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Internet advertising regulations and alcohol consumption

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Abstract: Alcohol consumption is well-known to cause issues such as drunk-driving fatalities, liver diseases and heart diseases. Many countries therefore work actively with alcohol policy to reduce these risks. A common policy is to regulate alcohol advertising, generally in the form of restrictions or bans for different beverage types. The effectiveness of these policies is, however, unclear so far. Moreover, internet usage has increased rapidly during the past decades, and there is a lack of studies on advertising regulations on the internet. I take use of data from 13 countries within the EU and EEA with focus on the period 1995–2012, to study if advertising bans and restrictions on the internet decrease alcohol consumption. I outline and estimate an alcohol demand function using panel data regressions. The results indicate that advertising bans may be an ineffective policy measure, while restrictions might help in decreasing alcohol consumption.

Keywords: Alcohol consumption, advertising bans, advertising restrictions, internet advertising, alcohol policy, advertising regulation

JEL: I1, I18, M3, M37, M38

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1 Introduction

Alcohol consumption and the negative social and health effects associated with excessive drinking, has for long been a well-known and often debated subject. Most countries work actively with reducing the risk of over-drinking in the population to avoid health issues such as liver and heart diseases, drunk-driving and to protect adolescents. Various alcohol policies have therefore been developed over time, many of which has been proven to efficiently and effectively reduce alcohol consumption. These policies are, for example, state-owned alcohol retail monopolies, minimum legal drinking ages and maximum blood alcohol content (BAC) levels for driving (Babor et. al., 2003).

Another commonly used policy is regulation on advertising. This type of policy varies much between countries, but generally comes in the form of either (i) restrictions on time, place and/or content of the ad, (ii) bans on ads for spirits, or (iii) bans on ads for all alcohol beverages (except for weak beer). The regulations often also differ between different media types, so that regulation on broadcast media (TV) is often not the same as it is for e.g. the internet.

Several previous studies have attempted to evaluate if advertising and advertising regulations have an effect on alcohol consumption. So far, however, the effect is ambiguous with differing results between studies and inconclusive results in many of them. Moreover, most studies have as of yet mostly focused on advertising in broadcast media, and fail to include newer media like the internet. The purpose of this thesis is therefore to study whether alcohol advertising bans and advertising restrictions on the internet decrease alcohol consumption. Moreover, the effect of broadcast alcohol advertising bans will also be estimated, to contribute with new data on the previously studied subject.

Alcohol advertising is substantial around the world and still increases rapidly in many countries, such as the US and Sweden. Alcohol advertising expenditures in the US, for example, was over 542 million USD in 2011, an increase with over 400% since 1970 (Richards, 2015). Furthermore, over the past two decades, internet usage has increased with an immense speed. In the EU, internet penetration went from 1.6% in 1995 to 80.9% in 2016. A new media has thus become available for the public over the past few decades and with it has come a new outlet for advertising. Online advertising is continuously increasing, and in the US, online advertising revenues reached 72.5 billion USD in 2016. Because of the large amount of advertising for alcohol, and advertising online in general, it is naturally of great interest to

evaluate if advertising bans and restrictions for the internet is effective in reducing alcohol consumption.

Generally, alcohol policies have become stricter in most European countries over time. Many countries have, for example, instated stricter BAC levels, higher legal drinking ages or decreased the availability of alcohol (WHO, 2014). At the same time, overall alcohol consumption has also decreased. However, largely because of liberalisation within the EU, many European countries have had alcohol advertising bans removed, so the overall number of countries with bans and restrictions have decreased or remained stable over the past few decades. Thus, variation in advertising bans and restrictions both between countries, and over time will be used to identify the effect of alcohol advertising online on alcohol consumption.

I make use of data on per capita alcohol consumption, and advertising bans and restrictions from 13 countries within the EU and EEA during the period 1975 to 2012 to estimate the effects of advertising bans and restrictions on alcohol consumption. The main results are, however, focused on the period 1995 to 2012. Because there is not a large variation of advertising bans and restrictions over time, it is necessary to make use of data from several countries, to also identify variation between them. Based on previous studies, such as Saffer and Dave (2002) and Nelson (2010), I outline a demand model for alcohol, depending on advertising bans and restrictions, the price of alcohol, and several cultural, social and economic factors, such as other alcohol policies, wine sentiment (the share of wine consumed out of all alcoholic beverages) and income. The alcohol demand model is then used to estimate a panel data model with time fixed effects to identify if advertising bans and restriction on the internet are effective in reducing alcohol consumption.

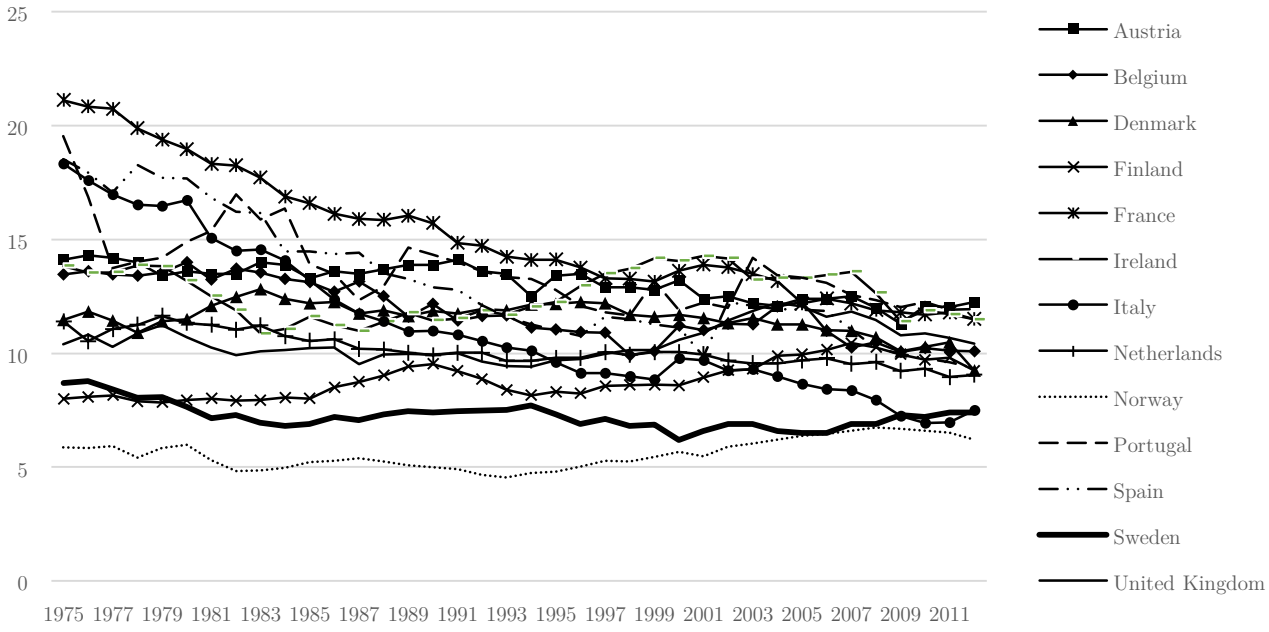
In the following section, a background on alcohol consumption levels, alcohol regulation, alcohol advertising and online advertising is given. Next, I summarize previous literature on the subject in Section 3. Thereafter I outline the theoretical framework in Section 4 and describe the empirical analysis in Section 5. The dataset is described in detail in Section 6 and results are presented in Section 7. Lastly, I end with a discussion in Section 8 and conclusions in Section 9.

2 Background

Alcohol consumption and alcohol policy is a frequently discussed and debated subject. While most countries now agree on that alcohol should not be prohibited completely, they recognise that there are many social and health

issues connected to alcohol consumption that they need to face. Excessive alcohol consumption is, for example, connected with drunk-driving fatalities, liver diseases and heart diseases (Mongan et. al., 2007). Over the past decades, there is an overall trend in many European countries of decreasing alcohol consumption, much of which likely can be attributed to effective alcohol policies implemented in the countries. In Graph 1 below, per capita consumption of alcohol from 1975 to 2012 are displayed for the 13 countries included in this paper. As can be seen, a majority of the countries have a decreasing consumption of alcohol, and mainly only the Nordic countries remain fairly stable in their consumption level. Moreover, it is evident that per capita consumption levels become more similar between the countries over time.

Graph 1. Per capita alcohol consumption in litres of pure alcohol, 1975–2012



Notes: Recorded alcohol consumption per capita for each year. Reported in litres of pure alcohol. *Source:* Authour's rendering of World Health Organization data (2016).

The issue of decreasing alcohol consumption, or more specifically minimising excessive drinking and issues related to it, is something most countries work actively with and is continuously important. However, countries of course tackle this issue in different manners, and regulation vary much between countries. Perhaps most commonly used are alcohol taxes, which increases the economic cost of alcohol, and so the demand should decrease. Babor et. al. (2003) list taxes as one of the 'best practices' to

minimise alcohol consumption. Other regulations mentioned in the same list are minimum legal purchase age, government monopoly of retail sales, lowered blood alcohol content (BAC) limits for driving, and hours and days of sale restrictions. Another common regulation for decreasing alcohol consumption is to restrict advertising. The type of advertising that is restricted is most commonly the ads from alcohol producers, wholesalers and retailers targeted towards the individual consumer. For example, TV commercials or ad banners on the internet. It has, however, been argued that advertising regulations are not very effective, or at the least, the effect is inconclusive so far. Still, many countries and organisations are advocating for more advertising bans and restrictions (Smith, 2009; Gayle, 2017; Murray, 2017).

