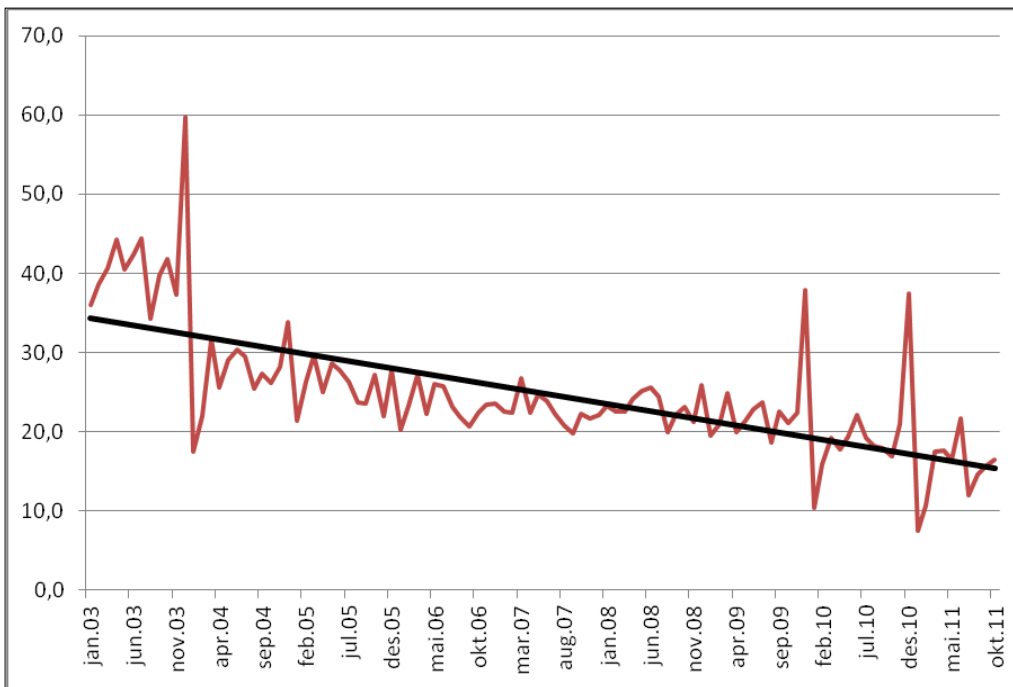
Figure 6. Monthly changes in tobacco without cigarettes sales per capita (grams). Source: Statistics Norway.
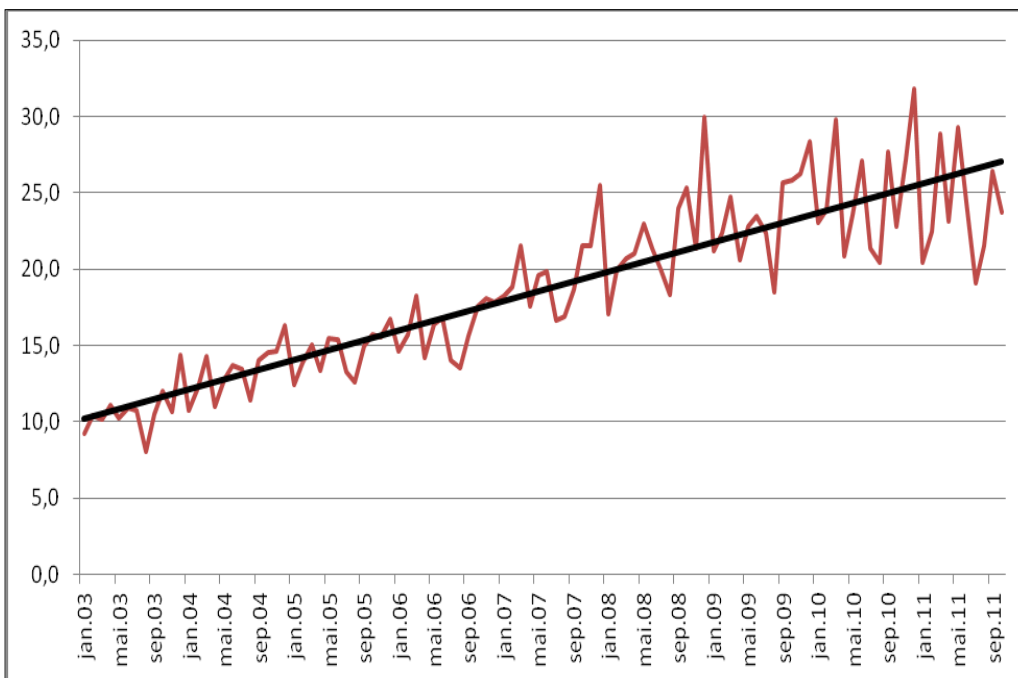
Figure 7. Monthly changes in snus sales per capita (grams). Source: Statistics Norway.

Because of the fluctuations, another data set has been made, where monthly periods are transformed into semiannual. One period starts from December and lasts up to May and another start in June and lasts up to November. It is seen from Figures 8-11 that the fluctuations are diminished, because both December and January are in one time-period now.

