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Master Thesis

The Economic Impact of COVID-19 Border Restrictions on the Labor Market

A Comparative case study on the Border
Municipalities in Sweden



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Abstract

This paper examines if the labor markets in border municipalities in Sweden were affected by the COVID-19 border restrictions implemented by the Swedish and Norwegian governments. To do so, this paper uses unemployment and population data gathered from different sources to estimate results derived from using the synthetic control method. The results imply that imposing border restriction had a larger negative effect on the unemployment levels in the border municipalities, compared to non-border municipalities. Results also shows that males were more affected by this compared to females in terms of unemployment and that there is a positive trend in unemployment associated with increasing these restrictions.

Keywords

Labor market, COVID-19, Economics, Synthetic control, Restrictions, Regional differences, Border, Unemployment

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Table of Contents

1	Introduction	1
2	Literature Review	4
3	Background/Theoretical Framework	7
3.1	Background of shopping tourism and border restrictions	7
3.2	Theoretical and Hypothetical framework on the labor market by imposing border restrictions	9
4	Data	11
5	Methodology	13
5.1	Synthetic control.....	13
5.2	Empirical framework.....	15
6	Results	18
6.1	Examining the treatment and synthetic treatment (control)	18
6.2	Estimated results of unemployment differences.....	21
6.3	Significance of the results	22
7	Conclusion/Discussion	25
8	References	27
9	Appendices	31



1 Introduction

Since the entrance of COVID-19 virus in the beginning of 2020, countries across the world have suffered numerous deaths and have affected all of us. To counteract the spread of the virus, countries started to implement different restrictions and suggestions to their population to counteract the spread and thus the deaths attributed to the COVID-19 virus. As these restrictions and suggestions (non-pharmaceutical interventions or simply NPI) put an emphasis on the social distancing and discouraged unnecessary traveling, it had a great impact on the society and the economies of the countries all over the world.

The country of Sweden was no exception in terms of being affected by COVID-19. But to counteract the spread of the virus, Sweden chooses a different way compared to many other countries in the world. Compared to their neighboring countries of Finland, Norway and Denmark, Sweden decided upon a different approach to counteract the spread of the virus. Instead of shutting down society, which the other Nordic countries did, Sweden opted for a more lenient approach with no lockdowns of society (Creutz et al., 2021). But, as the pandemic went along, several restrictions and suggestions were imposed on the population by the Swedish government which limited individual's everyday life. This in turn led to an increase in unemployment and an overall economic downturn. To counteract this, the Swedish government imposed several nationwide policies with the aim of levitating companies located in Sweden in terms of keeping employees and neutralizing financial instability. But this creates a question. Did the COVID-19 virus impact all the regions of Sweden in the same way?

As several municipalities located near the border of our neighboring country Norway have become a heaven for shopping tourism for Norwegians, they have become more and more reliable on the influx of Norwegians traveling across the border to purchase different goods. This behavior stems from the fact that goods are less expensive in Sweden compared to Norway. In 2019, HUI Research reported that the total Norwegians expenses in Sweden were



estimated to total 27,9 billion SEK, with around half being accumulated in the regions of Västra Götaland (9,4 billion SEK) and Värmland (6,1 billion SEK) located next to the border to Norway. As a result of this shopping tourism, large shopping areas have been created in several municipalities in the border area in Sweden and have resulted in a shift in the composition of these municipalities economic sectors (Lorentzon, 2011). However, as the border between Norway and Sweden were heavily restricted during the pandemic and even completely closed, this led to a negative economic effect in the municipalities near the border. In terms of revenue losses, border municipalities towards Norway reported in 2020 losses of 37.5 percent in grocery sales compared to the previous year. Meanwhile, municipalities, not located on the border, reported a 3.7 percent increase during the same period (Statistics Sweden, 2021).

Therefore, there exists an interest in examining if these municipalities labor markets were more greatly affected by the pandemic compared to non-border municipalities for several reasons. Firstly, there is an interest of the answers to this question from a policy standpoint. As there might exist different effects on different regions in Sweden when imposing restrictions, policymakers might gain knowledge of these results for future policymaking. As the Swedish government's strategy of levitating the worsening economic situation were centralized during the pandemic (it was the same all over the regions in Sweden), knowledge of this question might therefore lead to different approaches for future implementation of a similar problem. Secondly, the implementation of the travel restrictions was not mainly imposed by the Swedish government. It was the Norwegian government which imposed these travel restrictions for most of the pandemic. Therefore, examining these questions might also show the importance of cooperation between the Norwegian and Swedish government in times of crises. And thirdly, there exists a gap in the previous literature regarding the subject of border trade in terms of COVID-19 literature.