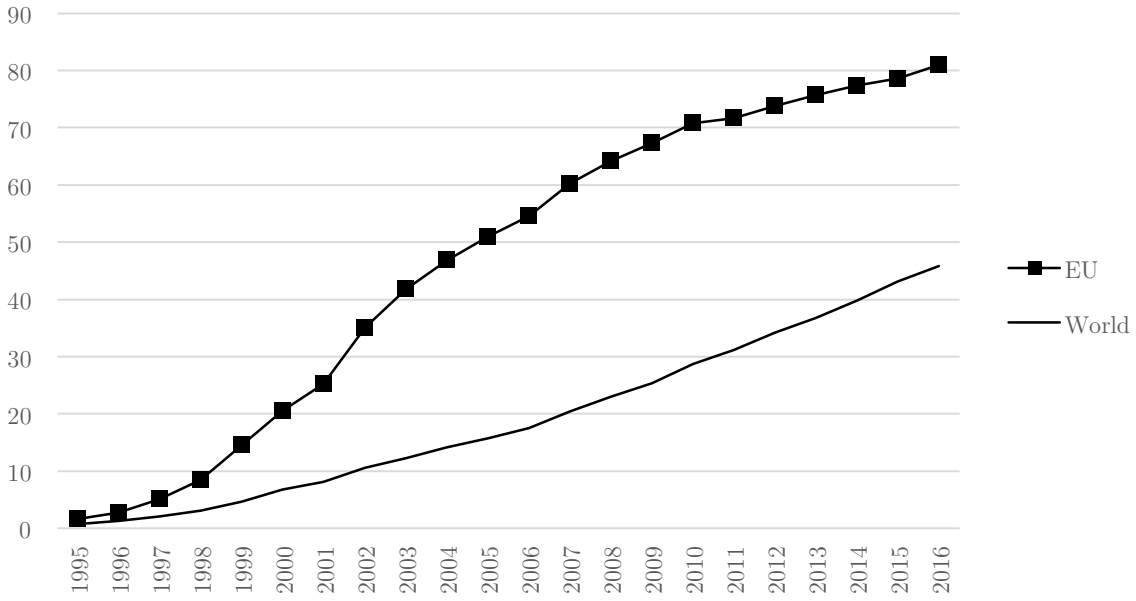
Advertising regulations for alcohol generally come either in the form of restrictions or bans, or a combination of the two (Nelson and Young, 2001; Saffer and Dave, 2002; Nelson, 2010; WHO, 2014). Wine and beer (except for weak beer) are usually categorised as one group, and spirits as another, when it comes to advertising regulation. There can, for example, exist partial bans or total bans on alcohol advertising. A partial ban refers to regulation prohibiting only advertising of spirits (often beverages over around 25% in alcohol content), whereas a total ban stipulates that no advertising for alcohol is legal (often with the exception of weak beer). Other than bans, there are three main restriction types on alcohol advertising: time, place and content. Time restrictions regulate what time of the day companies are allowed to display ads, place can be physical places or, for example, what type of websites that are allowed to display alcohol ads, and content defines what the ad can or must say.

Advertising regulations, and especially advertising bans, have long focused on restrictions on broadcast advertising. In, for example, print media, only a small number of countries have instated partial or total bans. In broadcast media, however, it is a common practice to ban either only spirits or all alcoholic beverages, except for weak beer (WHO, 2014). Imposing restrictions or bans on alcohol advertising on the internet is today quite common among European countries, though not as common as within broadcast media. Several countries within the EU still do not have any restrictions on alcohol advertising online. Moreover, in many countries, the restrictions on alcohol advertising online stem from other advertising regulations, such as those imposed on broadcast media. Thus, the regulations are not necessarily instated because of an increase in either alcohol consumption or internet usage.

However, with the rapid increase in both availability and usage of internet, it becomes increasingly important to understand the effects of advertising in newer media outlets like the internet, as well. Since 1995,

worldwide internet penetration has gone from 0.8% to 45.8% in 2016, and internet penetration in the EU reached 80.9% in 2016. The development of internet usage in the world and the EU are displayed in Graph 2 below. Moreover, the number of social media users surpassed 2.45 billion in 2017 (Statista, 2018a). With social media, people use the internet even more frequently and are exposed to online advertising more easily. Internet and social media penetration of course vary much between countries, but is regardless an important media outlet that a large share of the population interact with on a daily basis.

Graph 2. Internet penetration (%), 1995–2016

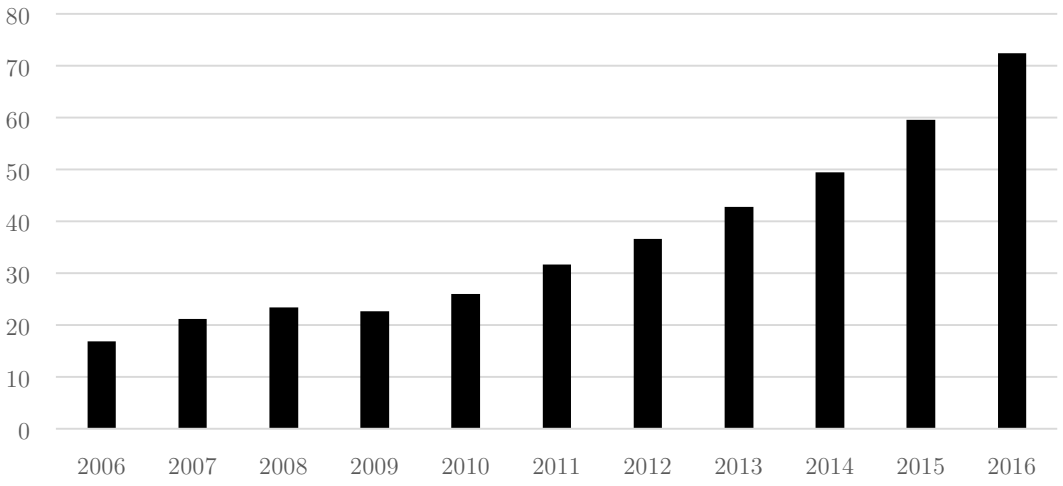


Notes: Individuals using the Internet, % of population. *Source:* Authour's rendering of data from the World Bank (2016).

In the US, alcohol advertising expenditures have gone from 9.3 million USD in 1970 to over 542 million USD in 2011 (Richards, 2015), suggesting a substantial increase in overall advertising of alcohol. On the other hand, Pernod Ricard, one of the largest alcohol producers in the world, only increased its advertising expenditures from 1625 million EUR in 2015 to 1691 million EUR in 2017 (Statista, 2018b). Moreover, German advertising investments for alcoholic beverages have remained stable from 1997 to 2016 (Statista, 2018c), indicating that there may not be a general trend in increasing alcohol advertising. However, alcohol advertising is still substantial and concerns regarding its effect on consumption is naturally therefore legitimised.

Furthermore, online advertising in the US has since 2006 to 2016 increased with 16% per year, from 16.9 billion USD to 72.5 billion USD (IAB, 2016). US online advertising revenues from 2006 to 2016 are displayed in Graph 3 below. Increasing advertising on the internet can naturally impact consumer preferences much. Online advertising among alcohol brands do not follow the same increasing trend, though, so its impact on alcohol consumption might be ambiguous. For example, Absolut Vodka's internet advertising spending in the US went from 541 thousand USD in 2010 to 335 thousand USD in 2015, with a peak of 1.3 million USD in 2014 (Statista, 2018d). Similarly, no clear patterns can be identified in internet advertising spending for other major brands such as Smirnoff, Belvedere, Grey Goose and Skyy Vodka. Many brands have, however, peak years with quite substantial spending over 1 million USD in internet advertising. Hence, the importance of evaluating alcohol advertising regulation for the internet remains.

Graph 3. US online advertising revenues (billion USD), 2006–2016



Source: Author's rendering of IAB/PwC Internet Ad Revenue Report data (2016).

3 Previous research

In this section, I will review and summarise previous literature on the subject of alcohol consumption. More specifically, I first review general research on the topic and factors that have been studied and may affect alcohol consumption. Thereafter, I more in detail review studies on advertising and alcohol consumption, which will make up the basis of the following theoretical and empirical analysis of this paper.

3.1 Alcohol consumption

As mentioned previously, countries often use different types of regulations in order to minimise health risks due to alcohol consumption. It therefore exists various types of alcohol policies, some of which are discussed below, which of course can affect alcohol consumption differently.

Perhaps one of the most common ways to regulate consumption of goods is through taxation, not the least with alcohol. Smith and Mitry (2006) study the effectiveness of taxation on drinking habits and find that alcohol consumption is sensitive to changes in price, especially wine and spirits. For example, in Denmark, a 10% decrease in the real price of wine, spirits and beer would lead to a 27%, 9% and 18% increase in consumption, respectively. Similarily, Heeb et. al. (2003) finds that spirits consumption increase significantly after a price decrease. They do not, however, find as strong evidence for wine and beer.

Instating a state-owned alcohol retail monopoly is another well-known policy to reduce alcohol consumption. This type of monopoly is for example used in Sweden, Finland, Norway and several states in the US. Numerous studies have shown that retail monopolies limit alcohol consumption and privatisation of these generally leads to an increase in alcohol consumption (Her et. al., 1999; Mann et. al., 2005). Much of these increases can be attributed to changes in availability, such as increased store density and longer opening hours, and price changes (Mäkelä et. al., 2002; Mann et. al., 2005; Norström and Skog, 2005).

Another important factor for changes in alcohol consumption is trends. For example, a strong health trend can cause per capita consumption of alcohol to decrease, while new packaging such as bag-in-box wine may increase the alcohol consumption (Holder et. al., 2005; Norström and Ramstedt, 2006). Moreover, Bentzen and Smith (2004) points to that more general trends such as increasing living standards can increase alcohol consumption.