Nevertheless, the trend is similar in both monthly and semiannual data. This means that distinction between using monthly or semiannual data in regression should not alter the results seriously.
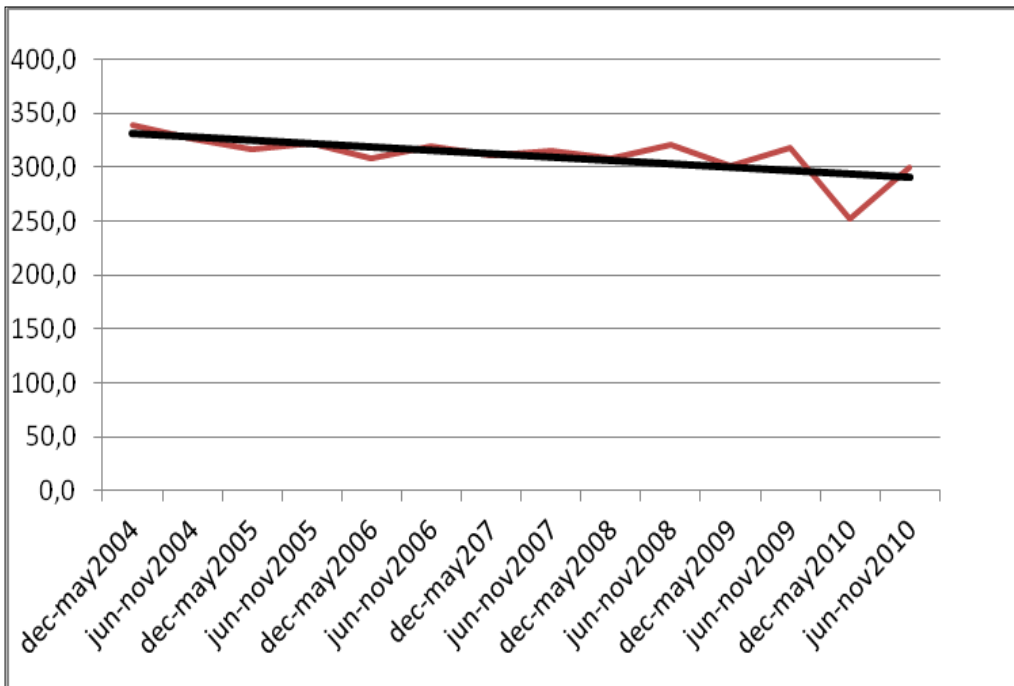
Figure 8. Semiannual changes in cigarette sales per capita (units). Source: Statistics Norway.
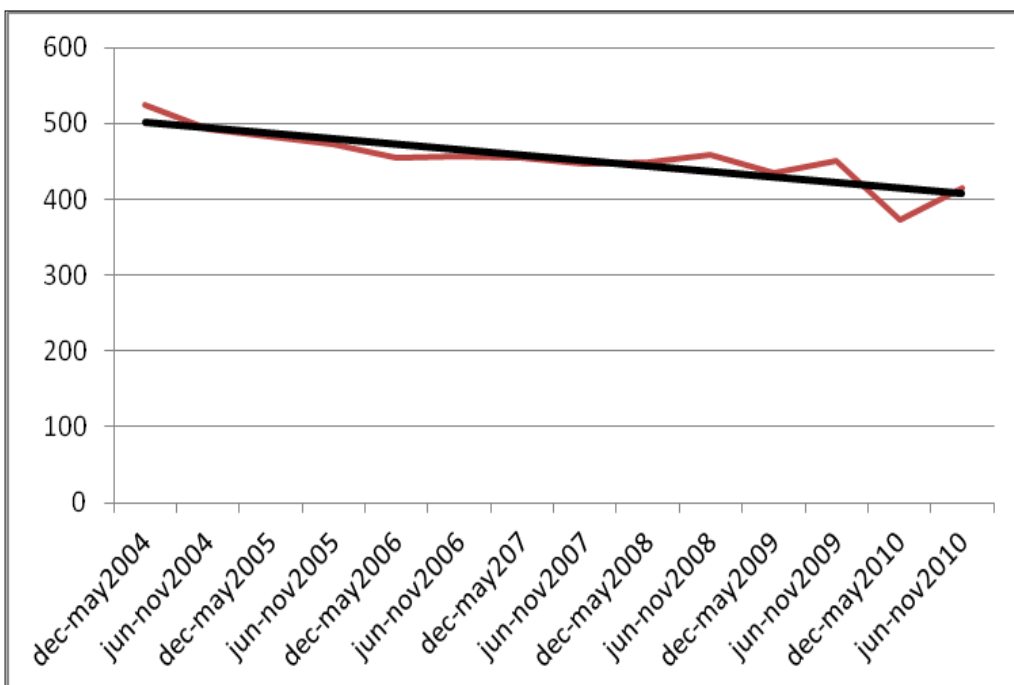
Figure 9. Semiannual changes in tobacco (cigarettes, cigars and rolled tobacco) sales per capita (grams). Source: Statistics Norway.
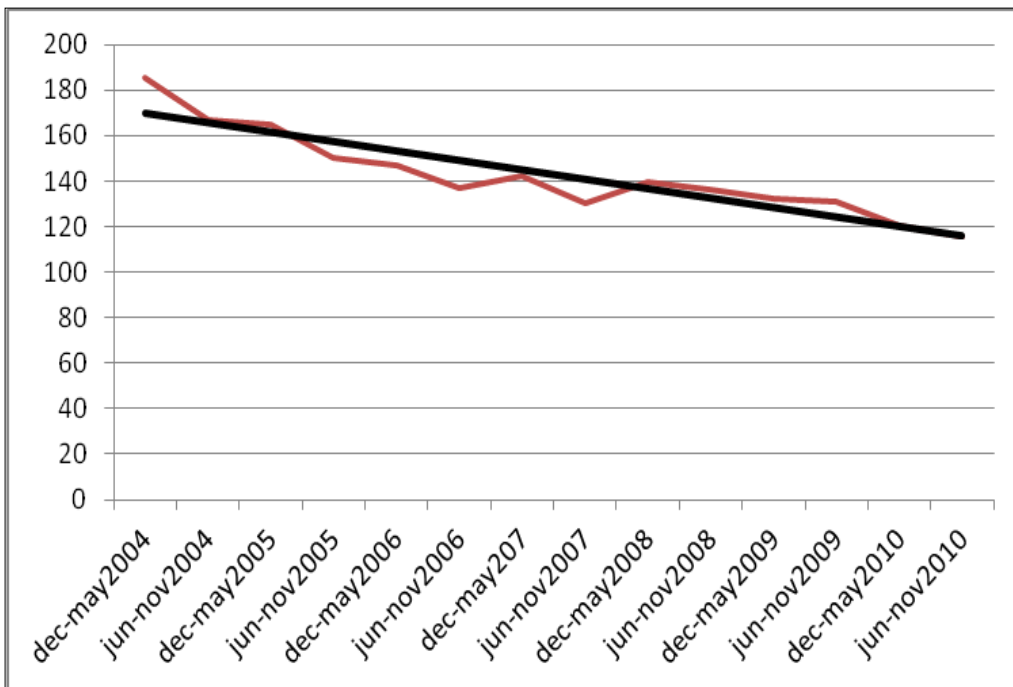
Figure 10. Semiannual changes in tobacco without cigarettes sales per capita (grams). Source: Statistics Norway.
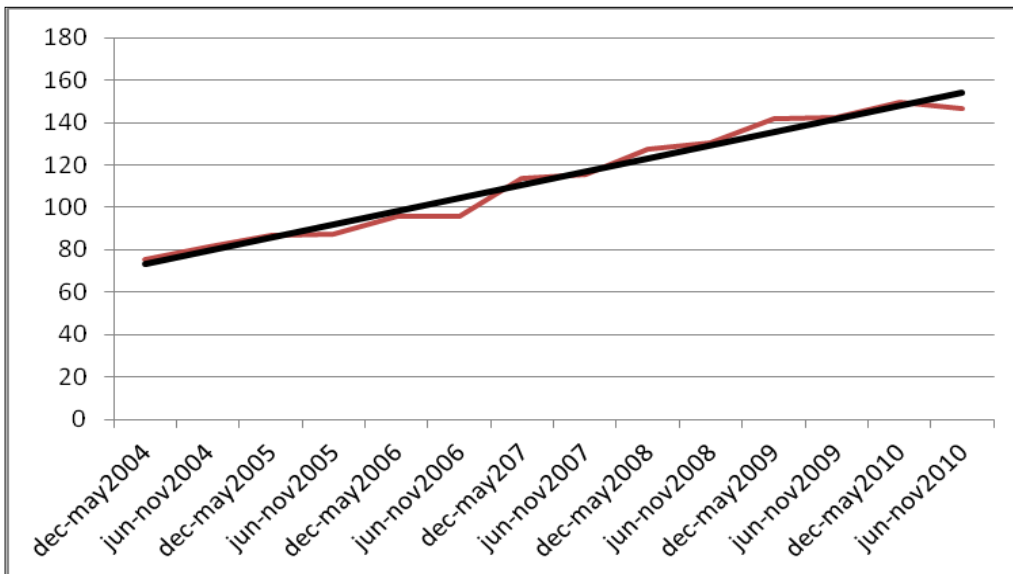
Figure 11. Semiannual changes in snus sales per capita (grams). Source: Statistics Norway.