There exists a fair amount of literature regarding the question of “How have the labor market been affected by the COVID-19 regulations?” which stems from the importance of the question itself. Studies conducted on the subject have found evidence that the labor market has been affected by the pandemic and that implementing non-pharmaceutical intervention is associated with an economic loss in terms of unemployment (Bauer et al., 2021). Other studies have also found evidence pointing towards that the short-term effects of the pandemic greatly affected the labor market in terms of job losses (Cajner et al., 2020) and less working hours (Huang et al., 2021) and that the composition of the labor market plays an important role in the effect that the pandemic has on a country’s regions (Raimo et al., 2021). Studies regarding the subject of “How has border regions been affected by the pandemic?” exists. The existing literature is however quite slim and have mostly focused on the economic impact (Paül et al., 2022). This paper therefore aims to fulfill this gap in the already existing literature by conducting a comparative case study with the usage of a synthetic control approach to examine the question “Did the travel restrictions between Sweden and Norway affect Swedish border municipalities’ labor markets compared to non-border municipalities?”

The findings from the estimated results show that the municipalities located on the Norwegian border has had a larger negative impact on their labor markets, compared to non-border municipalities. The results suggests that the closure of the border resulted in an increase in percentage unemployed in these municipalities, which increased when more restrictions were imposed. The results also showed that men were more affected than women in terms of unemployment.

This paper is divided into several sections and will proceed as follows. The next section will discuss the previous studies conducted on the subject at hand. The third section will discuss the theoretical background of this paper, where the behavior of border shopping tourism and border restrictions will be more in depth described. Also, will the hypothetical outcomes of this



paper be described from the background information. Fourthly, the data used in this paper will be discussed. Fifthly, the method used in this paper will be discussed in depth and why this paper decided upon this methodical framework. In this section will the empirical framework this paper relies upon also be described. In the sixth section will the results from the estimations be shown and lastly will section 7 conclude the paper, with some discussion of the implications of the results.

2 Literature Review

Studies that have been conducted based on border regional effects of the pandemic is, to my knowledge, quite slim. The studies that have been conducted on the subject have therefore focused more on the pure economic impact of the pandemic. However, these have found that border regions have suffered in economic terms during the pandemic. As Paül et al. (2022) who for example examined how the Minho valley border area between Spain and Portugal was affected in terms of GDP losses during the pandemic. The results show that 6 percent of the total fall in GDP during the beginning of 2020 were attributed to limiting the boundary between the two countries. BÖHM (2021) also found in his article that the COVID-19 pandemic had influenced the Czech-Polish borderland, as border restrictions did not allow free passage between these two countries. This resulted in economic losses as employers in the Czech Republic, who relies on heavily on a polish workforce, were not able to produce the expected volume of goods.

But as discussed before, there exists however a fair amount of literature regarding the subject of labor market effects by the COVID-19 pandemic. These studies have mostly been conducted on a macro level, where the interest has been to examine the COVID-19 impact on the country itself. Cajner et al. (2020) examined how the COVID-19 pandemic has affected the labor market in the United States by examining how the pandemic had decreased hiring by using weekly employment data. Their findings show that between February 15 and April 4 there were severe job losses in the United States that, when looking at the total sum, exceeded the amount of job losses



during the Great Recession. Other studies that have been conducted on a country wide level, including the study conducted by Lemieux et al. (2020). The authors examined the initial impact that the Covid-19 pandemic had on the Canadian labor market. This was done by examining how employment and aggregated working hours changed between February and April 2020 by using data from the Canadian Labor force study. The results also showed evidence of that workers who were in the lower income spectrum, non-unionized, younger, and paid hourly were the most affected by the pandemic. However, there also exists literature regarding examinations of regional differences within a country. Raimo et al. (2021) examined how the labor market were affected by examining how different sized municipalities in Spain were affected by the pandemic. Their findings show evidence of that the labor market effects of the pandemic depended on the municipality's economical characteristics.

