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The effect of the Covid-19 pandemic on private imports of alcoholic beverages in Sweden

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Abstract

Title: The effect of the Covid-19 pandemic on private imports of alcoholic beverages in Sweden

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Key words: Consumption theory, consumer preferences, Covid-19, regression analysis, substitution effect

Purpose: The purpose of this study is to determine how consumption patterns of alcoholic beverages on the Swedish market have changed as a consequence of the Covid-19 pandemic in 2020 and why this is the case. Consumption levels during the year 2020 will be compared to year 2019 in order to distinguish a potential pattern of change.

Theoretical framework: The study is based on consumption theory, where the income and substitution effect of alcoholic beverages in Sweden is examined. Relevant research on demand for alcohol in Sweden as well as socioeconomic changes brought by the Covid-19 pandemic are also used in the study.

Method: The study is of a quantitative nature, using statistical methods in order to reach a conclusion. The method mainly used is regression analysis, where the regressions are set up according to the Gauss-Markov assumptions and tested for multicollinearity.

Conclusion: The analysis showed that there partly exists a positive substitution effect when it comes to alcoholic beverages being purchased abroad. The changes in consumption was the biggest in Swedish counties closely bordering other countries.

Table of contents

1. Introduction	5
1.1 The Swedish monopoly on alcohol	5
1.2 The Covid-19 pandemic	5
1.3 Problem statement	5
1.4 Purpose	6
1.5 Demarcation	6
1.6 Methodology	6
2. Theoretical framework and relevant research	8
2.1 Consumption theory	8
2.1.1 Consumer preferences.....	8
2.1.2 The income and substitution effect.....	8
2.2 The demand for alcohol	9
2.3 Changes brought by the Covid-19 pandemic	11
2.4 Hypotheses	12
3. Methodology and Data	14
3.1 The approach	14
3.1.1 Linear regression analysis	16
3.2 Reliability and validity of results	17
3.2.1 Gauss-Markov assumptions and multicollinearity	17
3.2.2 Reliability and validity of sources and data used	17
4. Results and analysis	19
4.1 Private alcohol imports and their profitability	19
4.2 The correlation between distance to country borders and private alcohol imports	22
4.3 Testing for Gauss-Markov assumptions and multicollinearity	26

4.3.1 Heteroscedasticity	26
4.3.2 Multicollinearity	26
4.4 Substitution effect during the pandemic.....	27
4.5 Other contributing factors	27
5. Conclusion	28
5.1 Conclusion	28
5.2 Possibilities for further research.....	29
6. List of references	30
Appendix A	33
Appendix B	41
Appendix C	49
Appendix D	55

1. Introduction

1.1 The Swedish monopoly on alcohol

The state-owned Swedish alcohol monopoly Systembolaget was founded with the purpose of minimizing the dangerous aspects of alcohol consumption by selling and distributing it in a responsible manner (Systembolaget, 2021a). Research conducted by Wetoszka (2016) concluded that although the Swedish government is relatively successful in its mission to reduce alcohol consumption through its restrictive alcohol politics and avoidance of marketing alcoholic beverages, it is important to keep in mind the unregistered imports of alcohol that could have an effect on the statistical efficiency of the system.

1.2 The Covid-19 pandemic

In March of 2020 the World Health Organization declared the outbreak and spread of Covid-19 as a global pandemic (World Health Organization, 2020). The outbreak was deemed a global threat and therefore led to extensive restrictions globally in order to minimize the spread. In Sweden the intensity of the restrictions largely varied throughout the year. Since the start of the pandemic, Systembolaget has shown a large increase in overall sales throughout the year 2020. The company's revenues increased with 14% in comparison to 2019, while the volume of sales increased with around 11% (Systembolaget, 2021b). However, around 70% of Swedes asked in a study performed by Norstat claim that their consumption when it comes to alcohol has stayed the same during 2020 as compared to the year before (Systembolaget, 2021c). Research conducted by The Swedish Council for Information on Alcohol and Other Drugs (CAN) also showed that although total registered sales of alcohol have increased during March and April of 2020, the amount of unregistered private alcohol imports has had a significant decrease with -56% (Trolldal, 2020a) which can be a partial explanation for consumption levels technically remaining the same.

1.3 Problem statement:

As Systembolaget experienced a sharp increase in sales since the start of the pandemic, this suggests a correlation between the development of Covid-19 and levels of alcohol consumption in Sweden. Since restrictions imposed during the pandemic largely limited the possibility to travel and therefore the possibility to purchase alcoholic beverages abroad, one might suggest

that areas in Sweden closely bordering to other countries experienced larger changes in the volume of alcohol sold through Systembolaget than those further away from country borders. According to the study conducted by Norstat (Systembolaget, 2021c) the tendency to travel abroad from Sweden decreased from 18% to 5% amongst the population during the year 2020 which might have had an impact on the amount of privately imported alcohol.

The study will therefore focus on the following problem statement:

How has the inability to privately import alcoholic beverages affected consumption patterns in Sweden? This considering the different counties in which Sweden is divided.

1.4 Purpose:

The purpose of this study is to determine how consumption patterns of alcoholic beverages on the Swedish market have changed as a consequence of the Covid-19 pandemic in 2020 and why this is the case. More specifically, the study will focus on the difficulties of privately acquiring alcohol from abroad as well as the difficulties, due to the pandemic, in selling alcohol to foreigners wanting to purchase from Systembolaget. Consumption levels during the year 2020 will be compared to year 2019 in order to distinguish a potential pattern of change.

1.5 Demarcation:

This study explores consumption of alcoholic beverages on the Swedish market, focusing on quantities sold within the state-owned alcohol monopoly Systembolaget years 2019 and 2020. The quantities sold will be examined based on the different counties in Sweden, in order to determine whether there is a larger difference with quantities purchased in counties closely bordering with other countries. The data used for the analysis will be derived from annual reports and other available datasets obtained from the webpage of Systembolaget.

1.6 Methodology

The study will begin with an overview of the theoretical framework and relevant research, where the focus will lie on economic consumption theory and behavioral science. This framework will be used to analyze the selected datasets from Systembolaget in order to empirically study the

problem statements using descriptive statistics and econometric theory. The study will then be concluded and final remarks will be made.

2. Theoretical framework and relevant research

2.1 Consumption theory:

Consumption theory is based on exploring the way in which we consume and why we choose to do so. This can be fundamentally explained by the different preferences and budget that consumers might have, as well as the utility that consumers get from acquiring a certain good or service.

2.1.1 Consumer preferences

Consumption is most often limited by a budget, i.e. the disposable income. Each consumers' budget is represented by a budget line $p_1x_1 + p_2x_2 = m$ where m is the income, p_1 is the price of good x_1 and p_2 is the price of good x_2 (Varian, 2010). By letting x_1 represent a quantity of a certain type of good (for example a bottle of alcohol) and x_2 being the quantity of all other goods, we can get a clear representation of how much of its budget a consumer would be willing to pay for that bottle in relation to his or her income and other goods that he or she wishes to purchase. Based on the types of preferences that a rational consumer might have, it will most often choose to purchase the good or service that maximises his or her utility. This utility might be subjective, and could differ depending on the quantity of the goods bought. One consumer might for example enjoy one or two units of a good, but the third unit might bring a lower utility than the previous unit (Varian, 2010).

2.1.2 The income and substitution effect

Two important aspects to keep in mind whilst examining consumer preferences are the income effect and the substitution effect. The income effect could be explained as a change in demand for a certain good that occurs when the consumer's income changes, whilst the substitution effect refers to how likely consumers are willing to substitute a certain good for another one when the price of the first good rises (Varian, 2010). A study conducted by Clements & Selvanathan (1991) during the 1990's has shown that when it comes to alcohol consumption the substitution effect is strong in wines, beers and spirits. This reasoning is also supported in a study conducted by Andrienko & Nemtsov (2005) as the authors found that people tend to substitute particularly vodka and beer with one another, if the price of either one rises. Essentially, this entails that consumers prefer to purchase a cheaper substitute, when the prices of a certain alcoholic

beverage rise. Nelson (2003) further examined the substitution effect when it comes to alcohol beverages and concluded that monopolies have a large negative substitution effect on total alcohol demanded, which entails that with an increase in the price of alcohol consumers will either search for a better alternative or simply avoid buying the good at all.

When it comes to the income effect, Clements & Selvanathan (1991) concluded that most consumers, in relation to the income they receive, treat wine and beer as a necessary (or normal) goods whilst spirits are regarded as luxury goods. This means that consumers are less likely to purchase the same amount of spirits as previously if their income would decrease or if their employment status would in a similar manner be negatively affected. However, with rising income it has been shown that consumers tend to purchase more alcohol overall although it tends to be alcohol of a higher quality (Andrienko & Nemtsov, 2005).