3.2.2. Variables for the regression analysis

Table 1 gives definition of the variables. Names for the variables are the same, when monthly and semiannual data is used. Table 2 gives overall descriptive statistics of the variables for monthly periods and Table 3 gives overall descriptive statistics of the variables for semiannual periods.

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Variable	Definition
LOGCIG	Natural logarithm of cigarette wholesale sales per capita
LOGTOB	Natural logarithm of cigarette, rolled tobacco and cigar wholesale sales per capita
LOGTOWOC	Natural logarithm of rolled tobacco and cigar wholesale sales per capita
LOGPRICE	Natural logarithm of real consumer price index for cigarettes for the current period
LOGPRICEP	Natural logarithm of real consumer price index for cigarettes for the current period for the previous period
LOGPRICEF	Natural logarithm of real consumer price index for cigarettes for the current period for the following period
LOGCPI	Natural logarithm of real consumer price index for tobacco for the current period
LOGCPIP	Natural logarithm of real consumer price index for tobacco for the previous period
LOGCPIF	Natural logarithm of real consumer price index for tobacco for the following period
LOGSNUS	Natural logarithm of snus wholesale sales per capita
BAN2004	Dummy variable for smoking ban 2004. Equal to 1 if a ban existed during the period
BAN2010	Dummy variable for display ban 2010. Equal to 1 if a ban existed during the period.

Table 1. Definition of the variables.

Variable	Mean	St. deviation
LOGSIG	3.9191	0.2174
LOGTOB	4.3070	0.2358
LOGTOWOC	3.1595	0.3090
LOGPRICE	4.7168	0.0559
LOGPRICEP	4.7145	0.0554
LOGPRICEF	4.7191	0.0564
LOGCPI	4.8315	0.0859
LOGCPIP	4.8279	0.0874
LOGCPIF	4.8350	0.0843
LOGSNUS	2.8845	0.3054

Table 2. Descriptive statistics for the monthly period variables. N = 105

Variable	Mean	St. deviation
LOGSIG	5.7394	0.0677
LOGTOB	6.1161	0.0794
LOGTOWOC	4.9543	0.1285
LOGPRICE	4.8377	0.0378
LOGPRICEP	4.8177	0.0611
LOGPRICEF	4.8530	0.0480
LOGCPI	4.7112	0.0317
LOGCPIP	4.7011	0.0309
LOGCPIF	4.7245	0.0449
LOGSNUS	4.7060	0.2382

Table 3. Descriptive statistics for the semiannual period variables. n = 14

3.3. Hypothesis and assumptions

The main assumption of this thesis is that restriction to smoke in catering places had a significant negative effect on tobacco demand, and thus on wholesale sales in Norway. Therefore the hypotheses are:

$$H_0: \beta_{Smoking\ ban} \geq 0$$

$$H_1: \beta_{Smoking\ ban} < 0.$$

For this thesis both statistical significance of 95% and 99% are considered to be important. Following the theory described in Chapter 2, it is expected that variables should have negative signs.