Other studies have also been done, which have focused on the impact that imposing restrictions have had on a country's labor market. Bauer et al. (2021) examined how the German labor market were impacted by the shutdown of the German society. They found that the shutdowns short term effects impacted the labor market of Germany greatly in terms of unemployment. Other studies have also been conducted to examine the impact that imposing restrictions has had on the labor market in different economic sectors. Marcén et al. (2021) examined how the intensity of non-pharmaceutical interventions had impacted the labor market by focusing on different sector outcomes in the United States by using monthly data on labor market outcomes. Their findings show that the likelihood of being employed decreased with an increase in non-pharmaceutical interventions. Their findings also found evidence of that public employed individuals were less affected than those who employed in the private sector or self-employed. Meanwhile, Huang et al. (2021) examined how COVID-19 interventions policies impacted the hospitality sector in the United States by using high-frequency data on small businesses. Their findings show that increases in new cases of COVID-19 are associated with less working hours, less open



businesses and a reduction of employees employed by the business. There also exists evidence of country differences in this subject as Juranek et al. (2020) examined the economic effects of non-pharmaceutical interventions between the Nordic countries. This was done by using novel weekly data of regional unemployment and furlough spells in all four Nordic countries (Sweden, Norway, Denmark, and Finland) at the early stages of the pandemic. Their main findings suggest that the labor market in Sweden slightly outperformed their Nordic neighbors in terms of lower unemployment levels.

As previous literature conducted on the subject tells us, the covid-19 virus has had a negative impact on the labor market in several ways. However, most of the literature focuses on a country wide level for estimating the labor market impact. And those studies that have been conducted on a regional level have focused more on regional differences within a country in terms of differences in economic sectors. This is understandable. As knowing the impact that the COVID-19 pandemic has had on the labor market of a certain economic sector, or a country overall is of high interest. However, there exists a gap in the already existing literature in terms of how border closures or travel restrictions have affected the border regions labor markets. Studies on border regional effects of the COVID-19 pandemic exists, but these studies have focused more on the pure economic losses (i.e., GDP losses). Also, most of the studies conducted have examined the early pandemic impact on the labor market. Therefore, this paper aims to fill this gap in the already existing literature by adding knowledge of the impact that the COVID-19 pandemic has had on the labor markets in the Swedish border region towards Norway and examining if there exists a difference between genders in terms of unemployment. This will be done by using data from 2017 to 2021, almost covering the whole pandemic period.



3 Background/Theoretical Framework

3.1 Background of shopping tourism and border restrictions

When Norway found oil in the beginning of the 1970s, the country had an economic growth that have led to them becoming one of the richest countries in the world (measured in GDP per capita). Due to this, the income skyrocketed in Norway which also drove up the prices of goods in the country. This has in turn increased the Norwegian purchasing power, making Norway one of the most expensive countries in the world to live in.

Meanwhile, across the border to Sweden, purchasing power didn't increase with the speed that it did in its neighboring country. And with the introduction of the Schengen agreement, where traveling across the borders of the two countries became much easier and the fact that most of the Norwegian population lives in the southern region towards the Swedish border of Västra Götaland, have created strong economic incentives for the Norwegians to travel over the border to buy different goods. As less money gives you more in Sweden from a Norwegian standpoint, this economic phenomenon created an increase of Norwegian shopping tourism over the last decades. As a response for this shopping tourism, municipalities next to the border have increased their investments in shopping areas which have resulted in a structural shift of their combined economic sectors. These municipalities were heavily relying on the industrial sector before they shifted towards relying more and more on their trade sector for employment opportunities (Lorentzon, 2011). This can be most accurately seen in the municipality of Strömstad, located next to the Norwegian border, where approximately 25 percent of the workforce worked in the trade sector in 2019. Of these, 85 percent were attributable to the Norwegian shopping tourism (HUI Research, 2019).