2.2 The demand for alcohol

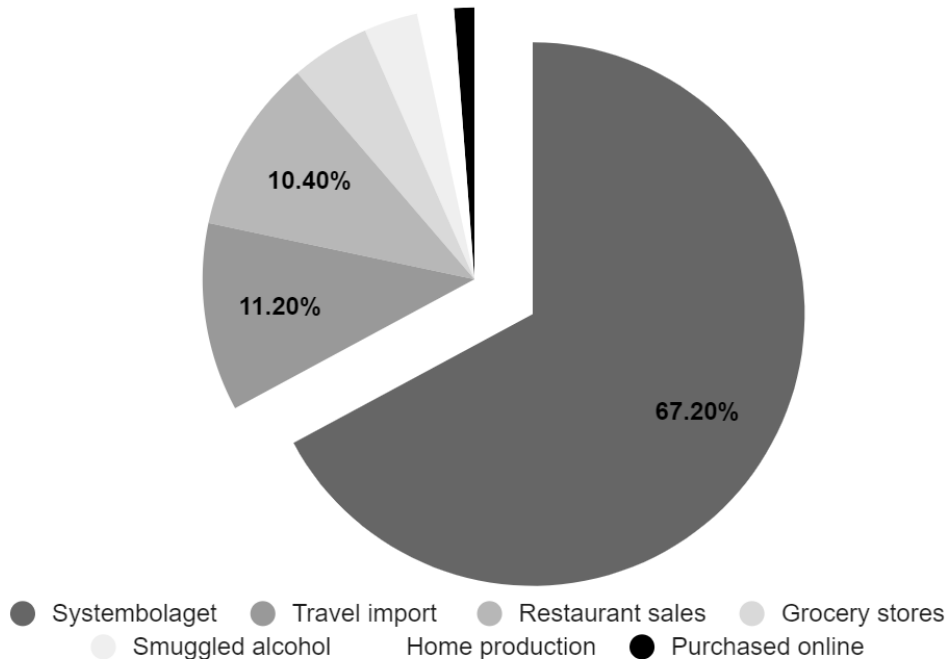
Gallet (2007) examined what affects the demand of alcohol in relation to elasticities. The author focused on price elasticity, income elasticity as well as advertising elasticity and found that the demand for beer is more inelastic than the demand for wine and spirits. This indicates that a relatively high increase in the price of beers will only lead to a slight decrease in the quantity demanded. Similarly, Gruenewald et al. (2006) examined the Swedish market during the 1990's and found that as price increases in alcoholic beverages that are of higher quality and higher price range consumers tend to substitute these for low-price alcoholic beverages instead of reducing their consumption. This entails that in order for the total quantity of alcohol demanded to be affected negatively there would have to be a large price increase when it comes to alcoholic beverages in the lower price range.

When it comes to purchasing alcohol abroad, Grittner et al. (2014) examined private alcohol imports in the Nordic countries and found that regional differences played a big role when it came to the willingness to travel abroad and purchase alcohol. The authors studied the responses of 4006 people and concluded that consumers living closer to country borders imported more alcohol than those living further away. Furthermore, it was also concluded that the most common country for Swedes to import alcohol from was Germany, and that the country most commonly importing alcohol from Sweden was Norway. The border trade between Sweden

and Norway has increased largely due to lower prices offered in Sweden and a profitable exchange rate that Norwegians face when it comes to the Swedish krona (Nordlund, 2003).

Holder (2009) also examined private imports of alcohol in the Nordics and found that the lower the price that the neighboring countries offer on alcohol, the more alcohol is being imported by those living close to the borders. During 2019 the most common place to purchase alcohol in Sweden was at Systembolaget, which accounted for 67,2% of all alcohol purchases. This was followed by alcoholic beverages privately imported by consumers through travel, which had a share of 11.2% as well as restaurant based consumption that accounted for 10,4% (Trolldal, 2020b). The remaining shares were divided between sales of medium-strong beers through grocery stores (4.7%), smuggled alcoholic beverages (3.2%), alcoholic beverages produced at home (2.2%) as well as alcoholic beverages purchased online (1.2%) (Trolldal, 2020b). These outcomes are illustrated in Graph 1 ‘The acquirement of alcohol in Sweden (2019)’.

The acquirement of alcohol in Sweden (2019)



Graph 1: *The acquirement of alcohol in Sweden (2019)*

Source: *Trolldal (2020b.)*

The Covid-19 pandemic largely limited the possibility of travelling abroad as well as within Sweden. A study conducted by Trafikanalys (2020) showed that as a result of the outbreak in March 2020 travelling decreased in total with 23% in March to April, and then decreased with an additional 12% during July through August.

These findings suggest that as travel import accounts for around 11% of the total acquisition of alcohol in Sweden, changes in consumption during the year of the pandemic should be relatively drastic within the alcoholic beverages that Swedes most commonly import from abroad. This leads to the first hypothesis that will be tested in this study:

1. *The change in consumption during the Covid-19 pandemic should be the biggest for the type of alcoholic beverage for which private imports are most profitable.*

Furthermore, Swedes living in counties closely bordering other countries might have experienced a shock when it comes to the costs of alcoholic beverages due to the inability to privately import alcohol from abroad. Along with the lack of foreigners coming into the country to purchase at Systembolaget one might suggest that there exists a large substitution effect for alcohol in these particular Swedish counties. This leads to the second hypothesis that will be tested in this study, namely:

2. *If there is a positive substitution effect for alcoholic beverages, it should be the largest in Swedish counties closely bordering to countries where alcohol is cheaper and the smallest in Swedish counties bordering to countries where alcohol is more expensive.*
 - a. *In contrast, if there is a negative substitution effect for alcoholic beverages, it should be the smallest in Swedish counties closely bordering to countries where alcohol is cheaper and the largest in Swedish counties bordering to countries where alcohol is more expensive.*

2.3 Changes brought by the Covid-19 pandemic

In addition to the hindrances in travel, the pandemic also has had a negative impact on employment levels in Sweden. The employment rate fell with 1.1% and the level of unemployment increased with 1.5% as compared to the previous year, setting total

unemployment level at 8.3%. Research has also shown that although a share of the population got to keep their employment status, the amount of hours worked decreased in businesses that were largely affected by the lack of tourism and inability to travel, amongst others. The amount of full time studying students was during 2020 the highest since 2005 (SCB, 2021), which may suggest an unwillingness to search for full time employment during the pandemic. These are factors that also could have affected the consumption patterns throughout the year and therefore partly influenced what alcoholic beverages became more or less desirable to purchase in Sweden, considering the previously mentioned income effect.

2.4 Hypotheses

The above mentioned theoretical framework and relevant research has therefore lead to the following hypotheses that will be tested in this study:

1. The change in consumption during the Covid-19 pandemic should be the biggest for the type of alcoholic beverage for which private imports are most profitable.
2. If there is a positive substitution effect for alcoholic beverages, it should be the largest in Swedish counties closely bordering to countries where alcohol is cheaper and the smallest in Swedish counties bordering to countries where alcohol is more expensive.
 - a. In contrast, if there is a negative substitution effect for alcoholic beverages, it should be the smallest in Swedish counties closely bordering to countries where alcohol is cheaper and the largest in Swedish counties bordering to countries where alcohol is more expensive.

The profitability of acquiring alcohol abroad is measured in two ways. Firstly, by the amount of SEK that a consumer saves by purchasing a liter of an alcoholic beverage abroad rather than in Sweden. This since purchases made abroad often come with a limit of space on how much consumers are allowed to import into the country, consumers should thus want to maximize their utility by importing the alcohol that is relatively cheaper when bought in large amounts. The second way in which this will be measured is by looking at the relative price ratio, that is the price of the alcoholic beverage at Systembolaget divided by the price of the same good purchased abroad. This will give a fair estimate of how much cheaper a certain good is abroad than in Sweden.

When it comes to examining whether there exists a positive or negative substitution effect for alcoholic beverages in Swedish counties a regression analysis is conducted. The dependent variable is the change in sales at Systembolaget between 2019-2020 in each of the country's counties. The first independent variable is the time that it would take a consumer to drive from each county's resident city to Denmark's Kastrup. Kastrup was chosen as the destination since it is a point through which Swedes most commonly pass whilst making the journey by car in order to purchase alcohol abroad. The second independent variable is a dummy variable stating whether or not the county borders a country will lower prices on alcoholic beverages.

3. Methodology and Data

3.1 The approach

In order to test hypothesis one, and determine which alcoholic products are most profitable for Swedes to privately import, the analysis begins by studying the price difference between the prices in SEK set by Bordershop (a border trade shop located in Germany) and Systembolaget (the state monopoly selling alcohol in Sweden). The price differences were studied for a unit of hard liquor, strong beer, wine and sparkling wine in order to determine the following:

1. How much a consumer saves based per liter of alcohol purchased
2. How much a consumer saves by focusing on the relative price ratio per unit of alcohol purchased

Choosing these two particular factors, a price difference per liter purchased and the relative price ratio, lies in the following reasons. There are often transport costs associated with importing any goods from abroad, in addition to the transport cost there is also a limited amount of quantity that a person can bring with them. It might therefore be reasonable to assume that each consumer would like to maximize their utility by purchasing the types of alcoholic beverages that are most profitable to privately import in large quantities. In this case, it might be of interest to see what type of alcohol is most profitable when purchased per liter. In addition, the relative price ratio is considered an important factor since it gives a proper estimation on what products are relatively cheaper while comparing the prices of the products between Systembolaget and Bordershop directly.

The price difference per liter purchased and the relative price ratio helps us first determine what type of alcohol is most commonly imported, and thereafter identify whether these beverages have been substituted by purchases made at Systembolaget during the Covid-19 pandemic when travelling abroad and importing goods was not possible. The data is derived from Bordershop (Bordershop, 2021) and Systembolaget (Systembolaget, 2021d.), and the derived values are thereafter analysed. For each product type, a mean value of savings per liter and a mean value of the relative price ratio was calculated for all articles per alcohol type in order to determine which types of alcoholic beverages are the most popular to import. Each category of alcohol includes 20 different brands of strong beers, wines, sparkling wines and spirits that were taken into account. The compiled datasets of how much money a consumer saves by purchasing a liter of alcohol abroad can be found in Appendix A, where ‘Price

difference per 1000ml’ represents the amount of money saved by choosing to purchase a liter of the beverage at Bordershop rather than at Systembolaget.