4. RESEARCH RESULTS

In this research, series of multiple and simple regressions test the significance of the smoking ban. Each regression is named *Model* and has certain variables in it. Model 1 is a multiple regression, which includes all variables. Model 2 is a multiple regression that includes only price variables (LOGPRICE, LOGPRICEP, LOGPRICEF or LOGCPI, LOGCPIP, LOGCPIF). Model 3 is a simple regression that includes variable for snus (LOGSNUS). Model 4 is a simple regression that includes variable for smoking ban 2004 (BAN2004). Finally, Model 5 is a simple regression that includes variable for display ban

2010 (BAN2010). Models 1-2 have LOGPRICE, LOGPRICEP and LOGPRICEF, as price variables, when LOGSIG is a dependent variable, and LOGCPI, LOGCPIP and LOGCPIF, when LOGTOB, or LOGTOBWOC are dependent variables. Model 5 is excluded from the analysis of semiannual data due to impossibility to code the BAN2010 variable properly. Additionally, coefficient of determination (R^2) and Durbin-Watson statistic have been calculated. The results are presented in tables below.

4.1. Cigarette sales

Regressor	Model 1	Model 2	Model 3	Model 4	Model 5
LOGPRICE	-13.292** (1.707)	-14.367** (1.625)	-	-	-
LOGPRICEP	5.821** (1.282)	6.112** (1.237)	-	-	-
LOGPRICEF	6.500** (1.350)	6.493** (1.227)	_	-	-
LOGSNUS	0.074 (0.090)	-	-0.127 (0.069)	-	-
BAN2004	-0.046 (0.060)	-	-	-0.122* (0.058)	-
BAN2010	-0.155* (0.075)	-	-	-	-0.263** (0.046)
Durbin-Watson	1.749	1.739	1.882	1.733	2.057
R^2	0.544	0.543	0.032	0.041	0.244

Table 4. Results from regressions (monthly data), coefficient and standard error (in parentheses). Dependent variable: LOGSIG. No. of obs. = 105.

*p-value < 0.05; **p-value <0.01

Table 4 shows the results for cigarette sales, using monthly data. In this analysis, most of the variables have the expected signs, except LOGPRICEP, LOGPRICEF and LOGSNUS. However, significance varies from model to model. BAN2004 is proven to be significant only in Model 4 and has the expected sign of the coefficient. In general, according to Model 1, there was a 5% decrease in sales after implementation of the ban, while according to Model 4 the decrease was 12%. Unfortunately, the coefficient of determination is very low in simple regression. Among other variables BAN2010 is proven to be very significant, both in Models 1 and 5 and showed a decrease of sales at 16% and 26%. R^2 for Model 1 is equal to 0.544, which is relatively high value. Overall, the range of R^2 in Models 2-5 is from 0.543 to 0.032 Durbin-Watson statistics varied from 1.733 to 2.057, which means that no serious autocorrelation is visible.

Regressor	Model 1	Model 2	Model 3	Model 4
LOGPRICE	-4.833** (1.211)	-4.121** (0.985)	-	-
LOGPRICEP	1.204 (1.134)	0.474 (0.313)	-	-
LOGPRICEF	1.557 (0.788)	1.799** (0.626)	-	-
LOGSNUS	0.077 (0.119)	-	-0.181* (0.063)	-
BAN2004	-0.123 (0.174)	-	-	-0.095 (0.068)
Durbin-Watson	2.607	2.430	2.485	1.951
R^2	0.807	0.770	0.403	0.140

Table 5. Results from regressions (semiannual data), coefficient and standard error (in parentheses). Dependent variable: LOGSIG. No. of obs. = 14.

*p-value < 0.05; **p-value < 0.01

The analysis of semiannual data (Table 5) has presented results with lower statistical significance than in monthly data. The exception is only LOGPRICE in Model 1 and 2, LOGPRICEF in Model 2, and LOGSNUS in Model 3. BAN2004 shows a decrease in sales by 10% and 12%, but is not statistically significant in both multiple and simple regression. One of the explanations of such results is that the number of observations for semiannual data is lower than for monthly data. Therefore, this may affect the accuracy of results. Nonetheless, values of R^2 are greater than for the monthly data.

4.2. Cigarette, rolled tobacco and cigar sales

Table 6 shows the results for cigarette, rolled tobacco and cigar sales using monthly data. It is notable that variables LOGCPI, LOGCPIP and LOGCPIF are significant in both Model 1 and 2, but only LOGCPI has expected value of β coefficient. This may implies that overall tobacco consumption is more price elastic than cigarette consumption. Also like in first analysis, LOGSNUS variable has changed its sign from positive in multiple regression to negative in simple regression. BAN2004 and BAN2010 have become insignificant in Model 1, but are more significant in Models 4-5 than in cigarette consumption. BAN2004 also has shown decrease in sales by 8% and 25%. This is higher than in results for cigarette sales. The values of R^2 are higher in this analysis than in previous one, which may imply that variables have greater influence on overall tobacco sales than just on cigarette sales.

Regressor	Model 1	Model 2	Model 3	Model 4	Model 5
LOGCPI	-7.457** (1.113)	-8.147** (1.116)	-	-	-
LOGCPIP	3.097** (0.844)	3.266** (0.805)	-	-	-
LOGCPIF	3.242** (0.854)	3.287** (0.820)	_	-	-
LOGSNUS	0.122 (0.089)	-	-0.265** (0.071)	-	-
BAN2004	-0.077 (0.077)	-	-	-0.252** (0.059)	-
BAN2010	-0.186** (0.057)	-	-	-	-0.317** (0.047)
Durbin-Watson	1.900	1.897	1.981	1.689	1.883
R^2	0.610	0.558	0.118	0.149	0.302

Table 6. Results from regressions (monthly data), coefficient and standard error (in parentheses). Dependent variable: LOGTOB. No. of obs. = 105.