But with the entrance of the COVID-19 pandemic in 2020, the border between Norway and Sweden became heavily restricted to contain the virus. As of 12 of March 2020, the Norwegian Government introduced a 14-day



quarantine for individuals coming from non-Nordic countries (Creutz et al., 2021). 2 days later, on the 14 March 2020, Norway started to impose travel restrictions on their citizens by creating internal border controls. This included the land border towards Sweden. At the same time, the Norwegian Ministry of Foreign Affairs started to advise Norwegian citizens from traveling abroad. However, with the lower infection rates during the second quarter of 2020, Norway started to lift their travel restrictions for their citizens. These included the non-essential traveling to certain countries and regions in Sweden. The regions in Sweden were at this time mapped with certain colors, which followed the infection rates of the region. But with the upswing of the infection rates, the Norwegian government again started to advise against non-essential traveling abroad. From 7 August 2020, these advises started to include all traveling to Sweden. This advice was kept for the remainder of 2020. With the new year, further restrictions were imposed to counteract the virus. On 25 January 2021, Norway imposed mandatory testing for all individuals entering the country. Even more restrictions were imposed later that month, which included entry bans for certain workers commuting to Norway from Sweden. During this time span, Sweden's government also started to impose travel restrictions on their citizens. On March 14, 2020, the Ministry of Foreign Affairs did advise to refrain from non-essential traveling abroad (same time as Norway) and 5 days later imposed a 30 day ban on all non-essential traveling. This included both traveling outside and inside of Sweden. This traveling ban were then renewed until 13 June 2020, when the ban on traveling within Sweden were lifted. The ban on traveling to their Nordic neighbors were lifted piece by piece under the third quarter of 2020, with the travel ban to Norway being lifted on 30 July 2020. This then held on for the remainder of 2020. But at the beginning of 2021, with the entrance of a new wave of the virus, Sweden started to impose an entry ban from Norway as of 25 January 2021. (Table 7 in the appendix shows the timeline of the advice and travel restrictions imposed by the Swedish and Norwegian government).



The remainder of the first quarter of 2021 were followed by more strict travel restrictions for both countries (Folkhälsomyndigheten, 2022; Regjeringen, 2022). These included mandatory quarantine for Norwegians traveling abroad (which were imposed by the Norwegian government 12 March 2021) and requiring proof of a negative COVID-19 test for entering Sweden (imposed 9 February of 2021). But with the introduction of vaccines for the virus, the traveling restrictions started to ease. On 11 June 2021, individuals who were fully vaccinated or recovered from COVID-19 during the past 6 months were exempted from the travel quarantine imposed before. But the last months of 2021, following the emergence of the omicron variant of the virus, were followed by an increase in travel restrictions from both the Norwegian and Swedish government. These restrictions persisted until Norway and Sweden lifted all traveling and entry restrictions (12 February 2022 in Norway and 9 February 2022 in Sweden)

3.2 Theoretical and Hypothetical framework on the labor market by imposing border restrictions

Due to the importance that Norwegian Shopping tourism has on the Swedish municipalities located in the Norwegian-Swedish border area, one could assume that these restrictions, discussed above, have had a great impact on these municipalities. As companies and stores located in these municipalities are highly relying on the demand for different goods from the influx of Norwegian citizens for their profits, one could assume from a theoretical standpoint that these restrictions resulted in a negative demand shock for the companies in the border municipalities. This assumption could be stated to be true since Statistics Sweden reported 55.7 percent losses in grocery sales during the second quarter of 2020 for border municipalities towards Norway (Statistics Sweden, 2020), with losses totaling 37.5 percent for the whole year (Statistics Sweden, 2021). Meanwhile, non-border municipalities had an increase in grocery sales by 5.4 percent, respectively 6.5 percent. And with the decrease of demand for a company's goods or services it produces, one could assume, from a theoretical standpoint of a profit maximization, that the demand companies have for laborers also decreased.



Consider the theoretical framework below. Assuming that there is a perfect competitive market, a certain product is produced and sold according to the equilibrium quantity (Q_1) and price (P_1), which is determined by the demand from consumers and the supply from the firms. If we then would assume that firms are profit maximizing, firms will hire workers in the short run until the value of marginal product of labor (VMP_E) equals the wage rate ($VMP_E = w$). The value of marginal product of labor is determined according to equation 1, where P is the price of the firm's output is sold for and MP_E is the marginal product of labor.

$$\text{Equation 1: } VMP_E = P * MP_E$$

If then there is a sudden decrease in demand from consumers, this will lead to new values of the equilibrium quantity (Q_2) and price (P_2), where $P_1 > P_2$ and $Q_1 > Q_2$. This leads to that the value of marginal product for labor decreases (as $VMP_E = P_1 * MP_E > VMP_E = P_2 * MP_E$). And as a firm hire workers until the value of the marginal product of labor equals the wage rate, this implies that a decreasing value of the marginal product of labor lead to less employed workers.