The dataset on how much money a consumer saves in relation to the relative price ratio can be found in Appendix B, where ‘Relative price ratio’ represents the ratio between purchasing a unit of alcohol at Systembolaget relative to purchasing it at Bordershop. This ratio was calculated by dividing the prices given at Systembolaget by the prices at Bordershop for each product. The calculations for the relative price ratio were based on 1000ml volume for spirits (as this was almost exclusively the volume sold at Bordershop), 750ml wines and sparkling wines, as well as 24 cans of 330ml strong beers.

In table 1 seen below are examples of price differences as well as relative price ratios for six different products available at Systembolaget and Bordershop, in order to provide an estimate on what values the results tended to move towards.

	<i>Article</i>	<i>Price difference per liter purchased</i>	<i>Relative price ratio</i>
<i>Strong beers</i>	Heineken 5%	23,99	2,59
	Falcon Export 5.2%	19,19	2,78
<i>Wines</i>	Cloudy Bay Sauvignon Blanc	45,69	1,14
	M de Minuty	40,36	1,28
<i>Sparkling wines</i>	Freixenet Chianti	54,76	1,60
	Piper-Heidsieck Brut	96,89	1,22
<i>Spirits</i>	Jameson	236,81	2,24
	Jägermeister	199,24	1,93

Table 1: *Examples of price differences and relative price ratios*

3.1.1 Linear regression analysis

As hypothesis two examines whether there exists a positive or negative substitution effect regarding alcoholic beverages in Sweden, and whether the size of this effect depends on consumers' proximity to country borders, a linear regression analysis was used. The regression is based on the percentage change in sales years 2019-2020 at Systembolaget in each of the Swedish counties, this is the dependent variable of the regression. A simple regression model is used according to the following formula (Montgomery & Peck, 1982):

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \varepsilon$$

Where β_0 as well as β_1 and β_2 were calculated with the help of the regression, and ε represents a random error that needs to be accounted for and which remains unknown. These constants were estimated with the help of the least squares method where the most appropriate values were calculated based on a minimized value of the sum squared differences (Montgomery & Peck, 1982). In order to determine whether there lies a positive or negative substitution effect for alcoholic beverages in Sweden I examined each of the 21 Swedish counties. I began by determining the driving distance from a residential city within each county to Denmark's Kastrup, this distance is the independent variable x_1 and is measured in the amount of hours that it takes to drive between the two points. This variable is called 'Time'. The reason for choosing Kastrup as the city from which the distance is measured is that it is a point through which most travellers typically pass in order to make the journey to Germany from Sweden by car. It is a city that is right at the end of Öresund bridge which connects Sweden and Denmark, making it an appropriate point to take into consideration in this study. The second variable is a dummy variable, which was established as a way to distinguish counties that border or are closely aligned with countries with more expensive alcohol than in Sweden, such as Finland and Norway. Counties that closely border countries with more expensive alcohol were given the value 1, whilst counties that do not were given the value 0. This variable is called 'Border'. With the help of the dummy variable, the independent variable β_2 is calculated. The regression therefore takes the following form:

$$\text{Change in sales} = \beta_0 + \beta_1(\text{Time}) + \beta_2 (\text{Border}) + \varepsilon$$

The regression was performed for each type of alcoholic beverage, showing what effect the time of travelling abroad to purchase alcohol and the vicinity to country borders has on the change in sales in each county. This in turn, gives an estimation on what effect the inability to privately import alcohol into Sweden has had on the consumption patterns in the country.

3.2 Reliability and validity of results

3.2.1 Gauss Markov assumptions and multicollinearity

In order to test the reliability of the regression model, the model was tested according to the Gauss-Markov assumptions in order to determine whether the estimates produced by the are best linear unbiased (Wooldridge, 2013) . The assumptions are as follows:

1. All explanatory variables are exogenous

$$E(\varepsilon_i | x_i) = 0$$

2. The error terms are homoscedastic

$$\text{Var}(\varepsilon_i | x_i) = \sigma^2$$

As both the variable ‘Time’ as well as ‘Border’ are variables that are determined outside of the model, and therefore do not depend on the change in sales, they are exogenous variables. The data was also tested for multicollinearity, which examines whether there might exist a linear combination of the explanatory variables. Testing for heteroscedasticity was performed with the use of White’s test, which tests the hypothesis ‘The errors are homoscedastic’. The test for multicollinearity was conducted with the Variance Inflation Factor (VIF) test.

3.2.2 Reliability and validity of sources and data used

As the data used in this study originates from official websites of the outlets being examined there is little reason to question the reliability of these sources. The quantitative methods used for this study produce transparent and objective results that enable reproducibility of the study. In terms of validity the quantitative methods used produce results that correspond well with the theoretical framework and lead to plausible conclusions. As there are only 21 counties in

Sweden, the regression consists of a relatively small data set, this needs to be kept in mind whilst interpreting the regression results as it could affect the reliability.

4. Results and analysis

4.1 Private alcohol imports and their profitability

Based on the data found in Appendix A, as well as the mean values shown in the second column of table 2 ‘Consumers’ gain of purchasing alcohol at Bordershop in comparison to Systembolaget’ shown below, it can be concluded that consumers save the most money by purchasing spirits when it comes to purchases made per liter. This followed by sparkling wines, wines and finally strong beers. As the value for spirits is significantly higher than the remaining three categories of alcohol, we can conclude that spirits are a popular good to import from abroad. This correlates well with the idea of spirits being regarded as luxury goods (Clements & Selvanathan, 1991) since the cheaper price abroad thus makes them all the more attractive to import.

Alcoholic beverage	Mean value of money saved (SEK)	Mean relative price ratio of Bordershop compared to Systembolaget
Strong beers	25,19	2,87
Wines	29,08	1,33
Sparkling wines	54,07	1,29
Spirits	185,32	2,04

Table 2: *Consumers’ gain of purchasing alcohol at Bordershop in comparison to Systembolaget*

Proceeding to the relative price ratio, and what goods become profitable for Swedes to privately import when considering this factor, the results can be found in Appendix B. In the appendix, the values shown in the ‘Relative price ratio’ column show a ratio of the prices of Bordershop in terms of the prices of Systembolaget. As an example, we turn to table 3 below. If a consumer has a certain amount of money to spend on a 24 pack of Carlsberg at Systembolaget, they can roughly buy 4 times as many units of it with the same amount of money at Bordershop.

Similarly, they can buy 3 times as many units of Tuborg Grön. This comparison is necessary as each consumer has, as previously mentioned, a limited budget which is constrained by the amount of disposable income they have (Varian 2010). The amount of a certain good that can be purchased at a certain price therefore has a large influence over how the consumer prefers to spend their income, especially considering the lower income that some consumers might have faced as a result of the increased unemployment rate in Sweden in 2020 (SCB, 2021). Based on the third column in table 2 above we can conclude that although consumers save most money by buying spirits per liter, they can also purchase significantly more strong beers at Bordershop than Systembolaget as shown by the relative price ratio values. This is a very significant amount as each unit represents 24 cans of 330ml strong beers, and we might therefore assume that strong beers would be a popular good to import as well.

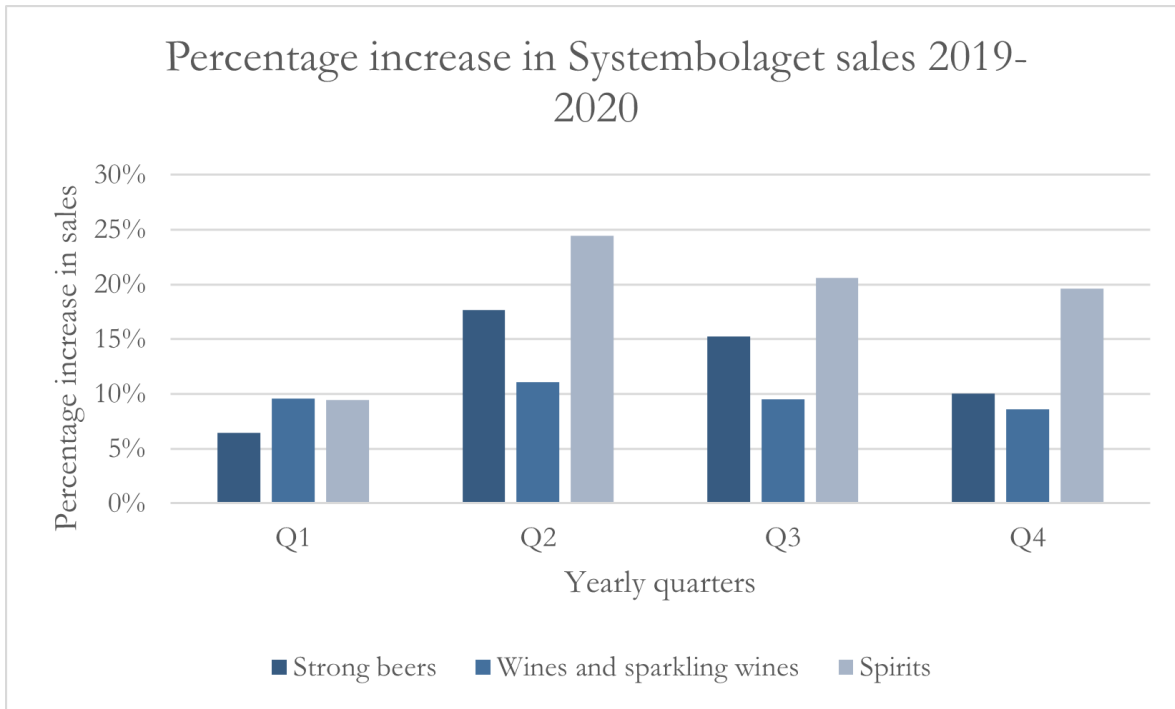
<i>Article</i>	<i>Bordershop price (SEK)</i>	<i>Systembolaget price (SEK)</i>	<i>Relative price ratio</i>
Carlsberg 4.6%	66,57	285,6	4,29
Tuborg Grön 4.6%	66,57	220,8	3,32

Table 3: *Examples of relative price ratio*

Taking into account both factors, i.e. savings made per liter purchased and through considering the relative price ratio, it may be concluded that consumers living in Sweden prefer to privately import mostly spirits and strong beers from abroad.