3.2 Advertising and alcohol consumption

As discussed previously, alcohol advertising has for many years been substantial and is a widely-debated issue because it might affect alcohol consumption. Because of the important policy implications, alcohol advertising and its effect on alcohol consumption is a quite well-studied area. However, results from previous studies are still inconclusive.

For example, experimental studies on the effect of alcohol advertisement show differing results. Martino et al. (2006) find that exposure to alcohol advertisement does not increase positivity towards alcohol, while Snyder et al. (2006) do find a significant increase in alcohol consumption due to advertisement.

There are also various econometric studies on the subject making use of time-series data to study if advertising affects overall alcohol consumption. In most studies, yearly data is used and only a few countries have data on alcohol advertising. Some of the studied countries are, for example, Australia, Canada, the UK and the US. However, most of the previous studies with such yearly data find no significant effect on alcohol consumption due to alcohol advertising (Selvanathan, 1988; Smith, 1990; Tegene, 1990; Lee and Tremblay, 1992; Calfee and Scheraga, 1994; Duffy, 1995; Fisher and Cook, 1995; Goel and Morey, 1995; Nelson and Moran, 1995; Gius, 1996; Blake and Nied, 1997; Lariviere et al., 2000). Data limitations, such as insufficient data on advertising expenditure and only availability of annual data, may be an explanation for the lack of conclusive results.

While it is not clear if advertising affects alcohol consumption levels, there is more of a consensus on advertising affecting market shares between both brands and beverage types. Fisher and Cook (1995), for example, find support for alcohol advertising realigning market shares between beverage types. Gius (1996) study brand-level effects of advertising within spirits and finds that advertising leads to a reallocation of market shares between the spirit brands. Furthermore, Nelson and Moran (1995) find the same type of reallocation both between brands within a beverage type and between beverage types (although to a lesser degree). This is also a common argument from the alcohol industry; that advertising does not affect overall consumption but is necessary for companies to attract consumers to their brand or beverage type.

Because of mentioned limitations in data availability, many studies have instead turned to advertising restrictions to measure if they have an effect on alcohol consumption. So far, results are ambiguous in these types of studies as well and, in many cases, results seem to depend on the design of the study. Several studies have focused on local advertising bans in the US, often limited to quite specific types of outdoor bans, such as billboards. These types of studies do not find support for alcohol advertising affecting alcohol consumption (Schweitzer et al., 1983; Ornstein and Hanssens, 1985; Markowitz and Grossman, 1998; Nelson, 2003). Other studies have used cross-country data to examine bans with a larger scope, mainly partial and total broadcast bans. For example, Saffer (1991) studies 17 OECD countries from 1970 to 1983 and finds that both partial and total broadcast bans decrease

alcohol consumption. Similarly, in a later study, Saffer and Dave (2002) study 20 OECD countries over the period 1970 to 1995 and again conclude that partial and total advertising bans decrease alcohol consumption. They find this by estimating an alcohol demand function with exogenous prices (unlike other common demand functions such as the one proposed by Berry (1994)), social and economic factors as well as endogenous advertising bans. The results of this study were, however, only significant at a 10%-level. Moreover, later studies have pointed out econometric flaws in the studies by Saffer (1991) and Saffer and Dave (2002). They do not, for example, include important demographic variables such as unemployment and aging of the population. Furthermore, they lack the inclusion of other alcohol policies that naturally may affect alcohol consumption. Young (1993), for example, reached opposite conclusions to Saffer (1991) when re-specifying the empirical strategy. Moreover, Nelson and Young (2001) and Nelson (2010) study advertising bans and find that they do not have any significant impact on alcohol consumption. Nelson (2010) makes use of yearly data from 15 OECD countries, and studies variation in alcohol consumption between countries and over time to identify the effect of alcohol advertising bans. The estimations in the study are based on data from the time-period 1975 to 2000. Moreover, in Nelson (2010), additional demographic variables and an alcohol control policy index are included in the specification, and, in comparison to Saffer and Dave (2002), advertising bans are treated as exogenous. The argument for this is that bans usually have a long-standing nature, and change or removal of bans largely depend on outside factors, such as EU trade liberalisation.

3.3 Hypotheses

Given the development of internet usage, internet advertising and alcohol advertising, it is likely that alcohol consumption may be affected by alcohol ads targeting consumers online. However, as seen in the previous section, previous literature on alcohol advertising and alcohol consumption finds no conclusive results. While some studies do find that advertising increases consumption, or advertising bans decreases consumption, several studies find the opposite. I will therefore take the more conservative view and form the hypotheses of the thesis with the basis in advertising not decreasing alcohol consumption.

Moreover, for broadcast advertising, both partial and total bans are present in many countries. For the internet, however, bans are not as frequent, but restrictions on time and place are. For internet advertising, I will therefore evaluate any type of ban (partial/total) together, and restrictions on time and

place. For broadcast media, I will follow previous literature and evaluate partial and total bans separately. Hence, the four hypotheses I aim to evaluate are:

H1: Bans on online alcohol advertisement do not decrease per capita alcohol consumption

H2: Restrictions on online alcohol advertisement do not decrease per capita alcohol consumption

H3: Partial broadcast alcohol advertising bans do not decrease per capita alcohol consumption

H4: Total broadcast alcohol advertising bans do not decrease per capita alcohol consumption

With the studies of Saffer and Dave (2002), Nelson and Young (2001) and Nelson (2010) as foundation, I next outline the theoretical framework and empirical analysis for this paper.

4 Theoretical framework

The theoretical framework of this paper follows that of Saffer and Dave (2002), with alterations and additions according to Nelson and Young (2001), and Nelson (2010). This theoretical framework specifies the demand function for alcohol and will be used as a guideline for the empirical analysis in the following sections. Saffer and Dave (2002) outlines a demand function for alcohol, which can be represented as:

$$A = A(P_A, Z, B)$$

Where A is the demand for alcohol, which depends on the price of alcohol P, other factors such as social, cultural and economic factors, Z, and alcohol advertising bans B.

Price will naturally have an effect on the demand of alcohol since consumers will afford less alcohol if prices increase. Following Saffer and Dave (2002) and Nelson (2010), prices are treated as exogenous in this model (as opposed to e.g. Berry (1994)) because of the competitiveness of the international market for alcoholic beverages, which creates a very elastic

supply function. The price of alcohol within a country in many cases also depend on outside factors, such as harmonisation of tax rates across the EU and trade liberalisation.

Z is a set of several social, cultural and economic factors affecting demand for alcohol. If, for example, a country's population is relatively rich, they can afford to spend more on alcohol, and therefore likely consume more alcohol. Income is therefore an important part of the demand function of alcohol and it is expected to have a positive impact on alcohol demand. Moreover, social factors, such as unemployment, may affect the demand of alcohol. Another important factor affecting the demand of alcohol is the cultural aspect, which varies much across countries. Some drinking cultures, such as those in the Nordic countries, are characterised by more binge-drinking on fewer occasions with the purpose of intoxication, and lower consumption on a daily basis. These countries usually drink relatively more of spirits than other beverage types. Other countries, such as those around the Mediterranean, drink relatively more of wine and more frequently, often without the purpose of intoxication. Naturally, these cultural aspects will affect the demand for alcohol. In general, wine-consuming countries tend to consume more alcohol than other countries. Moreover, these cultural differences towards alcohol can also be seen in alcohol policies in the country. Nordic countries, for example, tend to have stricter regulation on alcohol consumption, with the use of state monopolies on retail sales of alcohol. (Nelson and Young, 2001; Saffer and Dave, 2002; Nelson, 2010)

Lastly, alcohol advertising bans and restrictions may affect the demand for alcohol. Without bans and restrictions, the population will be more exposed to alcohol, which may affect the view on alcohol consumption and therefore also the demand. Saffer and Dave (2002) treats alcohol advertising bans as endogenous, meaning that the legislation of alcohol advertising bans is a function of public attitudes about alcohol and depend on factors such as levels of excessive alcohol consumption. They mean, for example, that the number of alcohol advertising bans has decreased over time because there has been a general decrease in alcohol consumption. I will, however, treat alcohol advertising bans and restrictions as exogenous, following the reasoning of Nelson (2010). Nelson (2010) argues that bans are exogenous because they largely depend on outside factors, such as EU trade liberalisation. In Sweden, for example, alcohol consumption per capita started to increase from 2000. In 2003, however, Sweden removed bans of alcohol advertising in print media, following pressure from the EU, indicating that alcohol advertising bans and restrictions are exogenous rather than endogenous. What will be estimated through the empirical analysis, presented in the next section, is therefore the variation in alcohol consumption with and without advertising bans and

restrictions. Thus, if alcohol consumption is lower with the presence of advertising bans and restrictions or not.

5 Empirical analysis

Having reviewed previous literature on the subject of alcohol consumption and alcohol advertising, I here outline the empirical analysis, which is guided by the theoretical framework from the previous section. I then address some limitations of the study.

5.1 Estimated model

The empirical analysis of this paper builds upon methods from Saffer (1991), Saffer and Dave (2002), Nelson and Young (2001) and Nelson (2010). I estimate a panel data model with time fixed effects, with the following specification:

$$A_{it} = \alpha + R_{it}\beta + \eta C_{it} + X_{it}\gamma + \delta_t + \varepsilon_{it}$$

The dependent variable, A, is the natural log of alcohol consumption per capita. Dummy variables for internet bans, internet restrictions, partial broadcast bans and total broadcast bans are included in the vector R. C is an alcohol policy control index accounting for other alcohol policies in the country. X is a vector of other control variables that affect alcohol consumption. These are price, income, aging, wine sentiment, tourism and unemployment. α is the constant, β and γ are coefficient vectors, η is the control coefficient, δ is time fixed effects, and ε is the error term. The main regression is estimated with weighted least-squares to account for heteroscedasticity. Following the methodology of Nelson (2010), for sensitivity analysis of the results, I also specify a regression with log first-differences to account for trends and non-stationarity and an OLS regression with unweighted data. Moreover, to include a longer time-period, I also estimate the GLS regression excluding one of the control variables (tourism), as this data is only available from 1995 and onwards.