However, it is notable to keep in mind that a negative demand shock could be stated to have occurred for the whole country of Sweden due to the pandemic, which greatly affected the labor market. To counteract this, the Swedish government imposed policies towards levitating the issue of companies' revenue losses (reorientation support) and increasing unemployment levels (short term employment). Reorientation support functioned as an aid for companies, who have had a great decrease in turnover due to the pandemic and covered up to certain percentage point of a companies fixed costs (The Swedish Tax Agency, 2022A). These percentage points changed during the pandemic. The short term employment policy implied that employees decreased their working hours and that the wage costs were divided by the employer and government (The Swedish Tax Agency, 2022B). But as these policies were the same for all the



municipalities in Sweden, arguments can be made that if the negative demand shock were greater in a specific municipality, then the relative impact of the pandemic should be higher in that municipality. Adding the fact that the restriction imposed by the Swedish government were the same for all regions and municipalities in Sweden leads this paper to the hypothesis that:

- Border municipalities labor markets were more affected by the travel restrictions imposed by the Norwegian and Swedish government than non-border municipalities.

4 Data

The data used in this paper was constructed from several data sources. Unemployment data containing the number of individuals being either unemployed or enrolled in a work program was retrieved from the Swedish public employment services. This data covers the time-period between 2017-2021 and is divided into monthly observations. The data was from the beginning divided into both genders and different age categories, but the age categories were summed for every gender for every monthly observation. Data regarding the population of every municipality were retrieved from Statistics Sweden and contained monthly observations of the number of individuals living in every municipality in Sweden and were divided into 10 year age categories and genders. Lastly, data retrieved regarding the land areal for every municipality was also retrieved from Statistics Sweden. To estimate percentages of female, male and total unemployment for every municipality, the number of unemployed individuals per gender and municipality were divided by the number of individuals residing in the specific municipality between the age of 16-64. This was done due to that the unemployment data covers this span of the age spectrum and dividing it by the total population per municipality would lead to measurement errors. Estimate of percentages of age groups were created by dividing the total number of individuals within these age groups by the total population per municipality. Lastly, an estimation of population per square km per



municipality were created by dividing the total population by the land areal associated with the certain municipality. As seen from the descriptive statistics table below in table 1, the data consist of 17 400 observations for all variables. This is due to that there are 290 municipalities in Sweden and all municipalities have one observation per month. As there are 60 monthly

Variable	Obs	Mean	Std	Min	Max	SE
Total Population	17 400	35 380,253	73 449,533	2376	979 267	556,819
% Population Age 16–24	17 400	9,558	0,976	6,694	16,583	0,0074
% Population Age 25–34	17 400	11,578	2,051	6,006	23,527	0,016
% Population Age 35–44	17 400	11,134	1,604	6,921	17,272	0,012
% Population Age 45–54	17 400	13,008	1,083	9,538	16,633	0,008
% Population Age 55–64	17 400	12,603	1,346	8,653	16,619	0,010
Population Aged 16–64	17 400	21 647, 804	48 708, 471	1242	653 705	369,258
Population per Square Km	17 400	156,835	571,666	0,21	6163,87	4,334
% Female Unemployed	17 400	5,714	2,035	1,303	14,043	0,015
% Male Unemployed	17 400	6,155	2,217	1,761	15,217	0,017
%Total Unemployed	17 400	5,943	2,079	1,669	13,131	0,016

Table 1: Descriptive Statistics



observations per municipality, we have in total 17 400 observations. We can also see that the mean percentage Male unemployment are somewhat higher compared to the percentage female unemployment, which is also true when looking at the minimum and maximum values for these variables. This shows that male unemployment is larger, compared to female unemployment. What's also interesting is that we can see that there is quite a deviation between the municipalities in regards of unemployment rates, as all the values measuring unemployment have large standard deviations, implying that there are some volatilities in the observations.