In order to test Hypothesis 1, whether the change in consumption during Covid-19 is the biggest for the product type where private imports are most profitable (in this case strong beers and spirits), Systembolaget’s quarterly sales reports from 2019 as well as 2020 are examined (Systembolaget, 2021e). As Systembolaget did not make a distinction between wines and sparkling wines in their sales reports these two product types are considered as one. The combined data can be seen in graph 2 ‘Percentage increase in Systembolaget sales through the

years 2019-2020' illustrated below, showing the percentage increase in yearly sales in 2020 as compared to 2019.



Graph 2: *Percentage increase in Systembolaget sales through the years 2019-2020*

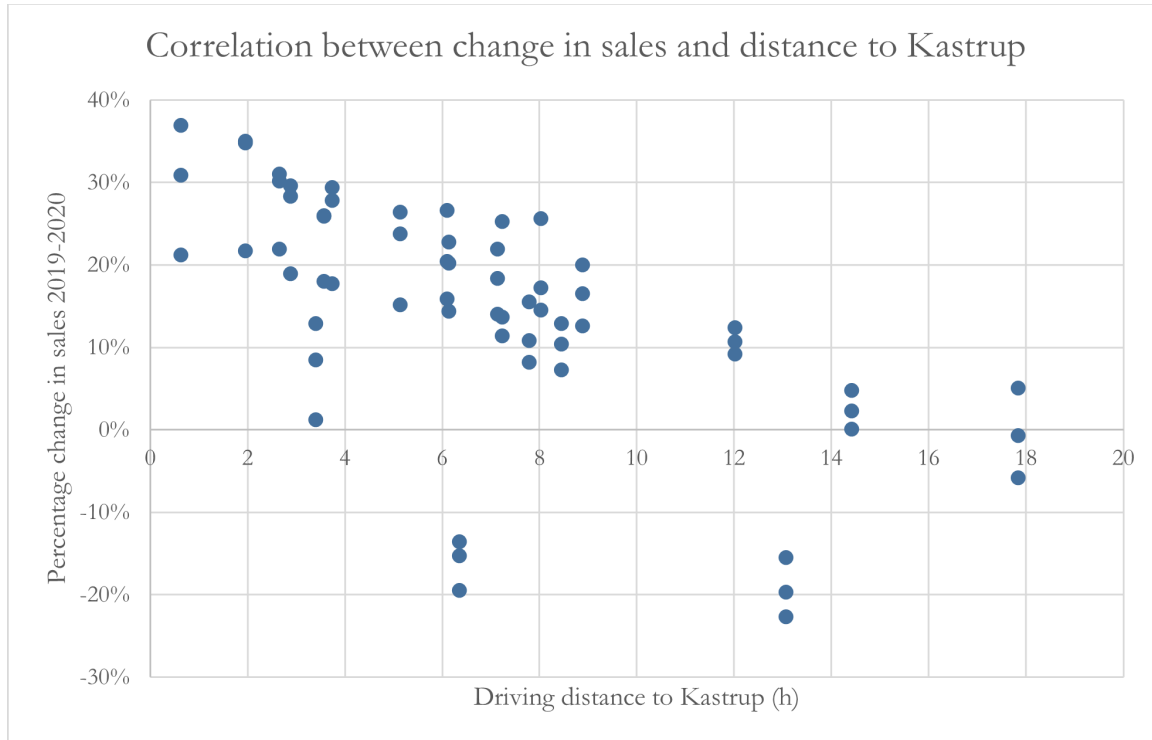
Source: *Systembolaget (2021e.)*

Based on graph 2 above we can see that quarter one experienced a stable and similar increase in sales in all three product categories. As the Covid-19 pandemic's spread increased rapidly in March, the remaining three quarters were affected the most since it was no longer possible to travel abroad and purchase alcohol. During this time, consumers suddenly experienced a supply shock and did not have the possibility to visit neighboring countries to purchase alcohol and turned to Systembolaget instead. This correlates well with the data on decreased total travel in Sweden, which saw its lowest points March through April as well as July through August (Trafikanalys, 2020). We can also tell from the diagram that spirits had the largest percentage increase in sales throughout the remaining part of the year, reaching nearly 25% in quarter two. A rather rapid increase can also be seen when it comes to strong beers, especially considering quarters two and three, whilst wines and sparkling wines remained rather steady at around 10%. The reasoning supports the previous findings of this study, as I concluded that based on price

differences per liter purchased and the relative price ratio consumers would be most likely to import precisely strong beers and spirits during normal circumstances. The above discussion therefore confirms hypothesis 1 which was the following: ‘The change in consumption should be biggest for the product type for which private imports are most profitable’.

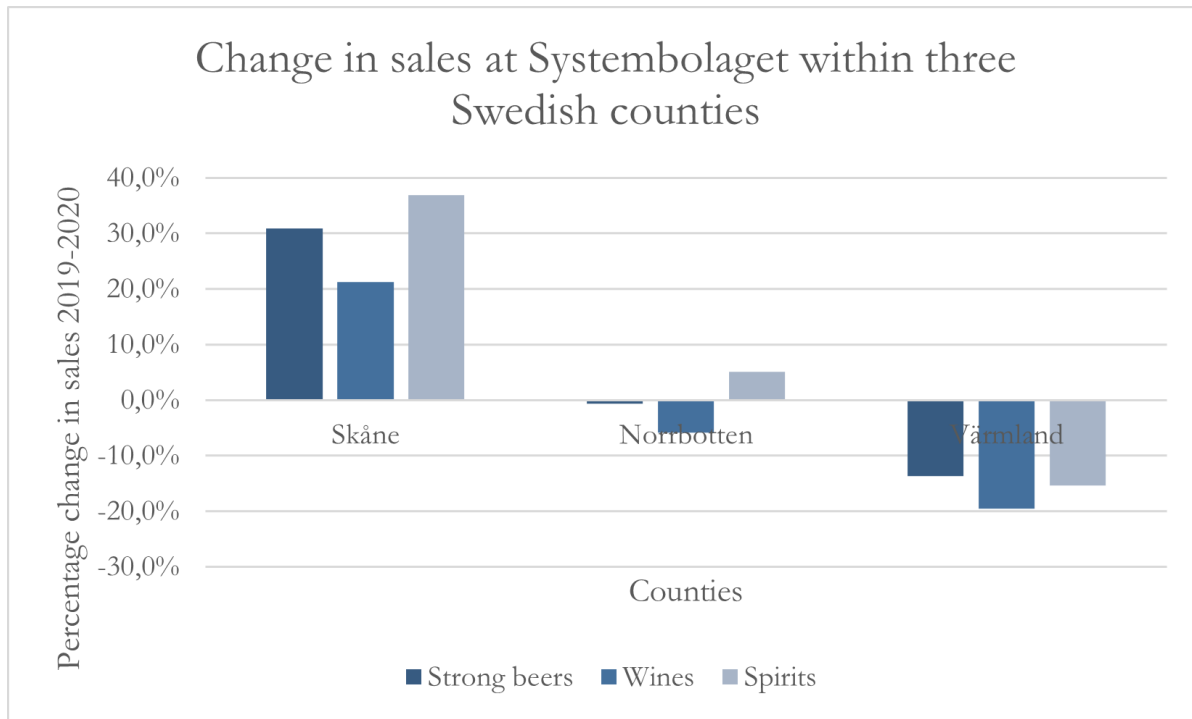
4.2 The correlation between distance to country borders and private alcohol imports

In order to establish a regression on how the change in sales has been affected by the inability to import and the proximity to borders two variables are of importance, the time in hours that it would take a consumer to drive from a certain county into Kastrup as well as the fact whether that county is closely bordering a country with lower or higher alcohol prices. The data used for the following regression can be found in Appendix C, where ‘Time (h)’ represents the driving distance from the residence city to Kastrup in hours, and ‘Border’ represents the dummy variable showing whether the county borders to a country with more expensive alcohol (value 1) or not (value 0). A plot diagram visualising the correlation between the driving distance to Kastrup and the percentage change in sales at Systembolaget is shown below in graph 3. With the exceptions of a few residuals with a negative change in sales, by only looking at the facts there seems to be overall a relatively positive correlation between the two variables as a significant increase in the change in sales occurs in counties that are closely situated to the border. A spike in the sales within these areas of Sweden might therefore be correlated with the fact that consumers in these areas tend to purchase their alcohol abroad, and when this was no longer possible during the pandemic they turned to Systembolaget instead. This correlation will be statistically examined in the regression.