*p-value < 0.05; **p-value < 0.01

Table 7 shows the results for semiannual data. LOGCPIP has changed its coefficient's sign from positive to negative in the Model 2, but still is not statistically significant in this model. BAN2004 variable is significant in simple regression and its value of β coefficient is lower than in cigarette sales analysis. Generally it is associated with 9% and 16% decrease in wholesale sales for cigarettes, rolled tobacco and cigars. R^2 is greater than in cigarette semiannual data and monthly data for cigarette, rolled tobacco and cigar sales.

Regressor	Model 1	Model 2	Model 3	Model 4
LOGCPI	-3.475** (1.040)	-3.251** (0.869)	-	-
LOGCPIP	0.646 (1.372)	-0.691 (0.814)	-	-
LOGCPIF	0.728 (0.771)	1.232 (0.617)	_	_
LOGSNUS	-0.005 (0.107)	-	-0.277** (0.054)	-
BAN2004	-0.084 (0.055)	-	-	-0.159* (0.073)
Durbin-Watson	2.752	2.555	1.902	1.071
R^2	0.894	0.862	0.690	0.285

Table 7. Results from regressions (semiannual data), coefficient and standard error (in parentheses). Dependent variable: LOGTOB. No. of obs. = 14.

*p-value < 0.05; **p-value < 0.01

4.3. Rolled tobacco and cigar sales

Table 8 shows the results for rolled tobacco and cigar sales, using monthly data. BAN2004 is proven to be statistically significant in simple regression, but not in the multiple regression. BAN2004 is associated with 7-48% decrease in wholesale sales. The value of R^2 is the greatest of all regressions for monthly data, which means that variables explain more variance in these models for monthly data, that any other. The R^2 range from 0.271 to 0.803. Durbin-Watson statistics also seem satisfactory.

Regressor	Model 1	Model 2	Model 3	Model 4	Model 5
LOGCPI	-9.959** (1.028)	-10.418** (0.990)	-	-	-
LOGCPIP	3.777** (0.779)	3.842** (0.714)	-	-	-
LOGCPIF	3.659** (0.789)	3.801** (0.727)	-	-	-
LOGSNUS	0.091 (0.082)	-	-0.527**(0.085)	-	-
BAN2004	-0.066 (0.071)	-	-	-0.481**(0.070)	-
BAN2010	-0.099 (0.053)	-	-	-	-0.434** (0.061)
Durbin-Watson	1.992	2.079	1.903	1.428	1.276
R^2	0.807	0.798	0.271	0.315	0.330

Table 8. Results from regressions (monthly data), coefficient and standard error (in parentheses). Dependent variable: LOGTOBWOC. No. of obs. = 105.
*p-value < 0.05; **p-value < 0.01

Table 9 shows the results for semiannual data. The multiple regression's results are of low statistical significance. Price variables that are very significant in the analysis of monthly data are no longer significant in semiannual data. The exception is just LOGCPIP variable, which also has changed coefficient sign from positive to negative. R^2 value for all models are the highest among the analyses. In Model 4, BAN2004 variable is statistically significant, but not in Model 1. The range of decrease for sales, associated with smoking ban is from 3% to 29%.

Regressor	Model 1	Model 2	Model 3	Model 4
LOGCPI	-1.328 (1.297)	-1.512 (0.968)	-	-
LOGCPIP	-3.156 (1.713)	-3.951** (0.907)	-	-
LOGCPIF	0.714 (0.963)	1.052 (0.687)	-	-
LOGSNUS	-0.050 (0.134)	-	-0.485** (0.068)	-
BAN2004	-0.034 (0.069)	-	-	-0.289* (0.111)
Durbin-Watson	2.040	2.016	1.396	0.520
R^2	0.937	0.935	0.807	0.362

Table 9. Results from regressions (semiannual data), coefficient and standard error (in parentheses). Dependent variable: LOGTOBWOC. No. of obs. = 14.

*p-value < 0.05; **p-value < 0.01

4.4. Summary

Generally, the results of the tests are not disappointing. Monthly data has stronger results, regarding statistical significance than semiannual data. Although, it might be associated with a large number of observations for monthly data. R^2 values for the regressions are from moderate to high, with the exception of simple regressions for cigarette sales. Durbin-Watson test also does not show serious autocorrelation in most of the cases. LOGSNUS variable is constantly changing its coefficient's sign from positive to negative, when simple regression is run. In addition, LOGCPIP and LOGCPIF have changed their signs several times, when semiannual data analysis is made. The statement that future prices have a negative effect on demant is shown to be doubtful in this study, as coefficients for variables of past and future prices have positive signs in most cases. It can assumed that a person who will face a price increase in the future will not try to change his/her smoking habits, but rather buy more tobacco and keep it for the future.

As it can be seen from the models, BAN2004 variable is significant in simple regression models. Though, a certain assumption can be made that smoking ban 2004 has an effect on tobacco demand and sales. P-value for almost all analyzes of monthly data for BAN2004 is below 0.01, which is a very good sign. However, BAN2004 is not statistically significant in multiple regression models. In addition, coefficients in simple regression models are unrealistically high. In the analyses of semiannual data, the results are weaker, which can be explained by the relatively small sample size (n = 14). This may affect the significance of the variables. Still, BAN2004 is significant in simple regression models.