5 Methodology

5.1 Synthetic control

To examine the effect that the border restrictions has had on the labor market in the border municipalities, the methodology approach of synthetic control will be used. The methodical approach of the synthetic control method could be stated to be an extension of the difference-in-difference method widely used in economic studies. But they differ in some ways to each other. The difference-in-difference approach attempts to examine a “treatment effect” on a treatment group against a control group and thus tries to mimic an experimental design approach, where the control group represents the treatment group if the treatment effect did not occur. However, this method relies on the assumption of parallel trends, meaning that the difference between the treatment and control group should be constant over time without the “treatment event” (Colombia University,2022). A violation of this assumption would then lead to questionable results, as the estimated causal effect might include bias. And in the science field of economics, finding such a relationship between two groups can be difficult, even impossible. The synthetic control method also tries to mimic an experimental design approach to examine the treatment effect on a treatment group against a control group. However, in comparison to the difference-in-difference method, the control group is created rather than chosen. This is done by creating a synthetic control, by using a combination of potential control



units. Therefore, is this methodological approach not relying on the parallel trend assumption as the method itself creates the counterfactual, by estimating a weighted average of the potential control units, rather than choosing it (Bouttell et al., 2018). Consider the following methodological framework constructed from previous studies on the synthetic control method by Abadie, A (Abadie et al., 2012; Abadie et al., 2015), which describes the fundamental methodological framework of the method.

Suppose we are interested in examining a causal effect of a certain event for a certain unit (municipality, region etc.) over the period $T = T_0 + T_1$, where T_0 is the period before the event and T_1 is the period after the event. To do so we have data consisting of $J + 1 = j$ units where j is the number of units in the data set. As we are interested in examining a certain unit, we assign our treated unit as $j = 1$. The other municipalities, which consist of the units $j = 2$ to $J + 1 = j$, are assigned to the donor pool. These are the potential control groups that we can use as a counterfactual towards our “treated unit”. Assuming then that we are interested in examining the “treated unit” before and after a certain event threshold, we can then with the usage of “weights” create a synthetic control group that are as exact to the treatment unit during the pre-event period of T_0 as possible. Defining the values of the pre-event period for the treated unit, that we are aiming to match to create the synthetic control, as X_1 , which is as $(J \times 1)$ vector. Then let X_0 be a $(K \times J)$ matrix that consists of the same values in the pre-event period for all other units in the donor pool. Lastly, we define the synthetic control also as a $(J \times 1)$ vector which consist of values of weights defined as $W = (w_1 + w_2 \dots w_{j+1})$, where every unit in the donor sample w_j has values between $0 \leq w_j \leq 1$. This implies that the synthetic control is defined as the weighted average of the units in the donor pool. By then minimizing the pre-event values of the units in the donor pool with the values of the treated unit accordingly, we select the optimal synthetic control, W^* , according to equation 2 below.



$$\text{Equation 2: } W^* = \sum_{m=1}^k v_m (X_{1m} - X_{0m}W)^2$$

Here X_{1m} and X_{0m} represents the treated unit, respectively the donor unit for the m -th variable. W represents the weights assigned and v_m represents the relative importance of the m -th variable when measuring the difference between X_{1m} and X_{0m} . As such, the values of X_{0m} that closely resembles X_{1m} are assigned large values of v_m which will in the end be those units that constructs the Synthetic control, W^* . Thus, will the synthetic control group be as similar as possible to the treatment group in this case, which in turn eliminates the uncertainty of choosing a counterfactual to the treatment ad hoc. And as the matching technique only matches the treated and the synthetic control on the pre-event period, the post-event period should reflect the potential difference between the treated and control group. However, this method is not without flaws. As this method relies on the ability of being able to match the treated unit with the potential controls in the donor pool based on periods before the event, it is sensitive to small data sets. Evidence from previous studies have shown that at least 20 different time observations should be included in the pre-event period (G. Peri et al., 2022). Otherwise, the usage of this method might lead to misleading control groups, as the difference between the treated and control might be larger than accepted. But for this occasion, this will not be a problem. As the data used to conduct this study have 72 observations for every unit measured in the pre-event period, this will not have an effect.