Graph 3: *Correlation between change in sales and distance to Kastrup*

In Graph 4 we can view an example that illustrates three of the counties in Sweden and the change in sales in spirits within these. Skåne county, which is the county that closely borders Kastrup, experienced a significantly sharp increase in sales of all three types alcoholic beverages at Systembolaget during the year of the pandemic. Norrbotten, a county that is situated up north in Sweden and therefore further away from countries with cheaper alcoholic beverages, has on the other hand only had an increase in spirits and a decrease in the remaining types of alcohol whilst Värmland, that closely borders Norway, has had a negative change in sales overall suggesting a correlation between the change in sales and the inability of the norwegians to enter the country to purchase alcohol.



Graph 4: *Change in sales at Systembolaget within three Swedish counties*

Source: *Systembolaget (2021e.)*

The effects of the regression, with change in sales as the dependent variable and ‘Time’ as well as ‘Border’ as the independent variables, are shown in Table 4 ‘Proximity to country borders and their effect on alcohol sales’ below. Although the visual representations of the data above suggested a strong correlation, the statistical significance of the results varies. The vicinity to the borders when it comes to driving time seems to be significant for the purchase of strong beers on a 90% level. In addition, the R-squared value is higher for strong beers which might entail a more accurate fit of this regression than the remaining two regressions. The p-value is higher for the remaining variables and regressions in this analysis. This could be explained by the small size of observations, as the regression is based on only the 21 counties in Sweden. The higher p-value do not necessarily entail that we are unable to reject the null hypothesis of the variables having no correlation at all, but rather that we should be careful in claiming that such a correlation exists to a highly significant degree. We can tell from Table 4 that the standard error is low for the β_1 (Time in hours) and β_2 (Border) values, suggesting that the data points generally lie close to the regression line and therefore have few outliers.

	Effect on percentage sales of strong beers	Effect on percentage sales of wines	Effect on percentage sales of spirits
Time in hours (β_1)	-0,01559*	-0,01006	-0,01375
Standard error of time in hours	0,00783	0,00732	0,00831
Border(β_2)	-0,10024	-0,07854	-0,08701
Standard error of border	0,06771	0,06326	0,07185
Constant (β_0)	0,30209***	0,19973***	0,31779***
Observations	21	21	21
R-squared	0,56813	0,42688	0,47281

Table 4: *Proximity to country borders and their effect on alcohol sales*

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

If we were to reject the null hypothesis for the case of strong beers we might envision the following example. Let us assume that a consumer would live in a Swedish county that closely borders a country with cheaper alcoholic beverages. In that case the x_2 variable would take on the value 0 which positively affects the change in sales, as the negative value of β_2 would become irrelevant. This simply for the reason that these consumers who live close to country borders and can during normal circumstances purchase their alcohol abroad, were unable to do so during 2020 and instead turned to Systembolaget. This in turn has a positive effect on the sales of strong beers in Systembolaget. Change in sales would oppositely be affected negatively if a consumer would live close to a country with more expensive alcohol as x_2 would take on the value 1 (although the significance of the border variable is questionable). As previously

mentioned, it is common for Norwegians to import alcohol from Sweden (Grittner et. al., 2014). As this was no longer possible during the pandemic, Systembolaget might have experienced a loss in sales in those areas commonly frequented by Norwegian shoppers. When it comes to β_1 , each additional hour that a consumer would have to travel in order to purchase strong beer abroad affects their demand negatively. This implies that the positive change in sales of strong beers at Systembolaget during the year 2020 has been biggest in those places which are close in proximity to neighboring countries with cheaper alcohol on average.

4.3 Testing for Gauss-Markov assumptions and multicollinearity

Results for the following tests can be found in Appendix D, these results are discussed down below.

4.3.1 Heteroscedasticity

The test for heteroscedasticity for all three alcohol types was conducted with the use of White's test. For each separate regression, the test was based on an auxiliary regression in which the dependent variables were the squared residuals. Thereafter, an LM-test was conducted. If it would be the case that $p < 0.05$, we can reject the null hypothesis that states 'There is no homoscedasticity'. In the case of strong beers, after conducting the LM-test the p-value turned out to be 0.289. This entails that we cannot rule out the possibility that the error terms are homoscedastic and that the regression therefore does not violate the Gauss-Markov assumptions. Similarly, the p-values for the LM-tests in the case of wines was 0.075 and in the case of spirits 0.069 which means that the remaining regressions do not violate the Gauss-Markov assumptions either as the variance of the error terms is constant.

4.3.2 Multicollinearity

Multicollinearity was tested with the VIF test. A value that rises above 10 could indicate that the independent variables in the regression suffer from multicollinearity, and that the regression therefore is unreliable when computed through the ordinary least squares method. As the independent variables in each of the three regressions, 'Time in hours' and 'Border', were the same - so were the results of the test for multicollinearity. Both variables showed a value of 2.246 which indicates that no high levels of multicollinearity could be observed.

4.4 Substitution effect during the pandemic

Hence, the above analysis partly shows that the closer a consumer lives to a country with cheaper alcoholic products, and the less time it has to spend in order to get to that country, the bigger the demand for that consumer to shop at Systembolaget when no alternative options abroad were possible. Although the p-values showed the biggest significance when it came to the driving time in hours for acquiring strong beers, the regressions follow the Gauss-Markov assumptions and show little signs of multicollinearity which makes them partially reliable. The inability to import alcoholic beverages, which usually is the second most popular way for Swedes to acquire alcohol (Trollidal, 2020b.), therefore led to changed consumption patterns in Sweden as consumers increased their domestic consumption. This in turn led to increased sales margins at the Swedish alcohol monopoly Systembolaget. The results suggest a positive substitution effect for purchasing alcohol abroad, that is strongest in counties closely bordering to countries with cheaper alcohol and the strongest in those bordering countries where alcohol is more expensive. This positive substitution effect holds regardless of the more expensive prices that consumers have to pay in Sweden, suggesting a highly inelastic demand for all examined product types.

4.5 Other contributing factors

There are however other factors to take into account throughout the analysis. As mentioned in previous episodes, the Covid-19 pandemic brought a rise in unemployment and a decrease in working hours for a significant portion of the population. However, despite findings made by Clements & Selvanathan (1991) regarding spirits being a luxury good, the demand for them did not seem to decrease during the year of the pandemic when many faced a decrease in salary levels or unemployment. The income effect for spirits, along with beers and wines, seems to be rather weak as the demand for all examined products increased significantly throughout the year 2020. An explanation for this could be offered by Wardell et al. (2020), who found that alcohol consumption increased rapidly in the beginning of the pandemic because it was a way for individuals to cope with the difficult situation they found themselves in. The authors also found that because social interaction was highly constrained during the year 2020 it caused an increase in what the authors call solitary drinking as this was a way for individuals to cope with restrictions.

5. Conclusion

5.1 Conclusion

The aim of this essay was to determine how the consumption patterns regarding alcoholic beverages have changed on the Swedish market as a result of the Covid-19 pandemic and why this has happened. I have examined this by focusing on the following problem statement:

How has the inability to import alcoholic beverages affected consumption patterns in Sweden? This considering the different counties in which Sweden is divided.

In order to come to a conclusion, I had to establish which alcoholic beverages are most commonly imported by Swedes from abroad and in turn examine whether there lies a positive or negative substitution effect when it comes to the consumption at Systembolaget.

By determining how much each consumer saves in SEK per liter of alcohol bought at Bordershop, relative to Systembolaget, I concluded that spirits would be a popular good to import. Furthermore, by instead examining how much a consumer would save based on the relative price ratio of prices at Systembolaget, relative to those at Bordershop, I also concluded that strong beers would be an attractive good to import. These results correlated well with the data from Systembolaget that showed sharp increases in sales of spirits and strong beers throughout 2020 as compared to 2019, since the pandemic hindered consumers from travelling abroad to acquire their alcoholic beverages.

In order to explain the increase in sales at Systembolaget a regression analysis was conducted where I looked at the significance of proximity to country borders as well as the amount of time it would take for a consumer to drive to a neighboring country in order to buy cheaper alcohol. I concluded that although the statistical significance of both variables 'Time in hours' and 'Border' could not be as reliable as anticipated, the results of the regression correlated well with the real life changes in sales that Systembolaget faced. As consumers that usually import their alcohol from abroad no longer could do so during the pandemic, they had but little choice than to turn to Systembolaget instead. Similarly, Systembolaget missed out on alcohol sales that foreigners usually would have stood for as e.g. norwegians had no possibility to enter the country in order to make their purchases.

In conclusion, the analysis partly showed that there exists a positive substitution effect for alcoholic beverages purchased abroad. Swedes that during normal circumstances are able to travel to a neighboring country in order to privately import alcohol choose to do so rather than to make their purchase at Systembolaget. The inability to privately import alcoholic beverages from abroad during the year 2020 therefore led to a spike in sales at Systembolaget, as consumers simply substituted the purchases they usually made abroad for those which were now the only option available. The consumption patterns per se did not change significantly as consumers technically consumed the same amount of alcohol as before, while the acquirement of alcohol and how it is executed did change.