5. DISCUSSION

5.1. Results for BAN2004 variable

The results obtained from the research are generally positive, but not as clear, as they were expected to be. If we recall the research question stated in Chapter 1 of the thesis, then the answer will be as following:

Question 1: *Was the change in wholesale sales of tobacco products significantly altered by the implementation of smoking ban on 1st June 2004?*
Answer 1: *Yes, it can be said that in all simple regressions (except for the semiannual cigarette consumption) p-value for the BAN2004 variable was lower than 0.05.*

Therefore, we cannot deny that implementation of the ban was a sensible action. However, if we assume that multiple regression models are more important than simple regression models, we may see that other factors for decreasing tobacco and cigarette sales are more effective than the ban. According to multiple regression, implementation of ban decreased wholesale sales by the range of 5-13%. If we take simple regressions, then the variance of downturn in sales is between 12-48%, which seems a bit unrealistic. Anyway, because *BAN2004* is statistically significant in simple regression models, it has some impact on tobacco and cigarette sales, though probably smaller than expressed by coefficients.

Generally, we may assume that, because it is forbidden to smoke in the catering places, people do not consume as much tobacco, as before. Therefore, retailers buy less tobacco products from wholesalers. There are some generalizations in the study. The sales of cigarettes and tobacco are given in grams or units (for cigarette sales) per capita. However, in reality, cigarettes, cigars and rolled tobacco are not sold by one gram or piece, they are sold in packages. Thus, a person may buy a package of tobacco product, but use it longer than usually. On the other hand, time span of the study is rather large, so counting tobacco products in units and grams should not make any severe deviations.

However, there are some variables that have not been measured in this research, but have importance on tobacco sales. That is why, the discussion would not be complete without taking into consideration such variables, as cross-border trade, income and education. The reason why these variables do not appear in the present research is due to their measurement complexity. Nonetheless, exploration of relationship between these variables and tobacco sales can be an important topic for the future researches.

5.2. Discussion of the factors that are not used in this research

5.2.1. Cross-border trade

As mentioned previously, tobacco smuggling and cross-border trade may affect real number of tobacco sales. This is very important in such regions where prices of cigarettes and other tobacco products are very high in one region (state or country) and low in another. In Norway, sale rates are strongly affected by cross-border trade with neighboring countries. Because of the large price difference, people have incentives to buy tobacco in Sweden, and a shopping trip is the main reason for Norwegians to travel to Sweden (Beatty, Larsen, Sommervoll, 2009). In fact, cigarettes that are bought in neighboring countries are not registered as inland sales in Norway, which makes rates of sales of tobacco products in Norway lower than actual. During the period of 1990-2004 purchases of tobacco in Norway, reported by Norwegian daily smokers, decreased by approximately 30%. At the same time purchases of tobacco in Sweden, reported by Norwegian daily smokers, increased from 3% to 25% (Lund, 2005). In the research done by Chaloupka and Saffer (1992) short distance smuggling had positive and significant effect on consumption (Chaloupka, Saffer, 1992).

What would happen if cross-border trade was included in the research? Then this amount would be added to the present sale level and we would get the actual sales, which represent consumption of tobacco goods better than inland wholesale rate. On the other hand, it is still ambiguous, whether new findings changed the results much. When a person is at the catering place he/she is still not allowed to smoke, no matter where tobacco is bought. So even if the quarter of the cigarettes in a person's pocket is from Sweden, the amount of cigarettes, smoked daily will not alter strongly. However, such variable has not been included here, because of complex calculation methods for cross-border trade, as it is not possible to track all Norwegians, who buy cigarettes abroad.

5.2.2. Personal income

Income effect on tobacco product consumption and smoking prevalence is ambiguous. Chaloupka and Saffer (1992) explain this phenomenon by the fact that cigarettes may be considered, as either normal (consumption grows, when income rises), or inferior (consumption falls when income rises) good (Chaloupka, Saffer 1992). According to the studies done, smoking is more prevalent in poor and middle-income countries (Chaloupka, Corrao, Jacob, Jha, 2006; Huisman, Kunst, Mackenbach, 2005). On the other side, young people who have high earning are more susceptible to smoking (Chaloupka, Grossman,

1996). Such differences in results may be explained by the type of data, researchers used. The first two studies looked at smoking at macro-level (countries), while the last study was done on the micro-level (specific type of inhabitants).
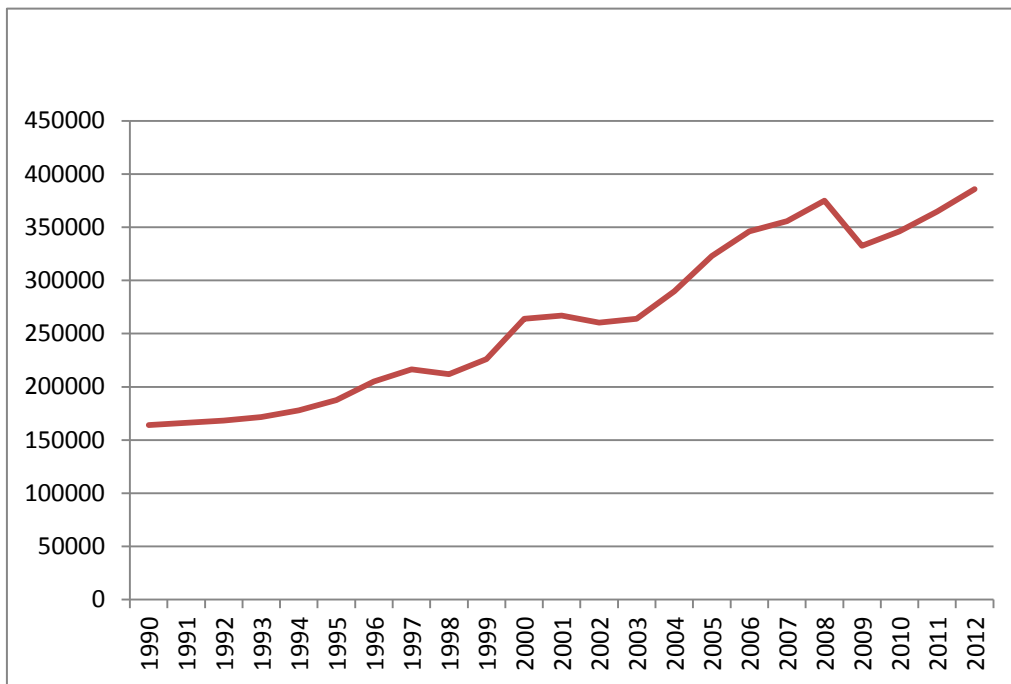