The main results from the regression are the coefficients for the dummy variables in the vector R. Four dummies are included: internet bans, internet restrictions, partial broadcast bans and total broadcast bans. The dummy for internet bans takes on the value 1 if the country has either partial or total

bans on internet advertising and 0 otherwise. The internet restrictions dummy is equal to 1 if the country has time and/or place restrictions on internet advertising (content codes are included in the alcohol control policy index), and 0 otherwise. If a country has partial broadcast bans in place, the partial broadcast dummy takes on the value 1, and similarly, if the country has a total broadcast ban, the total broadcast dummy takes on the value 1. For internet advertising, dummies for restrictions or bans are used, rather than partial or total bans as for broadcast media. This is because partial and total bans are more common for broadcast media, whereas restrictions are more common for internet advertising. Following the reasoning of Nelson (2010), these dummy variables will be treated as exogenous. The data shows that changes in these regulations happen seldom and they often change because of outside factors such as EU trade liberalisation. Moreover, the reason for why countries have regulation on internet advertising or not often depend on if earlier laws on advertising restrictions are decided to be applicable for the internet or not. These restrictions therefore often do not depend on current alcohol consumption trends in the country.

The alcohol policy control index is based on the index by Karlsson and Österberg (2001). The scale ranges from 0 to 20 and depends on factors such as BAC, age limits, production (e.g. monopoly on alcohol wholesales) and availability of alcohol (e.g. retail monopolies and retail opening hours). The higher the value, the stricter are the alcohol policies in the country. Advertising bans and place or time restrictions on advertising are not included in the index. According to Nelson (2010), the coefficient for alcohol policy control should be negative. If alcohol policies have an effect on consumption, more strict policies should decrease consumption.

Moreover, as outlined in the alcohol demand function, social, demographic and economic factors are also expected to affect alcohol consumption. GPD per capita for each country is therefore included in the model to account for income differences between countries and over time. Income will likely affect consumption positively, if alcohol is considered a normal good, since consumers can afford to consume more. Some studies, however, argue that more alcohol might be consumed in bad times (Ruhm and Black, 2002), so the expected sign is somewhat ambiguous.

Furthermore, unemployment is included to account for economic conditions in the different countries. The expected sign for unemployment is somewhat difficult to determine. Previous US studies have found a negative relationship between unemployment and alcohol consumption (Ruhm, 1995; Freeman, 1999; Ruhm and Black, 2002; Nelson, 2003a), but as Nelson (2010) states, this may not be universally true.

Aging in the population of the countries varies across countries and over time and may affect alcohol consumption since older tend to drink less than young. The aging is therefore accounted for with a control variable for the share of the population aged 65 years and older. The expected sign is negative (Nelson, 2010).

Following the methodology of Nelson (2010), the number of international tourists per capita is included to account for the fact that tourists contribute to the overall reported consumption of alcohol in the country. Tourism is expected to have a positive effect on recorded alcohol consumption.

Moreover, the share of wine out of the total consumption of alcohol is included to account for cultural differences towards drinking between the countries. In general, countries who traditionally consume relatively more wine than other beverage types tend to consume more alcohol per capita overall (Nelson, 2010). A positive sign is therefore expected.

Lastly, a price variable is constructed to account for price differences on alcohol between the countries. Because there is a lack of price indices for alcoholic beverages, a price index is constructed for each country using alcohol expenditure data. The alcohol expenditure is divided by litres of pure alcohol consumed, to get the price of one litre of pure alcohol in the country. The price is then deflated by the GDP deflator and indexed. The sign is expected to be negative, and following Saffer and Dave (2002) and Nelson (2010), the price is assumed to be exogenous.

5.2 Limitations

Some limitations can be found in this study, which will be addressed here. First, there are three endogeneity concerns. As discussed previously, I treat the dummy variables for advertising bans and restrictions as exogenous, as according to Nelson (2010). However, Saffer and Dave (2002) argue that bans are endogenous, and so there is a possible concern that this might be the case. As argued earlier, though, it is unlikely that advertising bans and internet restrictions are endogenous because they in most cases depend on factors such as EU trade liberalisation. Moreover, Nelson (2010) specified an IV model with instruments for the advertising ban dummies to test for endogeneity. A Hausman test did suggest that total broadcast advertising bans are endogenous, but when re-estimating the demand model, it did not yield significant results and partial bans were not found to be endogenous. This suggests that the specification treating advertising bans and restrictions as

exogenous is correct. It is, however, especially important to interpret the coefficient for total broadcast advertising bans carefully.

The second endogeneity concern that can be identified is that of the alcohol policy control index. While advertising bans and restrictions most likely are not endogenous, it is a greater probability that the control index should be treated as endogenous. Other alcohol policies change more frequently within countries and measures, such as lowering the BAC level or raising the minimum drinking age, are taken more often in response to alcohol consumption levels. Nelson (2010) addresses this issue by estimating an IV model similar to that used by Saffer and Dave (2002), but applying the instruments for the control index instead of advertising bans. The estimation is based on a public choice model of the control index, and uses instruments such as healthcare expenditure and an index of economic openness. However, the results show that treating the control index as endogenous does not change the main findings of the original model where the index is treated as exogenous. To verify these results, I will also estimate a model using instruments for the alcohol policy control index. I make use of two instruments: healthcare expenditure in the country (as percentage of GDP), and an economic openness index ((exports + imports)/GDP).

A final endogeneity concern is for the price variable, which is treated as exogenous in the model. Prices are commonly treated as endogenous in demand functions, such as in Berry (1994), but I here rely on the assumptions previously used in similar studies by Saffer and Dave (2002) and Nelson (2010). Saffer and Dave (2002), for example, argue that the price should be treated as exogenous because of the "competitive international market in alcoholic beverages which creates a very elastic supply function. This leaves the variation in price across countries largely the result of variation in taxes. Taxes could be endogenous, but are a relatively limited percent of the price".

Lastly, there are data limitations that may affect the results. First, there are 13 countries included in the estimation, mainly because of good data availability for these countries. Naturally, a more comprehensive study including, for example, all EU or all OECD countries could likely give a more accurate view on the effect of advertising bans and restrictions. Because there is a low frequency of changes of advertising bans and restrictions, a dataset including more countries could also provide more variation over time and between countries for the advertising dummies. Moreover, while data on alcohol consumption is available for a quite substantial time-period, public data on important control variables, such as tourism, is not available for as long, lowering the number of observations. A model excluding the tourism variable, as mentioned, is therefore estimated as well. Finally, there may be an issue of omitted variables. There may, for example, exist more variables

that could account for cultural, social or economic differences between the countries affecting alcohol consumption. However, the variables included in the estimated model are assumed to cover these differences sufficiently, but results should of course always be interpreted with caution.

6 Data

The dataset used consists of yearly data from 1975 to 2012 for 13 countries within the EU and EEA combined from different sources. The countries are chosen largely because of data availability, and these are Austria, Belgium, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden and the UK. Data is, however, not available for the entire time-period for all variables, so the time-period in focus will be 1995 to 2012.

The variables included in the dataset are alcohol consumption per capita, the share of wine of total per capita alcohol consumption, the alcohol policy control index, the price of alcohol, GDP per capita, the unemployment rate, number of international tourists per capita, the share of the population 65 years of age and up, healthcare expenditure, economic openness index, dummies for the advertising bans and restrictions, and internet penetration.

Alcohol consumption is in terms of litres of pure alcohol per capita and is gathered from World Health Organization (WHO). Consumption is available on beverage type level (beer, wine and spirits) for the entire time-period, 1975–2012. From this data, the share of wine is calculated as the percentage of total alcohol consumption. The alcohol policy control index is a measure for how strict a country's overall alcohol policy is. The index ranges from 0 to 20, where 0 is the least strict and 20 is the strictest. The index depends on control of production and wholesale, control of distribution, personal control, control of marketing (only content codes), social and environmental controls, and public policy. Data for the index is gathered through various sources, including Karlsson and Österberg (2001), Nelson (2010), WHO, and European Center for Monitoring Alcohol Marketing (EUCAM). Data is available from 1975 to 2012. Price is calculated as household expenditure on alcohol (data from OECD) divided by alcohol consumption, to get the price of one litre of pure alcohol. This is then deflated by the GDP deflator from Penn World Tables and indexed. GDP per capita is also available for the entire time-period, 1975–2012, and is gathered from the World Bank. The unemployment rate is from OECD, and is the harmonised unemployment rate (so that it is comparable between countries). Data is available from 1983–2012 for most countries, and in a few cases the

data is only available from 1988. The number of international tourists are gathered from the World Bank for 1995–2012. This data is then divided with the population to get tourists per capita. Population data and the number of persons 65 years or older is available for 1975–2012 from OECD. This data is used to calculate the share of people 65 years and older out of the total population. Healthcare expenditure is available from OECD for the entire time-period for all but two countries who misses data for the first years. The healthcare variable is expressed as the percentage out of GDP. Economic openness is calculated as exports plus imports divided by GDP. The data for the construction of this variable is gathered from OECD for 1975–2012. Advertising ban and restriction data is also available for the entire time-period, 1975–2012, and is gathered through Nelson (2010) and WHO. Lastly, internet penetration is measured as the number of internet users out of the population and is gathered from OECD. Data is available from 1990 and onwards. All data measured in currency is in current prices, current PPPs and in US dollars.