5.2 Possibilities for further research

Since the regressions in the study consisted of only 21 observations it may be interesting to increase the amount of observations and conduct a similar experiment in order to see whether the data would generate a more reliable level of p-values. A larger data set could have generated results that might have been statistically significant to a higher extent. Such a study could focus on the change in sales of Systembolaget within a larger amount of Swedish cities, if such data would be available, and examine whether such data would correlate well with the hypotheses set up in this study.

As this study only examines the changes in alcohol consumption and sales during the years 2019 through 2020 it might be of interest to expand the scope of research into further years to come, in order to distinguish a potential pattern of change post the Covid-19 pandemic. In addition, it would be interesting to further expand the study by dividing the results between different age groups. This since there exist differences in travel habits and the level of willingness to travel abroad to import alcoholic beverages between different age groups. Different age groups most likely also have different levels of income which may limit their consumption and affect the factors examined in this study. It might also be of interest to further examine the social aspects of the pandemic in relation to alcohol consumption. Since consumers no longer had the opportunity to gather in large social settings or for example frequent restaurants as often as before, this might have had an impact on the sales of alcoholic beverages commonly consumed during such gatherings.

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Appendix A - Money saved per liter purchased alcohol (in SEK)

Strong beers

Article	Bordershop price per 1000ml	Systembolaget price per 1000ml	Price difference per 1000ml
Carlsberg 4.6%	8,41	36,06	27,66
Tuborg Grön 4.6%	8,41	27,88	19,47
Carlsberg Sort Guld 5.8%	10,47	39,09	28,63
Tuborg Guld 5.6%	10,98	28,79	17,81
Staropramen 5%	15,45	51,52	36,07
Heineken 5%	15,10	39,09	23,99
Kronenbourg 1664 5%	24,89	43,03	18,14
Kronenbourg 1664 Blanc 5%	24,89	36,06	11,17
Corona Extra 4.5%	22,31	56,06	33,75
Singha 5%	25,75	48,18	22,43
Stella Artois 5%	21,46	51,52	30,06
Budweiser 5%	22,14	45,15	23,01
Erdinger Weißbier 5.3%	16,82	72,42	55,61
Norrlands Guld Export 5,3%	10,81	32,42	21,62
Mariestads Export	11,18	39,09	27,91

5.3%

Falcon Export 5.2%	10,81	30,00	19,19
Åbro Original 5.2%	10,64	28,49	17,85
Eriksberg 5.3%	11,50	39,09	27,60
Pistonhead Flat Tire 4.5%	11,15	34,85	23,70
Småland Premium Lager 5.2%	10,39	28,49	18,10

Wines

Article	Bordershop price per 1000ml	Systembolaget price per 1000ml	Price difference
Casillero del Diablo Cabernet Sauvignon	97,83	105,33	7,51
Gato Negro Cabernet Sauvignon	72,44	78,67	6,23
The Wanted Zin Zinfandel	108,71	118,67	9,96
Trapiche Malbec	72,44	118,67	46,23
Verosso	72,44	105,33	32,89
Black Tower Fruity White	63,37	82,67	19,29
Jacob's Creek Classic Chardonnay	90,57	105,33	14,76
Jacob's Creek Classic Riesling	90,57	105,33	14,76
Kung Fu Girl Riesling	144,97	189,33	44,36
Les Fumées Blanches Sauvignon Blanc	90,57	126,67	36,09
Cloudy Bay Sauvignon Blanc	326,31	372,00	45,69
El Coto Blanco	72,44	105,33	32,89
Barefoot White Zinfandel	81,51	105,33	23,83
Gérard Bertrand Cote des Roses Rosé	108,71	172,00	63,29
Black Tower Pink Bubbly	63,37	92,00	28,63

Jacob's Creek Classic Shiraz Rosé	90,57	105,33	14,76
M de Minuty	144,97	185,33	40,36
Pierre Chavin Côtes de Provence	126,84	166,67	39,83
El Coto Crianza	108,71	126,67	17,96
Grand Sud Merlot	40,73	83,00	42,27

Sparkling Wines

Article	Bordershop price per 1000ml	Systembolaget price per 1000ml	Price difference
Mionetto Prosecco Brut	90,57	118,67	28,09
Chapel Hill Chardonnay	83,32	92,00	8,68
Vigna Preziosa	144,97	172,00	27,03
André Clouet Grande Réserve	344,44	398,67	54,23
Bollinger Rosé Brut Champagne	761,51	878,67	117,16
Bollinger Special Cuvée Brut Champagne	598,31	665,33	67,03
Louis Roederer Brut Premier	598,31	625,33	27,03
Pongrácz Brut Pinot Noir Chardonnay	144,97	160,00	15,03
Freixenet Italian Rosé	90,57	118,67	28,09
Freixenet Chianti	90,57	145,33	54,76
Gusbourne Brut Reserve	507,64	600,00	92,36
Henkell Trocken	90,57	118,67	28,09
Veuve Clicquot Sec	562,04	606,67	44,63
Piper-Heidsieck Brut	435,11	532,00	96,89
Moët & Chandon Nectar Impérial Champagne	562,04	626,67	64,63
Bottega Gold	253,77	305,33	51,56

André Clouet Champagne Brut Nature Silver	362,57	492,00	129,43
Verdi Raspberry Sparkletini	45,33	119,33	74,00
Black Tower Ice Sparkling Rosé	90,57	100,00	9,43
Freixenet Ice	108,71	172,00	63,29

Spirits

Article	Bordershop price per 1000ml	Systembolaget price per 1000ml	Price difference
Explorer Vodka	145,61	288,57	142,96
Absolut Vodka	149,53	345,71	196,18
The Famous Grouse Blended Scotch Whiskey	135,93	398,57	262,64
Jägermeister	213,61	412,86	199,24
Tullamore Dew	190,53	427,14	236,61
Captain Morgan Spiced Gold	190,33	355,71	165,38
Black Velvet	163,13	335,71	172,58
Koskenkorva Vodka	122,33	320,00	197,67
Bell's	176,73	341,43	164,70
High Commissioner	163,13	310,00	146,87
Smirnoff	163,13	327,14	164,01
Jameson	190,33	427,14	236,81
Baileys Original Irish Cream	190,33	292,86	102,53
Bacardi Carta Blanca	203,93	355,71	151,78
Johnnie Walker Red Label	203,93	377,14	173,21
Jack Daniel's	299,13	470,00	170,87

Beefeater London Dry Gin'	176,73	365,71	188,98
Cointreau	271,90	455,71	183,81
Minttu Peppermint	176,66	388,00	211,34
Licor 43	217,53	455,71	238,18

Appendix B - Relative price ratio between alcoholic beverages purchased at Systembolaget in relation to Bordershop

Strong beers

Article	Bordershop price (SEK) per 24 units á 330ml	Systembolaget price (SEK) per 24 units á 330ml	Relative price ratio
Carlsberg 4.6%	66,57	285,6	4,29
Tuborg Grön 4.6%	66,57	220,8	3,32
Carlsberg Sort Guld 5.8%	82,89	309,6	3,74
Tuborg Guld 5.6%	86,97	228	2,62
Staropramen 5%	122,33	408	3,34
Heineken 5%	119,61	309,6	2,59
Kronenbourg 1664 5%	197,13	340,8	1,73
Kronenbourg 1664 Blanc 5%	197,13	285,6	1,45
Corona Extra 4.5%	176,73	444	2,51
Singha 5%	203,93	381,6	1,87
Stella Artois 5%	169,93	408	2,40
Budweiser 5%	175,37	357,6	2,04
Erdinger Weißbier 5.3%	133,21	573,6	4,31
Norrlands Guld Export	85,61	256,8	3,00

5,3%

Mariestads Export 5.3%	88,53	309,6	3,50
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Falcon Export 5.2%	85,61	237,6	2,78
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Åbro Original 5.2%	84,25	225,6	2,68
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Eriksberg 5.3%	91,05	309,6	3,40
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Pistonhead Flat Tire 4.5%	88,33	276	3,12
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Småland Premium Lager 5.2%	82,25	225,6	2,74
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Wines

Article	Bordershop price (SEK) per 750ml	Systembolaget price (SEK) per 750ml	Relative price ratio
Casillero del Diablo Cabernet Sauvignon	73,37	79	1,08
Gato Negro Cabernet Sauvignon	54,33	59	1,09
The Wanted Zin Zinfandel	81,53	89	1,09
Trapiche Malbec	54,33	89	1,64
Verosso	54,33	79	1,45
Black Tower Fruity White	47,53	62	1,30
Jacob's Creek Classic Chardonnay	67,93	79	1,16
Jacob's Creek Classic Riesling	67,93	79	1,16
Kung Fu Girl Riesling	108,73	142	1,31
Les Fumées Blanches Sauvignon Blanc	67,93	95	1,40
Cloudy Bay Sauvignon Blanc	244,73	279	1,14
El Coto Blanco	54,33	79	1,45
Barefoot White Zinfandel	61,13	79	1,29
Gérard Bertrand Cote des Roses Rosé	81,53	129	1,58

Black Tower Pink Bubbly	47,53	69	1,45
Jacob's Creek Classic Shiraz Rosé	67,93	79	1,16
M de Minuty	108,73	139	1,28
Pierre Chavin Côtes de Provence	95,13	125	1,31
El Coto Crianza	81,53	95	1,17
Grand Sud Merlot	30,5475	62,25	2,04

Sparkling Wines (750ml units)