Figure 12. Real disposable income for Norway (in NOK). Source: Statistics Norway

Figure 12 shows the yearly value of real disposable income for Norway. We may see that the income has been growing steadily from year to year, with the exception in 2009, when it decreased due to the financial crisis. If we compare Figure 12 with Figures 6-8, we may assume that increase in income decreases cigarette and tobacco sales in Norway. However, these figures alone cannot not prove that increase in income decreases tobacco sales and consumption. Therefore, income variable is not used in this thesis, so misleading results from regression could be avoided.

5.2.3. Education

Education is also a variable that may affect tobacco sales and consumption. People with lower education are more likely to be heavy smokers and are less likely to quit smoking (Zhu et al., 1996). Anti-smoking educational campaigns have also showed their significance in reducing the prevalence of smoking. Various researches show that education and awareness about the harm that smoking does, significantly decreases tobacco consumption (Chaloupka, Saffer, 1992; Bardsley, Olekalns, 1999; Joossens, Raw, Godfrey, 2004). Among most successful anti-smoking campaign, researchers emphasize those that include frightening

feelings related with smoking, lectures, counseling or behavioral interventions (Hamilton, 1972; Elixhauser, 1990).
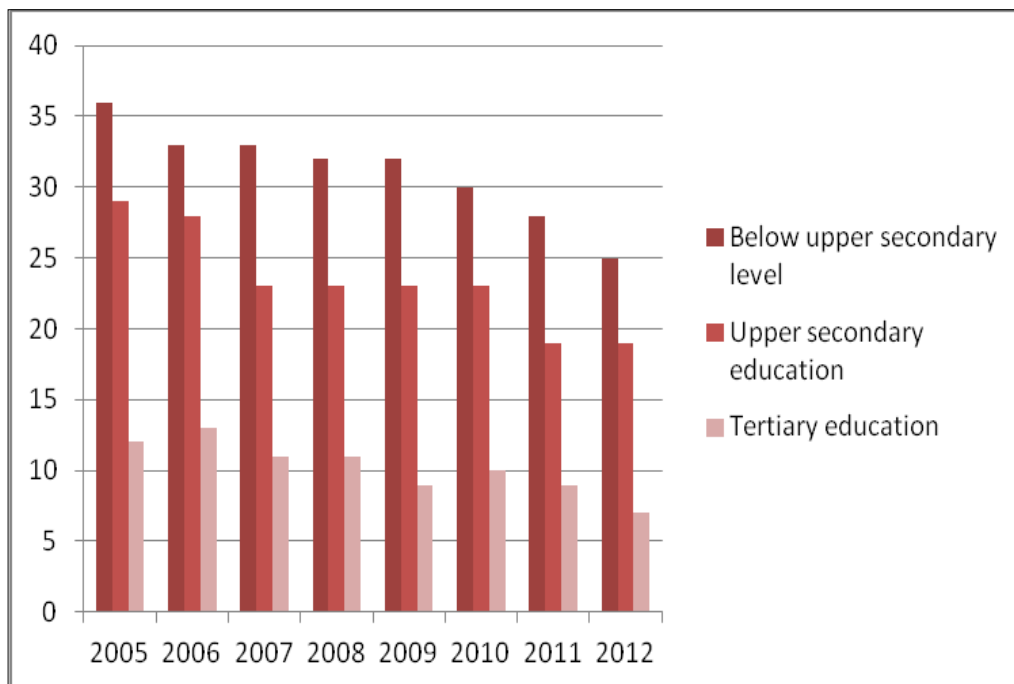

Figure 13. Prevalence of daily smokers in Norwegian population divided by the educational level. Source: Statistics Norway.

The claim that educational level may decrease smoking prevalence is partially supported by Figure 13. It may be assumed that an educated person is more aware of harm, cigarettes impose, understand the risks clearly and looks after his/her health better. According to Figure 14, we may see that percentage of people with college/university education has been growing for the past twenty years, whereas the percentage of people with only basic education has been decreasing. Therefore, if there were a variable that represented education and perception about smoking, significance of *BAN2004* and *BAN2010* variables might decrease. In other words, sales did not decrease sharply, when the ban was implemented. Instead, tobacco sales have been declining steadily, because more and more people believe that smoking is a deadly habit. A variable, which represents education has not been included in this research, because it is hard to measure educational level and perception about smoking in a quantitative study. Therefore, qualitative research is needed.
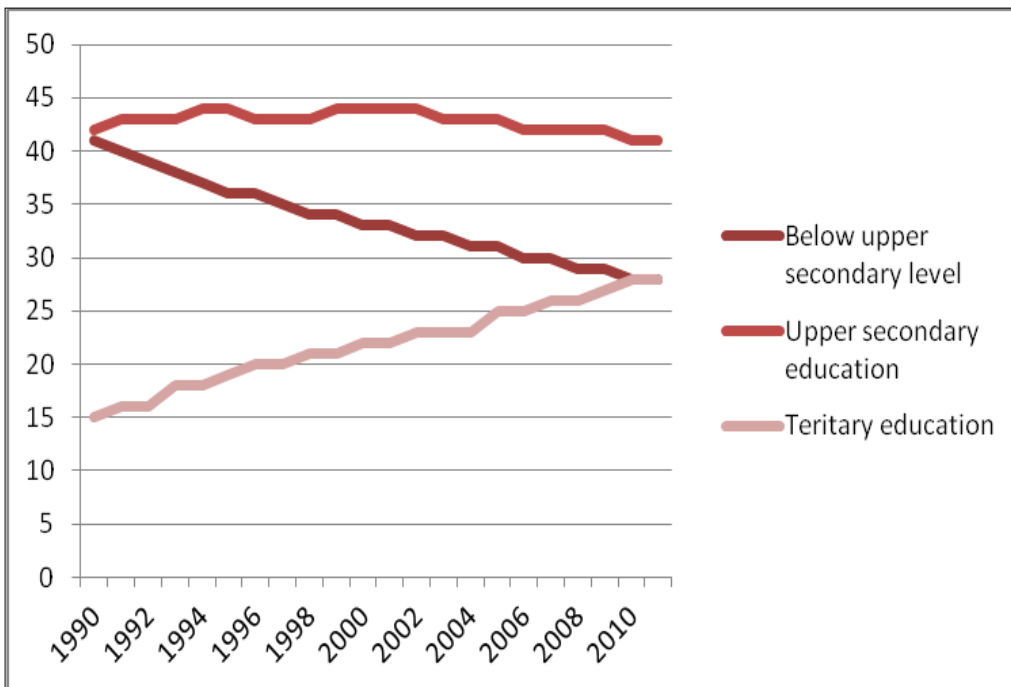
Figure 14. Educational level of Norwegian population. Source: Statistics Norway.