5.2 Empirical framework

To examine the difference between non-border municipalities and border municipalities, three estimations will be conducted. These estimations will use the outcome variable of the total percentage unemployment in the municipalities, the male unemployment in percentage and the female unemployment in percentage. This is done as to examine if there exist differences in terms of total impact and if there exist differences between



genders. As there are 290 municipalities in Sweden and we are interested in examining the difference between a border municipality and a non-border municipality, will this paper use 3 border municipalities as the treated unit and the rest as potential controls. This is done to create an average treatment municipality. Therefore, our treated unit will be the municipalities of Årjäng, Strömstad and Eda. The reasoning behind the choice of these three municipalities stems from the fact that these three municipalities have a large connection with border shopping tourism along the Norwegian border. The municipalities of Strömstad and Eda have created large shopping centers due to the influx of Norwegian citizens. The municipality of Årjäng also has a connection with border shopping tourism as the town of Töckfors, located within the municipality, have also built shopping centers due to the shopping tourism. And in 2020, these three municipalities were reported to have lost a large percentage in grocery sales (62.1 percent for Strömstad, 49.1 percent for Eda and 42.2 percent for Årjäng), compared to the previous year (Statistics Sweden, 2021). These municipalities therefore serve as great “treated” units to examine the impact that border restrictions have had on unemployment. To accurately estimate the average treatment effect of the border closure, a treatment group will be constructed by creating an average treatment group where all the municipalities above are used. Thus, there will be 287 possible donor pool left to create the synthetic control group. To be able to estimate the effect of the border closure, this paper will use the event threshold of April 2020. This date is chosen as the first implementation of border restrictions started 14 March 2020. Due to that this paper uses monthly data, choosing the exact date is impossible. This might therefore lead to some measurement errors, but it will at least show the effect that the border closure had on a monthly level. As these estimations want to examine the difference between non-border municipalities and border municipalities, we exclude 18 other municipalities which border to Norway. This is due to that including these municipalities will lead to that our synthetic control might have units that were affected by the border restrictions. This leaves us with 269 potential donors for our treatment group. The municipalities excluded from the donor sample are described in Table 6 and are



geographically represented in figure 4 in the appendix. To create the synthetic counterpart to our treatment group, lagged variables of the outcome variable is used for every estimation (for the male estimation the percentage unemployment for males are used etc.). These lagged outcome variables are lagged into 10 month spans from January 2017 to April 2020 (2017-10, 2018-08, 2019-06 and 2020-04). Other variables are used to match the treatment group to the synthetic control, which account for composition of the population and the population density, which are shown in table 2 above. To control for population composition, we include percentages of population aged between the age categories 25-34, 35-44, 45-54 and 55-64. This is done to match the potential controls to the treatment group by the division of the

Outcome variables	Matching variables
Percentage Male Unemployed	%Population Age 25-34
Percentage Female Unemployed	%Population Age 35-44
Percentage Total Unemployed	%Population Age 45-54
	%Population Age 55-64
	Total Population Per Square Km
	Outcome variable 2017-10
	Outcome variable 2018-08
	Outcome variable 2019-06
	Outcome variable 2020-04

Tabell 2: Outcome and matching variables for the synthetic control estimations

municipalities population, as the unemployment impact could have been different on different age groups. Therefore, by matching the synthetic control to the age groups, we would ensure that the age groups would be similar in both groups. To account for the population density, an estimate for total population per square km are used. As the treatment municipalities are sparsely populated municipalities, we would want to have sparsely populated municipalities in the synthetic control.



6 Results

6.1 Examining the treatment and synthetic treatment (control)

Looking at table 3, we can see the weights assigned to every municipality in the synthetic control groups. The table shows us the municipalities that have been assigned a weight larger than 0.01. The results display that the estimations use different combinations of municipalities in the donor pool to construct the synthetic control and the estimations are using 6 to 7 municipalities to best reproduce the synthetic control prior to the border closure. The municipalities used to construct the synthetic control group are spread across Sweden and includes municipalities that are closely located to the border, but also located further away (Figures 5, 6 and 7 in the appendices shows the exact location of the municipalities in the synthetic control).

Male		Female		Total	
<i>Municipalities</i>	<i>Weight</i>	<i>Municipalities</i>	<i>Weight</i>	<i>Municipalities</i>	<i>Weight</i>
<i>Sunne</i>	<i>0,275</i>	<i>Sunne</i>	<i>0,270</i>	<i>Sunne</i>	<i>0,309</i>
<i>Orsa</i>	<i>0,114</i>	<i>Gotland</i>	<i>0,337</i>	<i>Gotland</i>	<i>0,320</i>
<i>Vansbro</i>	<i>0,149</i>	<i>Umeå</i>	<i>0,180</i>	<i>Umeå</i>	<i>0,128</i>
<i>Umeå</i>	<i>0,173</i>	<i>Nykvarn</i>	<i>0,088</i>	<i>Orsa</i>	<i>0,099</i>
<i>Knivsta</i>	<i>0,133</i>	<i>Mora</i>	<i>0,055</i>	<i>Mölnadal</i>	<i>0,044</i>
<i>Ånge</i>	<i>0,150</i>	<i>Orsa</i>	<i>0,036</i>	<i>Knivsta</i>	<i>0,089</i>
		<i>Ale</i>	<i>0,026</i>		
<i>Total</i>	<i>0,994</i>	<i>Total</i>	<i>0,992</i>	<i>Total</i>	<i>0,989</i>