Article	Bordershop price (SEK) per 750ml	Systembolaget price (SEK) per 750 ml	Relative price ratio
Mionetto Prosecco Brut	67,93	89	1,31
Chapel Hill Chardonnay	62,49	69	1,10
Vigna Preziosa	108,73	129	1,19
André Clouet Grande Réserve	258,33	299	1,16
Bollinger Rosé Brut Champagne	571,13	659	1,15
Bollinger Special Cuvée Brut Champagne	448,73	499	1,11
Louis Roederer Brut Premier	448,73	469	1,05
Pongrácz Brut Pinot Noir Chardonnay	108,73	120	1,10
Freixenet Italian Rosé	67,93	89	1,31
Freixenet Chianti	67,93	109	1,60
Gusbourne Brut Reserve	380,73	450	1,18
Henkell Trocken	67,93	89	1,31
Veuve Clicquot Sec	421,53	455	1,08
Piper-Heidsieck Brut	326,33	399	1,22
Moët & Chandon Nectar Impérial Champagne	421,53	470	1,11
Bottega Gold	190,33	229	1,20

André Clouet Champagne Brut Nature Silver	271,93	369	1,36
Verdi Raspberry Sparkletini	34	89,5	2,63
Blac Tower Ice Sparkling Rosé	67,93	75	1,10
Freixenet Ice	81,53	129	1,58

Spirits

Article	Bordershop price per 1000ml	Systembolaget price per 1000ml	Price ratio
Explorer Vodka	145,61	288,57	1,98
Absolut Vodka	149,53	345,71	2,31
The Famous Grouse Blended Scotch Whiskey	135,93	398,57	2,93
Jägermeister	213,61	412,86	1,93
Tullamore Dew	190,53	427,14	2,24
Captain Morgan Spiced Gold	190,33	355,71	1,87
Black Velvet	163,13	335,71	2,06
Koskenkorva Vodka	122,33	320,00	2,62
Bell's	176,73	341,43	1,93
High Commissioner	163,13	310,00	1,90
Smirnoff	163,13	327,14	2,01
Jameson	190,33	427,14	2,24
Baileys Original Irish Cream	190,33	292,86	1,54
Bacardi Carta Blanca	203,93	355,71	1,74
Johnnie Walker Red Label	203,93	377,14	1,85
Jack Daniel's	299,13	470,00	1,57

Beefeater London Dry Gin'	176,73	365,71	2,07
Cointreau	271,90	455,71	1,68
Minttu Peppermint	176,66	388,00	2,20
Licor 43	217,53	455,71	2,09

Appendix C - Regression Data

Strong beers

Percentage change in sales 2019-2020	Swedish County	Residential City	Time (h)	Border
30,2%	Blekinge	Karlskrona	2,65	0
10,4%	Dalarna	Falun	8,45	1
10,8%	Gotland	Visby	7,78	0
16,5%	Gävleborg	Gävle	8,88	1
34,8%	Halland	Halmstad	1,95	0
-22,7%	Jämtland	Östersund	13,07	1
29,4%	Jönköping	Jönköping	3,73	0
25,9%	Kalmar	Kalmar	3,57	0
29,6%	Kronoberg	Växjö	2,88	0
-0,7%	Norrbottn	Luleå	17,83	1
30,9%	Skåne	Malmö	0,63	0
13,7%	Stockholm	Stockholm	7,23	1
20,4%	Södermanland	Nyköping	6,10	0
17,2%	Uppsala	Uppsala	8,03	1
-13,6%	Värmland	Karlstad	6,35	1
0,1%	Västerbotten	Umeå	14,42	1

10,7%	Västernorrland	Härnösand	12,02	1
18,4%	Västmanland	Västerås	7,13	0
8,5%	Västra Götaland	Göteborg	3,40	0
20,2%	Örebro	Örebro	6,13	0
23,8%	Östergötland	Linköping	5,13	0

Wines

Percentage change in sales 2019-2020	Swedish County	Residential City	Time (h)	Border
21,9%	Blekinge	Karlskrona	2,65	0
7,3%	Dalarna	Falun	8,45	1
8,2%	Gotland	Visby	7,78	0
12,6%	Gävleborg	Gävle	8,88	1
21,7%	Halland	Halmstad	1,95	0
-19,7%	Jämtland	Östersund	13,07	1
17,7%	Jönköping	Jönköping	3,73	0
18,0%	Kalmar	Kalmar	3,57	0
18,9%	Kronoberg	Växjö	2,88	0
-5,8%	Norrbottn	Luleå	17,83	1
21,2%	Skåne	Malmö	0,63	0
11,4%	Stockholm	Stockholm	7,23	1
15,9%	Södermanland	Nyköping	6,10	0
14,5%	Uppsala	Uppsala	8,03	1
-19,5%	Värmland	Karlstad	6,35	1
2,3%	Västerbotten	Umeå	14,42	1
9,2%	Västernorrland	Härnösand	12,02	1

14,0%	Västmanland	Västerås	7,13	0
1,2%	Västra Götaland	Göteborg	3,40	0
14,4%	Örebro	Örebro	6,13	0
15,2%	Östergötland	Linköping	5,13	0

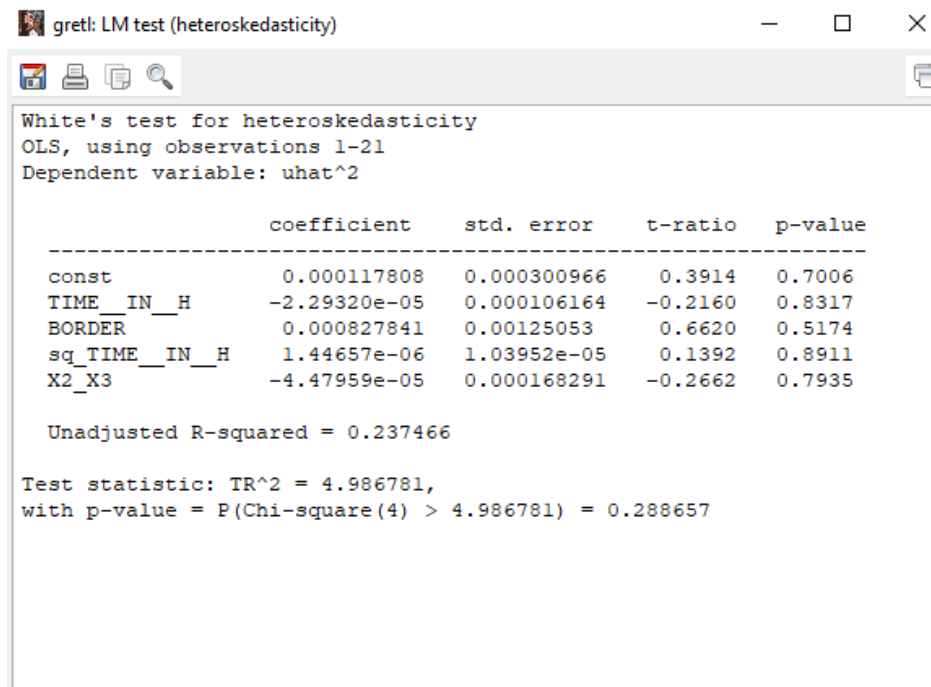
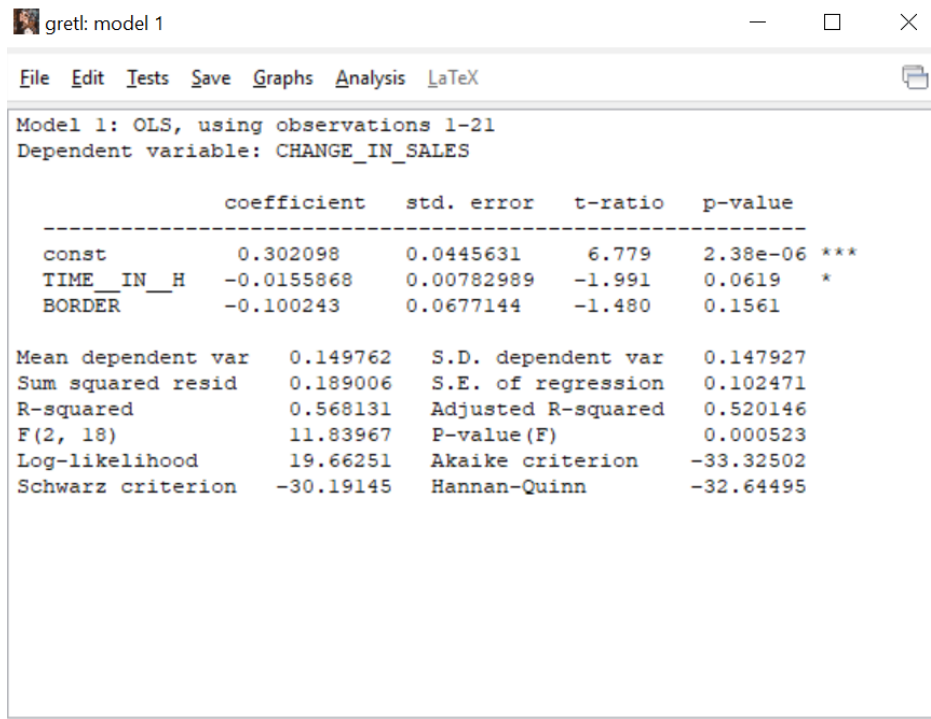
Spirits