6.1 Summary statistics

Summary statistics for variables in the dataset are reported in Table 1 below. Alcohol consumption levels, beverage shares, alcohol policy control index, advertising restrictions and internet penetration will be presented more in detail later in this section.

In general, it is clear that there is large variation both between countries and over time for the variables in the dataset. For example, the price of alcohol ranges from a minimum of 3.13 USD per litre of pure alcohol in Italy 1975, to a maximum of 97.21 USD in Norway 2005. Moreover, GDP per capita varies much between the countries, with the lowest levels in Portugal and highest in Norway. Similarly, there is large variation in unemployment and other factors such as tourism.

6.2 Consumption levels and beverage shares

Mean alcohol consumption in litres of pure alcohol for the 13 countries is reported in Table 2. For an easy overview, the countries are divided into three conventional categories according to the beverage traditionally relatively most consumed in the country, for example used in Nelson (2010). The three categories are beer countries, wine countries and spirits countries. The overall sample mean of alcohol consumption per capita is 11.13 litres of pure alcohol,

with a minimum value of 4.55 (Norway in 1993), and a maximum of 21.12 (France in 1975). Wine countries has the highest overall sample mean of 13.31. Beer countries have a sample mean of 11.64 and spirits countries have the lowest mean of 7.22. The overall consumption peaked around 1975 and has since decreased over time. Wine countries have decreased their alcohol consumption the most over the time-period from 19.4 to 10.1 litres of pure alcohol per capita (48% decrease). Beer countries have also decreased their consumption (from 12.4 to 10.4, 16% decrease), while the overall consumption in spirits countries has remained fairly stable over time. However, consumption in both Finland and Norway has increased since 1975, with its peak around 2010, and Sweden has decreased with 15% since 1975.

Table 1. Summary statistics

Variable	Obs	Mean	Stddev	Min	Max
Alcohol consumption per capita	494	11.13	3.06	4.55	21.12
Alcohol policy control index	494	11.46	4.25	0.00	19.00
Wine share (%)	494	35.43	20.98	4.70	86.45
Beer share (%)	494	43.24	16.69	4.59	74.92
Spirits share (%)	494	18.85	7.73	2.43	47.78
Price	376	33.35	20.97	3.13	97.21
GDP per capita	494	24030	16491	2128	101668
Unemployment (%)	365	8.20	3.88	1.56	24.79
Tourists per capita	234	0.92	0.58	0.26	2.86
Population 65+ (%)	494	14.74	2.19	10.05	21.02
Healthcare/GDP (%)	467	7.47	1.49	4.09	10.94
Economic openness	494	0.74	0.35	0.29	2.00
Internet penetration (%)	299	37.53	32.78	0.00	94.65

Note: The definition of the variables and construction of shares, price, etc. are described in the text. *Sources:* World Health Organization, the World Bank, OECD, EUCAM, Karlsson and Österberg (2001), Nelson (2010) and Penn World Tables.

In Table 3, descriptive statistics for the overall per capita alcohol consumption with and without different types of alcohol advertising regulations are reported. T-tests on the difference in consumption with and without advertising bans and restrictions confirm that per capita alcohol consumption is significantly lower with alcohol advertising bans on the internet, restrictions on alcohol advertising online, and with total broadcast bans for alcohol advertising. For partial broadcast bans, however, the opposite

is shown through the t-test; per capita consumption is significantly higher with partial ad bans than without. The p-value is 0.00 for all t-tests.

Table 2. Mean per capita consumption of litres of pure alcohol, 1975–2012

Beer countries	1975	1980	1990	2000	2010	2012
Austria	14.1	13.6	13.9	13.2	12.1	12.3
Belgium	13.5	14.0	12.2	11.2	10.2	10.1
Denmark	11.5	11.5	11.9	11.7	10.3	9.3
Ireland	13.8	13.2	11.5	14.1	11.9	11.5
Netherlands	11.4	11.3	9.9	10.1	9.3	9.1
UK	10.4	10.7	10.0	10.6	10.9	10.4
Wine countries						
France	21.1	19.0	15.7	13.6	11.7	11.5
Italy	18.3	16.7	11.0	9.8	7.0	7.5
Portugal	19.6	14.9	14.3	11.9	12.3	12.0
Spain	18.5	17.7	12.9	11.1	9.8	9.4
Spirits countries						
Finland	8	7.9	9.5	8.6	9.7	9.2
Norway	5.9	6.0	5.0	5.7	6.6	6.2
Sweden	8.7	7.7	7.4	6.2	7.2	7.4
Averages						
Beer countries	12.4	12.4	11.5	11.8	10.8	10.4
Wine countries	19.4	17.1	13.5	11.6	10.2	10.1
Spirits countries	7.5	7.2	7.3	6.8	7.8	7.6
Overall	13.4	12.6	11.2	10.6	9.9	9.7

Note: Alcohol data do not include estimates for unrecorded consumption. *Source:* World Health Organization.

Besides trends in consumption levels of alcohol, there is also an evident shift in what beverage types are consumed, a so called 'beverage homogenisation'. In 1975, the country categories displayed very strong preferences between the beverage types; beer stood for 60.7% of consumption for beer countries, wine for 75.5% for wine countries, and spirits for 35.6% for spirits countries. Over time, though, these patterns are not as evident as earlier. For beer countries, the share of wine increased from 16% in 1975 to 36% in 2012, beer decreased from 61% to 44%, and spirits decreased from 22% to 17%. In contrast, the wine share in wine countries decreased from 76% to

53%, beer increased from 12% to 28%, and spirits increased from 13% to 17%. Spirits countries also had a shift, with an increase in wine from 11% to 35%, decrease in beer from 45% to 42%, and spirits decreased from 36% to 19%. Hence, in 2012 the beverage shares of each country type are more similar to each other than in 1975 where the country types are more distinct in what types of beverages they consume relatively more of.

Table 3. T-tests for per capita consumption of litres of pure alcohol with and without advertising regulations

Variable	Obs	Mean	Stderr	Stddev
Without internet ad ban	426	11.54	0.14	2.91
With internet ad ban	68	8.58	0.33	2.74
Difference		2.96* (7.85)	0.38*	
Without internet restrictions	352	11.89	0.16	2.93
With internet restrictions	142	9.25	0.21	2.52
Difference		2.54* (8.23)	0.31*	
Without partial TV ad ban	304	10.69	0.19	3.29
With partial TV ad ban	190	11.84	0.18	2.50
Difference		-1.15* (4.15)	0.29*	
Without total TV ad ban	352	11.98	0.14	2.57
With total TV ad ban	142	9.03	0.26	3.16
Difference		2.95* (10.80)	0.27*	

Note: Alcohol data do not include estimates for unrecorded consumption. t-Statistics reported in parentheses. *indicate statistically significant at the 5%-level. *Sources:* World Health Organization, Nelson (2010) and EUCAM.

Within the country types, though, there are differences as well. Among beer countries, the UK has experienced the largest shift in beverage shares with a decrease in beer share from 74% to 33% and a substantial increase in wine. Among wine countries, Spain has seen the largest drop in wine share from 62% to 23% and a large increase in beer. Out of the spirits countries, Sweden has had the largest change from a spirits share of 43% in 1975 to 15% in 2012. Overall, though, the largest difference between the countries over the entire sample period is the share of wine consumed, supporting the use of wine share as a cultural control variable in the empirical analysis.

Table 4. Beverage share of total consumption (%), 1975 and 2012

	1975			2012		
Beer countries	Wine	Beer	Spirits	Wine	Beer	Spirits
Austria	36.9	47.5	15.6	35.1	51.1	13.9
Belgium	18.7	62.2	19.0	37.0	47.5	15.4
Denmark	14.2	66.2	19.6	44.4	38.4	16.4
Ireland	5.3	67.6	21.3	25.5	46.7	20.0
Netherlands	13.3	46.4	40.3	34.9	48.3	16.8
UK	7.2	74.3	18.5	38.0	33.2	20.7
Wine countries						
France	71.0	14.0	15.1	58.3	18.3	21.7
Italy	82.4	4.6	13.0	66.6	22.7	10.5
Portugal	86.4	10.8	2.8	65.9	23.5	7.1
Spain	62.3	17.5	20.1	23.0	47.3	28.8
Spirits countries						
Finland	12.4	38.9	22.6	18.4	46.2	23.4
Norway	8.2	50.8	41.1	36.9	43.0	17.9
Sweden	13.2	43.7	43.0	48.7	36.5	14.9
Averages						
Beer countries	15.9	60.7	22.4	35.8	44.2	17.2
Wine countries	75.5	11.7	12.7	53.4	27.9	17.0
Spirits countries	11.3	44.5	35.6	34.6	41.9	18.7
Overall	33.2	41.9	22.5	41.0	38.7	17.5

Source: Author's rendering of data from World Health Organization.

6.3 Alcohol policies

In Table 5, the number of countries (out of the 13 countries in the sample) with different types of alcohol advertising regulations are displayed. Since 1975, the number of countries with restrictions of alcohol advertising online has naturally increased because of the creation and increasing use of the internet. The amount of countries with bans or restrictions for online advertising appears to be fairly stable though, and is not a regulation that is changed, removed or added frequently.

The amount of broadcast bans is also fairly stable over time. In total, partial broadcast bans have decreased since 1975, but decreased during the period in between. The number of countries with total broadcast bans have

decreased over the past two decades. When a country does change, remove or add a broadcast ban it is often due to EU regulations, as mentioned before and as argued by Nelson (2010).