6. LIMITATIONS, SUGGESTIONS FOR THE FURTHER STUDIES AND CONCLUSSION

The study tried to research the case, by looking at all aspects of the research question and implementing as much knowledge from the theory, as possible. As in all quantitative studies, there are some limitations, regarding the data presentation and analysis. Readers should be aware of them, in order to make correct judgments and think about improvements of this research.

First, the data for the sales of cigarettes and tobacco products is the wholesale amount purchased by the retailers at the certain period of time, which did not included cross-border trade, thus final sales may differ from wholesale sales. In addition, there is no certainty, if snus really affects cigarette and tobacco sales. The trend for snus sales is upward sloping, while the trend for tobacco sales is downward sloping. Therefore, these two factors may be misinterpreted as affecting each other. Finally, the study is not able to track how Norwegians have been following the ban. We may assume that visitors of the pubs and bars did not smoke inside the premises. Nevertheless, they could just go outside or in a specially designated area to have a smoke.

If further studies are to be done, there are some suggestions that might be useful:

Quantitative study that also includes income and cross-border trade as independent variables

One may research the effect of ban 2004 on tobacco sales by including personal income and cross-border trade in the study. Including these variables may give a broader picture on how smoking ban in catering places has affected tobacco sales with respect to other factors.

Qualitative study of relationship between smoking ban and cigarette sales

Instead of doing quantitative study with data series, one might have qualitative study. Qualitative study can give answers to those questions, which are not solved by time-series. For example, one may research how smoking habits have changed after the implementation of the ban. For instance, a person may smoke fewer cigarettes, but inhale smoke deeper and hold it longer in the lungs. The study may also research, whether availability to smoke is crucial in choosing a catering place. This can be done, in order to see, whether the ban did have a central role in decreasing tobacco sales.

There are also some topics that are not directly related to this thesis, but which I find interesting to analyze and research:

Relationship between snus and a smoking ban

As mentioned before, snus may become an alternative for cigarettes and other tobacco products. It is not only price that matters, but also some advantages of snus, among which is availability to use it inside the building. Thus, it may be assumed that smoking ban might have actually encouraged some smokers to switch to snus, as it gives them needed nicotine without forcing to break the law. The study can have the same methodology, as in this thesis. It is preferred that a researcher used snus sales at the point of retail, in order to have more accurate results.

Relationship between educational level and perception of tobacco

Most have heard of negative effect of tobacco, but still people keep smoking. One of the reasons is that some people do not take the hazard seriously, due to the lack of information and education. We may assume that an educated person is more resistant to smoking. This is not necessary implies that all educated people must have university degree, rather the study should focus on general knowledge of a person. Nevertheless, the relationship between general knowledge and educational level is assumed to be positive. This study would help to

see, whether there is a pattern between education and smoking and, as a result, help policymakers create more developed educational anti-smoking programs.

Relationship between the usage of physical therapy, need to smoke and smoking prevalence

People do not usually start smoking, because they want to inhale toxic fumes. The reason for substance abuse lies on a deeper level. Usually, it is stress or peer pressure that pushes a person to start smoking. From a medical point of view, nicotine, drugs and other addictive substances interact with hypothalamus, a part of the brain that involves in secretion of dopamine and norepinephrine (which are also called *feel-good neurotransmitters*). This interaction leads to mental problems, such as addiction, mood swings or depression. Therefore, there should be a safe alternative that may reduce stress, or increase self-esteem without bringing harm and physical suffering to oneself. Physical therapy is a wonderful solution:

> Because therapeutic massage stimulates the release of the feel-good neurotransmitters and hormones, inclusion of these therapies has been shown to support the treatment of addictive behavior by replacing a destructive manner of mood alteration with a constructive, more moderate way to feel good.
>
> (Fritz, 2013, p. 118)

Along with therapeutic massage, there are other kinds of physical therapy, which include exercise, yoga and many more. These activities both reduce stress and make a person feel more confident. The study might research which type of therapy is the best for a specific issue and to what degree. Such results would be very helpful to policymakers, health sector workers and general audience.

To sum up, smoking is a harmful habit that is associated with various diseases and increased mortality. That is why, government takes actions, such as implying certain regulations. One of such regulations is the ban to smoke in catering places. Following Ireland's example, Norway implemented such ban on the 1st of June 2004. The study shows that the ban is statistically significant, but not in all cases. This is either because the ban is not the strongest policy against tobacco sales, or because the research has particular limitations. Therefore, more profound studies are needed, in order to find out if the ban is a good policy to combat smoking.

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