Percentage change in sales 2019-2020	Swedish County	Residential City	Time (h)	Border
31,0%	Blekinge	Karlskrona	2,65	0
12,9%	Dalarna	Falun	8,45	1
15,5%	Gotland	Visby	7,78	0
20,0%	Gävleborg	Gävle	8,88	1
35,0%	Halland	Halmstad	1,95	0
-15,5%	Jämtland	Östersund	13,07	1
27,8%	Jönköping	Jönköping	3,73	0
26,0%	Kalmar	Kalmar	3,57	0
28,3%	Kronoberg	Växjö	2,88	0
5,1%	Norrbottn	Luleå	17,83	1
36,9%	Skåne	Malmö	0,63	0
25,3%	Stockholm	Stockholm	7,23	1
26,6%	Södermanland	Nyköping	6,10	0
25,6%	Uppsala	Uppsala	8,03	1
-15,3%	Värmland	Karlstad	6,35	1
4,8%	Västerbotten	Umeå	14,42	1
12,4%	Västernorrland	Härnösand	12,02	1

21,9%	Västmanland	Västerås	7,13	0
12,9%	Västra Götaland	Göteborg	3,40	0
22,8%	Örebro	Örebro	6,13	0
26,4%	Östergötland	Linköping	5,13	0

Appendix D - Regression results

Strong beers



Wines

gretl: model 2

File Edit Tests Save Graphs Analysis LaTeX

Model 2: OLS, using observations 1-21
Dependent variable: CHANGE_IN_SALES

	coefficient	std. error	t-ratio	p-value	
const	0.199738	0.0416322	4.798	0.0001	***
TIME_IN_H	-0.0100598	0.00731492	-1.375	0.1859	
BORDER	-0.0784540	0.0632609	-1.240	0.2308	

Mean dependent var 0.095524 S.D. dependent var 0.119964
Sum squared resid 0.164962 S.E. of regression 0.095732
R-squared 0.426875 Adjusted R-squared 0.363194
F(2, 18) 6.703379 P-value(F) 0.006672
Log-likelihood 21.09119 Akaike criterion -36.18238
Schwarz criterion -33.04881 Hannan-Quinn -35.50231

gretl: LM test (heteroskedasticity)

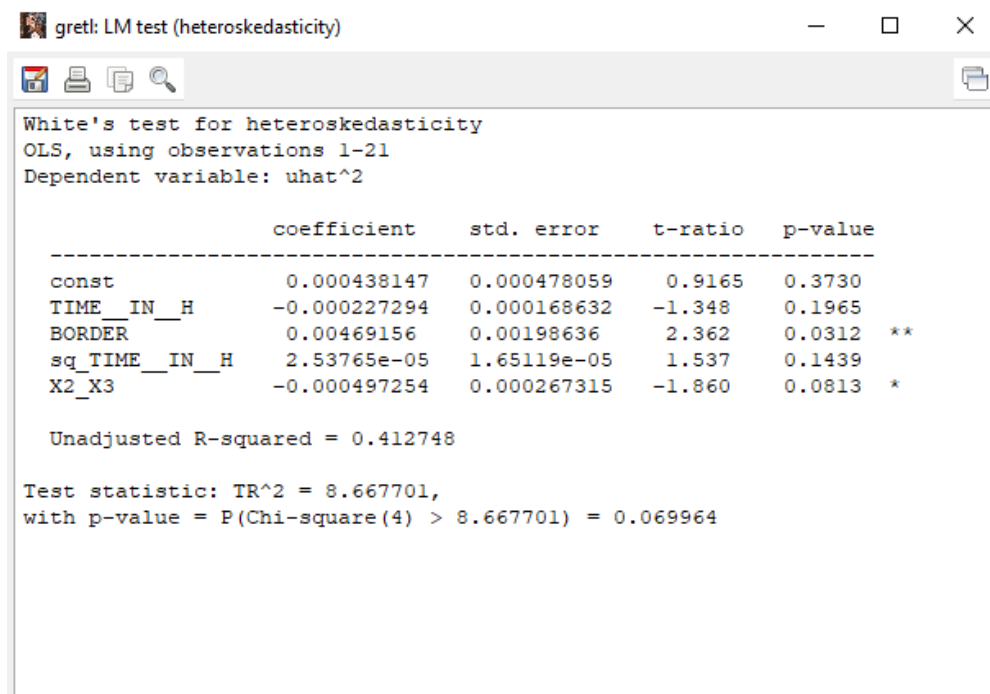
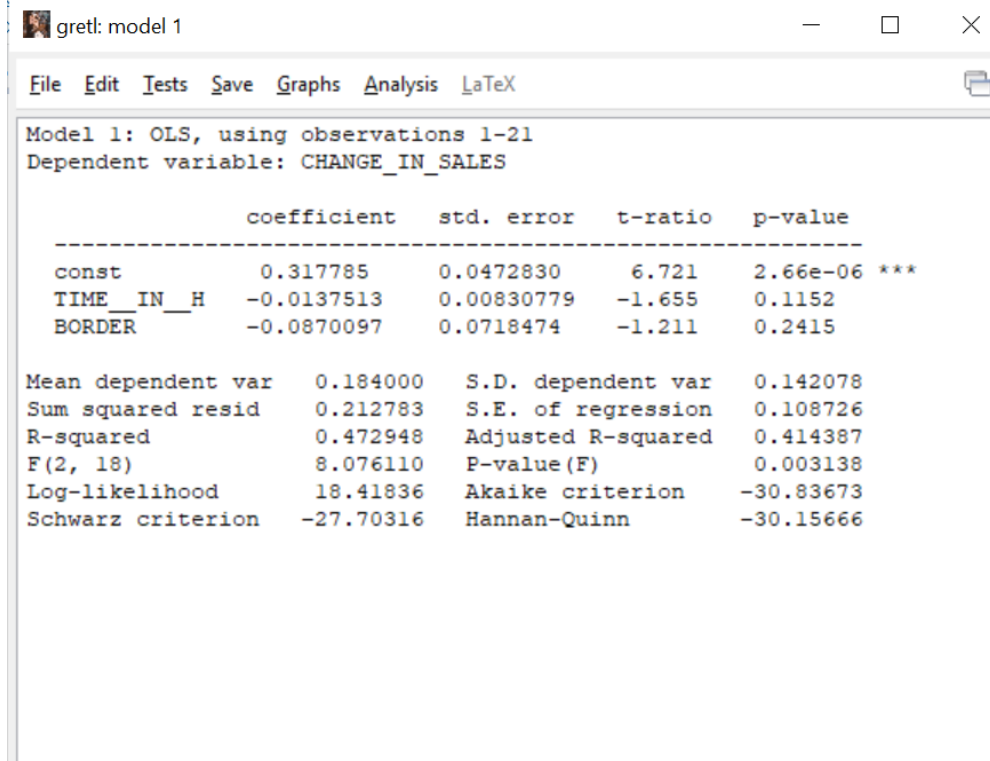
White's test for heteroskedasticity
OLS, using observations 1-21
Dependent variable: uhat^2

	coefficient	std. error	t-ratio	p-value	
const	0.000294168	0.000260160	1.131	0.2748	
TIME_IN_H	-0.000131138	9.17700e-05	-1.429	0.1722	
BORDER	0.00249195	0.00108098	2.305	0.0349	**
sq_TIME_IN_H	1.37360e-05	8.98578e-06	1.529	0.1459	
X2_X3	-0.000260881	0.000145473	-1.793	0.0918	*

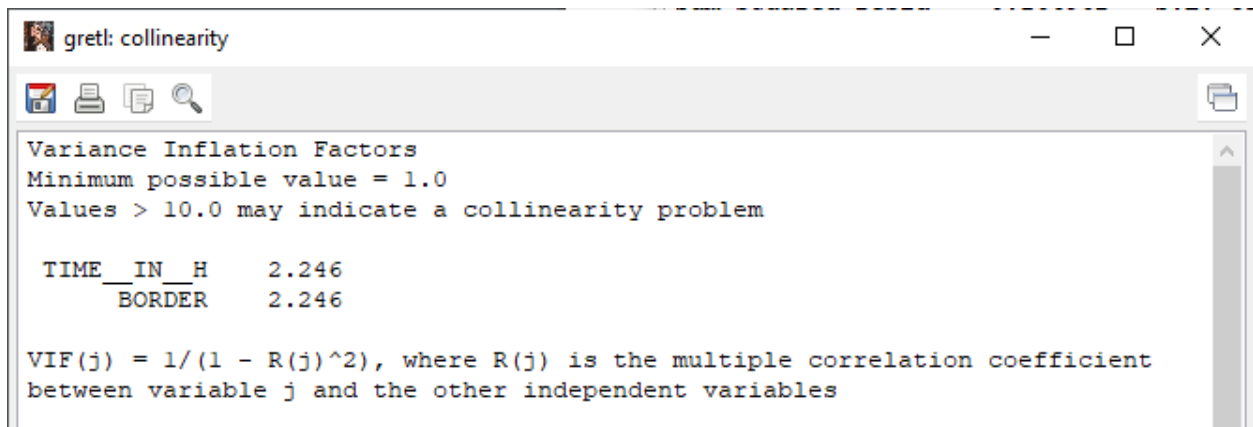
Unadjusted R-squared = 0.404120

Test statistic: $TR^2 = 8.486519$,
with p-value = $P(\text{Chi-square}(4) > 8.486519) = 0.075297$

Spirits



Test for multicollinearity



```
gretl: collinearity
Variance Inflation Factors
Minimum possible value = 1.0
Values > 10.0 may indicate a collinearity problem

TIME_IN_H    2.246
  BORDER     2.246

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient
between variable j and the other independent variables
```