Table 5. Number of countries with advertising restrictions/bans, 1975–2012

	1975	1980	1990	2000	2010	2012
Internet restriction	0	0	0	5	6	6
Internet ban	0	0	0	4	3	3
Partial broadcast ban	7	4	4	5	6	6
Total broadcast ban	1	4	5	4	3	3

Sources: World Health Organization, Nelson (2010) and EUCAM.

Table 6 reports the alcohol control policy index from 1975 to 2012 for the 13 countries. The alcohol policy control index has a sample mean of 11.46, with a minimum value of 0 (Spain 1975 to 1979), and a maximum of 19 (Norway 1975 to 1995). The overall trend is that the index is increasing over time, meaning that alcohol policy becomes stricter over time, especially for wine countries who in total have increased from 4.9 in 1975 to 10.9 in 2012. Spain is the country with the largest increase, from 0 to 10. Beer countries have increased their overall index value some, but remain fairly stable over the period. Spirits countries have the highest index values, and are the only country group which experienced a decrease in the index during the sample period. This decrease can largely be attributed to the Nordic countries joining the EU and EEA, forcing them to, for example, removing their alcohol wholesale monopolies.

6.4 Internet penetration

Over the past two decades, internet usage has grown rapidly, not the least within European countries, as can be seen in Table 7. Internet started to reach the population in 1990, hence, data is only available from 1990 and onwards. Internet penetration is highest in the spirits countries, with the highest value in Norway (94.6% internet penetration in 2012). Wine countries have the lowest overall penetration with 66.9% in 2012, and beer countries have a penetration of 85% in 2012. Italy has the lowest share of internet users in the sample, with a penetration of 55.8% in 2012. In general, though, the internet usage has increased rapidly in all countries from 2000 to 2012. Northern

European countries tend to have the highest penetration, while countries around the Mediterranean have the lowest penetration.

Table 6. Alcohol control policy index values, 1975–2012

Beer countries	1975	1980	1990	2000	2010	2012
Austria	7	6	7	7	7.5	7.5
Belgium	8	8.5	10.5	11.5	12.5	12.5
Denmark	6	7	7	8.5	9	9
Ireland	12	12	12	12	13	13
Netherlands	11	11	13	13	13	13
UK	14	14	14	13	14	14
Wine countries						
France	9.5	9.5	10.5	12.5	13.5	13.5
Italy	8	12	12	13	14	14
Portugal	2	4	6	8	8	8
Spain	0	4.5	10	10	11	11
Spirits countries						
Finland	15.5	18.5	18.5	14.5	15	15
Norway	19	19	19	17	17	17
Sweden	18.5	18.5	18.5	16.5	16.5	16.5
Averages						
Beer countries	9.7	9.8	10.6	10.8	11.5	11.5
Wine countries	4.9	7.5	9.6	10.9	11.6	11.6
Spirits countries	17.7	18.7	18.7	16.0	16.2	16.2
Overall	10.0	11.1	12.2	12.0	12.6	12.6

Sources: World Health Organization, Karlson and Österberg (2001) and Nelson (2010).

Table 7. Internet penetration (%), 1990–2012

Beer countries	1990	1995	2000	2005	2010	2012
Austria	0.1	1.9	33.7	58.0	75.2	80.0
Belgium	0.0	1.0	29.4	55.8	75.0	80.7
Denmark	0.1	3.8	39.2	82.7	88.7	92.3
Ireland	0.0	1.1	17.6	41.6	69.9	76.9
Netherlands	0.3	6.5	44.0	81.0	90.7	92.9
UK	0.1	1.9	26.8	70.0	85.0	87.5
Wine countries						
France	0.1	1.6	14.3	42.9	77.3	81.4
Italy	0.0	0.5	23.1	35.0	53.7	55.8
Portugal	0.0	1.5	16.4	35.0	53.3	60.3
Spain	0.1	0.4	13.6	47.9	65.8	69.8
Spirits countries						
Finland	0.4	13.9	37.2	74.5	86.9	89.9
Norway	0.7	6.4	52.0	82.0	93.4	94.6
Sweden	0.6	5.1	45.7	84.8	90.0	93.2
Averages						
Beer countries	0.1	2.7	31.8	64.9	80.7	85.0
Wine countries	0.0	1.0	16.9	40.2	62.5	66.9
Spirits countries	0.6	8.5	45.0	80.4	90.1	92.6
Average	0.2	3.5	30.2	60.9	77.3	81.2

Source: Author's rendering of data from the World Bank (2016).

7 Results

An examination of the data showed that there has been a rapid increase in internet usage in the studied countries, an overall increasing strictness of alcohol policy, a general decrease in per capita consumption of alcohol and a fairly stable amount of advertising regulations over time. T-tests indicate differences in consumption with and without advertising regulations. With the use of the theoretical framework and empirical analysis outlined earlier, I here present results and a sensitivity analysis.

7.1 Main regression results

As described in Section 5, the main regressions results consist of two estimated models; one model including the tourism control variable, and one model without this variable in order to extend the time-period, allowing for more variation over time in the advertising dummy variables. The main regression results are presented in Table 8, where regression (1) are the results from the model without tourism, (2) is the model without tourism but with a shorter sample period as in (3), and (3) is the model including all controls. Moreover, Table 9 and Table 10 reports estimations of the model including all controls, but with only of the advertising regulation dummies included. All regressions are GLS estimations with time fixed effects.

In the first regression (1) in Table 8, without the tourism variable included, the results suggest that internet advertising bans have no significant impact on consumption. The dummy for internet advertising restrictions, however, do take on a significant negative sign. These results suggest that advertising restrictions online may help decrease alcohol consumption, while bans seem to be ineffective. Moreover, both estimates for broadcast bans show significant positive signs, suggesting that bans in broadcast media likely are ineffective as well. The alcohol policy control index shows a significant negative sign, as expected. Both income and price also show significant negative signs, while the estimates for wine sentiment and unemployment show insignificant positive estimates. Aging of the population is estimated to have a negative effect on consumption, as expected.

In the third regression (3), with the tourism variable included, the results are somewhat different. The coefficient for internet advertising bans turns positive and significant, supporting the finding in the first regression that advertising bans online likely do not decrease alcohol consumption. The estimate for internet advertising restrictions is again significant and negative. The coefficients for the broadcast bans are, however, now negative and significant, contradicting the results in the first regression. The control index is negative and significant, as are price, aging and tourism. Income however has turned positive and insignificant. The unemployment rate remains positive and becomes significant. Wine sentiment remains insignificant with the additional control. The second regression (2) in Table 8, as well as the regressions in Table 9 and Table 10, report similar results.

Because the estimates differ somewhat between the estimated models, it is important to interpret them together. Among the control variables, the estimates for the control index, price and aging stay the same sign and are significant for both equations. They all also have the expected signs. The price elasticity is estimated to be between -0.24 and -0.55, which is in line with

previous studies on alcohol consumption (Nelson and Young, 2001; Selvanathan, 2006; Nelson, 2010). This suggests that the estimates for these should be reliable. Unemployment is only significant in the second regression, suggesting that it has no effect or a slightly positive effect on alcohol consumption. Wine sentiment is insignificant in both regressions, indicating that this cultural variable has little or no impact on alcohol consumption. Income changes sign and turn insignificant in the second equation, also suggesting that it has no significant effect on alcohol consumption.

Table 8. Panel data regressions for alcohol consumption

Variable	(1)		(2)		(3)	
Internet ad ban	-0.029	(1.25)	0.068*	(2.36)	0.099*	(3.49)
Internet ad restriction	-0.119*	(9.32)	-0.138*	(9.50)	-0.153*	(10.41)
Spirits TV ad ban	0.057*	(3.18)	-0.100*	(4.30)	-0.096*	(3.95)
All beverage TV ad ban	0.142*	(7.29)	-0.031	(1.15)	-0.069*	(2.64)
Control index	-0.039*	(19.71)	-0.058*	(16.70)	-0.061*	(18.20)
Income	-0.202*	(7.97)	-0.006	(0.18)	0.050	(1.58)
Price	-0.244*	(6.82)	-0.498*	(8.16)	-0.550*	(8.97)
Wine sentiment	0.027	(1.51)	-0.044*	(2.05)	-0.017	(0.78)
Unemployed rate	0.023	(1.44)	0.127*	(6.18)	0.121*	(6.04)
Percent 65 yr & over	-0.542*	(10.89)	-0.463*	(7.87)	-0.518*	(8.72)
Tourism rate	-	-	-	-	-0.060*	(4.15)
Constant	7.004*	(23.44)	6.413*	(15.20)	6.178*	(15.02)
Obs	302		227		227	
Time fixed effect	Yes		Yes		Yes	
Log first-diff	No		No		No	
Est. method	GLS		GLS		GLS	

Note: Dependent variable is natural log of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in natural logs, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

Of most importance, though, are the estimates for the advertising regulation dummies. The t-tests, reported in Section 6, suggested that alcohol consumption is lower with internet advertising bans, internet advertising restrictions and partial broadcast advertising. The opposite was, however, found for total broadcast advertising bans. As evident in Table 8, the regression results differ from the results from the t-tests, indicating that there are important country and time specific factors that need to be controlled for.

Table 9. Panel data regressions for alcohol consumption

Variable	(1)		(2)	
Internet ad ban	-0.019	(0.91)	-	-
Internet ad restriction	-	-	-0.138*	(10.01)
Control index	-0.052*	(14.51)	-0.052*	(23.85)
Income	-0.004	(0.13)	-0.021	(1.05)
Price	-0.483*	(7.11)	-0.484*	(8.62)
Wine sentiment	-0.033	(1.63)	0.008	(0.42)
Unemployed rate	0.083*	(3.87)	0.101*	(5.46)
Percent 65 yr & over	-0.606*	(9.30)	-0.536*	(9.42)
Tourism rate	-0.033*	(2.06)	-0.080*	(5.94)
Constant	6.591*	(13.86)	6.467*	(19.21)
Obs	227		227	
Time fixed effect	Yes		Yes	
Log first-diff	No		No	
Est. method	GLS		OLS	

Note: Dependent variable is log first-difference of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in log first-differences, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

The coefficient for internet advertising bans is in the first equation negative and insignificant, suggesting that they do not decrease alcohol consumption. Moreover, in the third equation, when tourism is controlled for, the coefficient turns positive and significant. These results suggest that internet advertising bans likely do not decrease alcohol consumption. The hypothesis of internet advertising bans not decreasing alcohol consumption can thus not be rejected.

Internet advertising restrictions, on the other hand, hold the same negative sign and significance for both (1) and (3). With the tourism control the size of the coefficient is somewhat larger. Overall, the results suggest that internet advertising restrictions likely can decrease alcohol consumption. The coefficient holds for both a longer time-period, and with the additional control of tourism, so results are likely reliable and the null hypothesis of internet advertising restrictions not decreasing alcohol consumption is rejected. However, it is important to interpret the results carefully because of limitations of the study discussed previously.

Table 10. Panel data regressions for alcohol consumption

Variable	(1)		(2)	
Spirits TV ad ban	0.039	(1.61)	-	-
All beverage TV ad ban	-	-	-0.033	(1.77)
Control index	-0.049*	(12.49)	-0.052*	(15.50)
Income	-0.035	(0.90)	0.010	(0.30)
Price	-0.479*	(6.99)	-0.472*	(7.13)
Wine sentiment	0.006	(0.22)	-0.025	(1.28)
Unemployed rate	0.062*	(2.36)	0.084*	(3.89)
Percent 65 yr & over	-0.684*	(9.85)	-0.605*	(9.81)
Tourism rate	-0.041*	2.28	-0.034*	(2.11)
Constant	6.960*	(14.52)	6.373*	(12.98)
Obs	227		227	
Time fixed effect	Yes		Yes	
Log first-diff	No		No	
Est. method	GLS		OLS	

Note: Dependent variable is log first-difference of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in log first-differences, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

The results found for the two broadcast advertising ban dummies are similar in all regressions. For the longer time-period, without tourism accounted for, they show a positive sign and are statistically significant, suggesting that the null hypotheses should not be rejected. When controlling for tourism, however, the signs turn negative and holds its significance, suggesting that the hypotheses can be rejected. While the third regression should be the preferred one, because of more controls, the contradicting results indicate that the broadcast advertising bans do not significantly decrease alcohol consumption. The null hypotheses of partial and total broadcast advertising bans not decreasing alcohol consumption is therefore not rejected.

7.2 Sensitivity analysis

In the previous section the results of the two main regressions suggested that three out of the four null hypotheses could not be rejected. Internet advertising restrictions was found to likely decrease alcohol consumption, while no type of alcohol advertising bans evaluated was estimated to decrease

alcohol consumption. Here, I re-estimate the model, first with OLS. next with log first-differences and lastly with the IV model presented in Section 5. Regressions with and without the control for tourism are reported for all specifications.

The two OLS regressions show similar results to the main regressions previously presented and thus support the previous findings. The results for these regressions are presented in Table 11. The alcohol policy control index, price and aging variables are still negative and statistically significant. The estimated price elasticity now ranges from -0.23 to -0.56, still in line with previous research. The unemployment rate is positive and significant in both regressions, similar to the main regressions. Income changes sign and turn insignificant in the second regression, again indicating small or no impact on alcohol consumption. Wine sentiment remains insignificant in both regressions.

Table 11. OLS regressions for alcohol consumption

Variable	(1)		(2)	
Internet ad ban	0.012	(0.43)	0.096*	(3.34)
Internet ad restriction	-0.148*	(7.52)	-0.166*	(9.61)
Spirits TV ad ban	0.035	(1.36)	-0.062	(1.81)
All beverage TV ad ban	0.078*	(3.11)	-0.021	(0.67)
Control index	-0.046*	(15.07)	-0.061*	(13.80)
Income	-0.174*	(3.80)	0.016	(0.34)
Price	-0.229*	(3.91)	-0.563*	(6.84)
Wine sentiment	0.036	(1.52)	0.026	(0.85)
Unemployed rate	0.049*	(2.00)	0.133*	(4.57)
Percent 65 yr & over	-0.552*	(7.08)	-0.640*	(7.94)
Tourism rate	-	-	-0.076*	(3.61)
Constant	6.754*	(12.73)	6.675*	(11.11)
R-squared	0.8159		0.8539	
Obs	302		227	
Time fixed effect	Yes		Yes	
Log first-diff	No		No	
Est. method	OLS		OLS	

Note: Dependent variable is natural log of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in natural logs, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

Furthermore, the conclusions about the advertising dummies drawn from the main regressions still hold. The internet advertising ban dummy is positive and turn significant in the second OLS regressions. Thus, the null hypothesis can still not be rejected. The broadcast advertising dummies are either insignificant, or positive and significant in the two OLS regressions. The null hypotheses for these dummies can therefore not be rejected either. The coefficient for internet advertising restrictions, however, is still negative and significant in both regressions. Again, the results therefore indicate that internet advertising restrictions may decrease consumption.

To account for possible non-stationarity in the data, GLS regressions with log first-differences (i.e. growth rate) are estimated. These results are presented in Table 12 below. From these regressions, we can see that only the price and unemployment variables remain significant for both estimations. The price coefficient is negative as in previous estimates and the price elasticity is now estimated to be between -0.40 and -0.56. The constant gives us the exogenous growth rate of per capita alcohol consumption, which is estimated to be between -1% and -2% annually. The constant is, however, insignificant in the second regression.

The coefficients for the alcohol advertising ban dummies are insignificant. Thus, alcohol advertising bans do not seem to reduce the growth rate or accelerate the decline of alcohol consumption. This supports previous results of not rejecting the null hypotheses that advertising bans do not decrease alcohol consumption. Most notable, however, is that the coefficient for internet advertising restrictions no longer is significant (although still the correct sign in both equations). The previous results, supporting the claim that internet advertising restrictions likely decrease alcohol consumption, therefore need to be interpreted with caution.

Lastly, the results from the IV model are presented. As explained previously, the IV model contains two instruments for the alcohol control policy index. The instruments are healthcare expenditures and the openness index of the country. In Table 13, results on level data are reported, and log first-differences are reported in Table 14.

Results do not differ significantly from the specifications previously reported. For the level data IV regressions, the (instrumented) alcohol policy control index, price, unemployment and aging all keep the same sign and significance as in the main regressions. Price elasticity is estimated to be between -0.30 and -0.56. Wine sentiment remains insignificant and income is only significant in the first regression. Internet advertising bans again show no indication of decreasing alcohol consumption. Estimates for broadcast advertising bans are overall insignificant, except the coefficient for partial bans that is negative and significant in the second regression. The differing

results still indicate that broadcast advertising bans likely do not decrease alcohol consumption. Moreover, the results for internet advertising restrictions are still negative and significant in both regression, again supporting the rejection of null hypothesis H2. The IV estimations with log first-differences also show similar results to the previously reported log first-differences estimates. Here, only the price estimate is statistically significant and indicate a price elasticity ranging from -0.48 to -0.55.

Table 12. Log first-difference regressions for alcohol consumption

Variable	(1)		(2)	
Internet ad ban	0.000	(0.03)	0.001	(0.17)
Internet ad restriction	-0.000	(0.00)	-0.001	(0.18)
Spirits TV ad ban	0.004	(0.82)	0.006	(1.17)
All beverage TV ad ban	-0.000	(0.00)	-0.003	(0.43)
Control index	0.002*	(2.80)	0.001	(1.56)
Income	-0.003	(0.18)	-0.058*	(2.67)
Price	-0.396*	(12.31)	-0.561*	(14.14)
Wine sentiment	0.032	(1.23)	0.022	(0.87)
Unemployed rate	-0.042*	(2.02)	-0.053*	(3.80)
Percent 65 yr & over	-0.068	(0.42)	-0.241	(1.27)
Tourism rate	-	-	-0.019	(1.01)
Constant	-0.020*	(2.55)	-0.010	(0.84)
Obs	289		214	
Time fixed effect	No		No	
Log first-diff	Yes		Yes	
Est. method	GLS		OLS	

Note: Dependent variable is log first-difference of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in log first-differences, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

Table 13. Instrumental variable regressions for alcohol consumption

Variable	(1)		(2)	
Constant	6.600*	(10.75)	5.978*	(8.26)
Internet ad ban	0.048	(1.22)	0.138*	(3.69)
Internet ad restriction	-0.157*	(7.62)	-0.169*	(9.52)
Spirits TV ad ban	-0.028	(0.62)	-0.116*	(2.52)
All beverage TV ad ban	0.054	(1.85)	-0.053	(1.43)
Control index IV	-0.055*	(6.31)	-0.074*	(8.74)
Income	-0.131*	(2.25)	0.095	(1.45)
Price	-0.299*	(4.03)	-0.560*	(6.66)
Wine sentiment	-0.023	(0.54)	-0.010	(0.26)
Unemployed rate	0.051*	(1.96)	0.169*	(4.73)
Percent 65 yr & over	-0.428*	(4.05)	-0.603*	(7.12)
Tourism rate	-	-	-0.080*	(3.70)
Obs	291		227	
Time fixed effect	Yes		Yes	
Log first-diff	No		No	
Est. method	IV-GLS		IV-GLS	

Note: Dependent variable is natural log of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in natural logs, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

Table 14. Instrumental variable regressions for alcohol consumption, log first-differences

Variable	(1)		(2)	
Constant	-0.184	(0.53)	0.177	(1.05)
Internet ad ban	-0.054	(0.47)	0.082	(1.10)
Internet ad restriction	0.014	(0.48)	-0.005	(0.55)
Spirits TV ad ban	0.026	(0.51)	-0.026	(0.91)
All beverage TV ad ban	-0.006	(0.61)	-0.039	(1.19)
Control index IV	0.015	(0.55)	-0.013	(0.98)
Income	-0.012	(0.33)	-0.039	(1.07)
Price	-0.477*	(5.03)	-0.549*	(8.45)
Wine sentiment	-0.047	(0.34)	0.096	(1.22)
Unemployed rate	-0.076	(0.90)	-0.039	(1.32)
Percent 65 yr & over	0.140	(0.16)	-1.095	(1.60)
Tourism rate	-	-	-0.054	(1.05)
Obs	277		214	
Time fixed effect	No		No	
Log first-diff	Yes		Yes	
Est. method	IV-GLS		IV-GLS	

Note: Dependent variable is log first-difference of per capita consumption of litres of pure alcohol for 13 countries within EU and EEA. All variables in log first-differences, except for four advertising regulation dummies and the alcohol policy control index. t-Statistics reported in parentheses. * indicate statistically significant at the 5%-level.

8 Discussion

In the previous section, the results from the main regressions and sensitivity analysis regressions were reported. Overall, I find support for rejecting null hypothesis H2, meaning that internet advertising restrictions likely can decrease alcohol consumption. The other three hypotheses could not be rejected, however, so I find no support for alcohol advertising bans on the internet or in broadcast media decreasing alcohol consumption. In this section, I will discuss these results and possible explanations. First, I will discuss the results found for the set of control variables and end with a discussion on the alcohol advertising regulations.

For several of the control variables, the estimates keep the same sign and remain significant over a number of specifications, and are thus considered to be reliable estimates. There are, however, of course limitations remaining

(that have been discussed earlier) so the interpretation should always be done with caution. The alcohol policy control index shows a negative effect on alcohol consumption. This is also what is found in, for example, Nelson (2010). The control index increases when stricter alcohol regulation is implemented in the country, so the results seem reasonable and indicate that stricter alcohol policies likely work to decrease alcohol consumption. Another explanation could be that the control index mainly measures the countries that generally consume more or less because of attitudes towards drinking. For example, Nordic countries generally have stricter alcohol policies and attitudes in these countries towards alcohol consumption likely make them drink less than other countries. However, this is what the IV regression aims to capture, and the estimates remain the same with this specification as well, supporting the initial findings.

The estimates for price also remain stable over various specifications. The estimates of the price elasticity ranges from -0.23 to -0.56, with the highest in the OLS regression without tourism control and the lowest estimate in the OLS regression with tourism control. The estimates are in line with previous research on the subject, as mentioned earlier, and seem reasonable considering that many studies show that alcohol consumption responds considerably to price changes. It is also worth noting that the price estimates are the only estimates that hold for the models using log first-differences.

Aging and unemployment estimates also hold for most specifications, with unemployment having a significant positive effect on alcohol consumption and aging having a significant negative effect on alcohol consumption. The unemployment estimates are in line with those of Nelson (2010), but contradict previous US studies such as Ruhm (1995) and Ruhm and Black (2002), indicating that the US experience cannot be applied universally. Moreover, unemployment is likely positively correlated with alcohol consumption because people often consume more alcohol in bad times. It could also be an indication of various social and economic factors contributing to an increase in alcohol consumption. Furthermore, with a larger share of the population being 65 years and older, alcohol consumption will reasonably decrease since young people tend to consume more alcohol, as suggested by Nelson (2010).

The estimates for income and wine sentiment are quite inconclusive. With the use of different models, these controls change sign and are in many cases insignificant. This could mean that these factors in general do not have a significant effect on alcohol consumption. On the other hand, there may be issues with the chosen data. GDP per capita is used as the income variable, which is a fairly broad measurement for income. In future research, a narrower measurement such as household income could be more favourable for the

study, as it would likely capture how much the population can afford to consume better. Moreover, wine sentiment is used as a cultural control, following the methodology of Nelson (2010). However, as is shown in Section 6, there is a homogenisation of beverage types across countries, but cultural differences and attitudes towards drinking may remain, which could be an explanation for the ambiguous results. Furthermore, the estimates for tourism is negative and significant in most specifications. This is quite counterintuitive, as it is supposed to capture alcohol consumed by tourists, and is contrary to some of the estimates found in Nelson (2010) taking use of the same control for tourism. In future research, another measure such as alcohol expenditure from tourists would likely give more accurate estimates.

The results presented in the previous section indicate that there is no significant decrease in alcohol consumption with either partial or total alcohol advertising bans on internet or in broadcast media. As discussed previously, earlier research on the topic has so far been inconclusive with some studies finding a reduction in alcohol consumption due to advertising bans, while some do not find this. The results of this study are in line with studies such as Nelson and Young (2001) and Nelson (2010). Because other previous research has found the opposite to be true, it is necessary to draw conclusions with precaution. In some of the specifications, for example, the estimates for both partial and total broadcast bans are negative and significant, suggesting that they may decrease alcohol consumption. Because the results differ between specifications, however, the null hypotheses will not be rejected. A possible explanation for the results is because advertising bans here are treated as exogenous, while some previous studies treat the bans as endogenous. Because of the long-lasting nature of the bans and liberalisation within the EU, it is however quite unlikely that bans are endogenous. Moreover, more accurate results could probably be given when a more comprehensive time-series on internet advertising bans is available, as it would facilitate more variation.

Lastly, the coefficients for internet alcohol advertising restrictions remain negative and significant for almost all models, except for when log first-differences are used. This indicates that the null hypothesis for internet advertising restrictions can be rejected, and that this type of regulations likely does decrease alcohol consumption. A possible explanation for this is that with restrictions on when and where on the internet companies can advertise alcohol, consumers are less exposed to alcohol overall and so the demand decreases. With the restrictions, it is also likely more difficult for companies to target consumers on the internet as easily as it would be without restrictions. Because mainly advertising bans have been studied previously, rather than restrictions, it is, however, necessary with more research on the

topic of restrictions to be able to draw certain conclusions from the results. As discussed, there are limitations to the study, such as treating the restrictions as exogenous. Again, a more comprehensive dataset containing a longer time-period or more countries could likely give more accurate results because of more variation in the number of restrictions. To better rule out endogeneity concerns, a specification like the one used in Saffer and Dave (2002) where restrictions would be treated as endogenous could also help test the validity of the results in future studies.

While there are limitations to the study, most of the results found do hold for a number of specifications and are in line with previous research on alcohol consumption and alcohol advertising. In the specifications using log first-differences, however, estimates are generally insignificant, so there is uncertainty in the possibility of drawing conclusions from the results. The results for alcohol advertising bans are in general inconclusive, so there is no clear evidence of them decreasing alcohol consumption. Alcohol advertising restrictions on the internet, however, show a significant negative effect on alcohol consumption and should therefore be preferred from a policy perspective. As stated, though, results should be interpreted with precaution because of the limitations of the study discussed previously.

9 Conclusion

Alcohol consumption and how to prevent excessive drinking resulting in issues such as drunk-driving fatalities, liver diseases and heart diseases have for a long been an important issue for many countries. Countries often work actively with alcohol policy and implement regulations such as minimum legal drinking ages or BAC levels for driving. Another common alcohol policy is regulation of alcohol advertising. These regulations often apply on different media types and generally come in the form of restrictions on time, place and content, partial bans or total bans. During the last few decades, it is also evident that the internet has become a big part of the population's everyday life and advertising on the internet is increasing rapidly.

While much research has been done on the topic, previous studies on the subject of alcohol consumption and alcohol advertising are, however, so far inconclusive. Some studies find that alcohol advertising bans have a significant negative effect on alcohol consumption, while several studies find no evidence for this conclusion. Moreover, previous studies have mainly focused on advertising bans in broadcast media, as this generally has been the main output for alcohol advertising. With the rapid increase in both internet

usage and internet advertising since the 1990's, it is, however, of importance to evaluate whether bans and restrictions on alcohol advertising on the internet have an effect on alcohol consumption.

This study has contributed with two main results. The first is contribution to previous literature on advertising bans in broadcast media. The results vary over different types of specifications, and so they are inconclusive. This may be an indication of advertising bans in broadcast media not significantly decreasing alcohol consumption. The second results are those for bans and restrictions on alcohol advertising on the internet. The estimates for internet advertising bans are generally insignificant, suggesting that advertising bans, both on the internet and in broadcast media, do not decrease alcohol consumption. Internet restrictions, however, are estimated to have a significant decreasing effect on alcohol consumption over various specifications. Limitations, which previously have been addressed, can though be found with the study so results should be interpreted with precaution.

These results can be valuable from a policy perspective when evaluating alcohol policies. This study contributes to previous research indicating that alcohol advertising bans may not be an effective alcohol policy measure. Advertising restrictions on the internet, however, may decrease alcohol consumption and could therefore be a more efficient and effective policy.

Moreover, this thesis emphasises the need for additional research on the subject of alcohol advertising on the internet. Future studies should address the mentioned limitations in this study, as well as evaluate a more comprehensive dataset, preferably containing more countries to facilitate more variation. Lastly, a comparison of different types of alcohol advertising restrictions would ease alcohol policy work and help decrease health risks from alcohol consumption.

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