Table 3: Municipality weights in the Synthetic control

Looking at the results from table 4, we can see how the estimated variables for every group differ in every estimation in the pre-event period. We can see



that there exist differences between the treatment municipalities and the other municipalities in Sweden. As the table shows us that the donor samples for all three estimations of unemployment differs from the treatment, both when looking at females, males and when looking at the total for the treatment municipalities. Examining females, we can see that the treatment group differs between approximately 1-2 percent compared when comparing to the donor sample average in percentage unemployment.

Variable	Treatment Female	Synthetic Treatment Female	Donor sample Female	Treatment Male	Synthetic Treatment Male	Donor sample Male	Treatment Total	Synthetic Treatment Total	Donor sample Total
%Population Age 25-34	12,264	12,250	11,557	12,264	12,257	11,557	12,264	12,211	11,557
%Population Age 35-44	11,085	11,121	11,194	11,085	10,895	11,194	11,085	11,087	11,194
%Population Age 45-54	13,254	13,251	13,229	13,254	13,238	13,229	13,254	13,244	13,223
%Population Age 55-64	12,850	12,860	12,429	12,850	12,840	12,429	12,850	12,943	12,429
Total Population Per Square Km	15,269	28,443	166,477	15,269	22,908	166,477	15,269	43,015	166,477
Unemployment 2017-10	4,224	4,210	5,656	5,069	5,003	6,22931	4,664	4,600	5,954
Unemployment 2018-08	3,461	3,494	5,398	3,783	3,830	5,444	3,631	3,640	5,422
Unemployment 2019-06	3,287	3,335	5,328	3,406	3,507	5,304	3,349	3,551	5,315
Unemployment 2020-04	5,107	4,790	6,176	5,370	5,204	6,731	5,244	5,213	6,464

Table 4: Balance Table for Female, Male and Total Unemployment



This can be stated to be true for the other estimations, as both percentage unemployment for total and males differs with 1-2 percent as well. However, the most interesting to examine from this table is to study the treatment with the synthetic version of the treatment group. Looking at the three different estimations, we can see that the treatment and synthetic treatment are matching quite well. As we want these estimates to be as close to each other as possible for every variable, it suggests that the treatment and synthetic control are nearly identical. Comparing the values between these two groups for all three estimations, we can see that almost every variable has a difference smaller than 1 percent. The lagged values of unemployment for all three estimations differ between approximately 0.01-0.3 percent. Only total population per square km are different to a larger extent, with values differing approximately between 7-28 individuals per square km. But the difference has shrunk, when comparing it to the donor sample averages. Otherwise, the values are approximately equal across the variables, with differences estimated to be smaller than 1. These results suggest that the synthetic treatment (synthetic control) is approximately equal to the treatment group. Looking at Figure 1 below, we can see the trend in percentage of unemployment for both the synthetic and the treatment group for all the estimations. The dashed vertical line represents the event date of April 2020. From this figure, we can see that the treatment and control group are very similar in the pre-event period (for all estimations), which shows that the similarities between these two groups are quite identical. Looking at the estimated average difference between the treatment and synthetic control group outcomes in the pre-event period, we can see that the estimated difference is between -0.041 and 0.016 percent (-0.041 percent for females, 0.016 percent for males and -0.411 percent for the total estimations). This again shows us that the synthetic control represents the treatment group as a good counterfactual for all estimations. When looking at the post-event period of the figure, we can however see differences in the percentage of unemployment between the treatment and control groups. After the border closure, we can see that the treatment group rose more rapidly compared to the synthetic control group for the estimations. The estimated average



difference between the treatment and synthetic control groups in the post-event period where 0.92 percent for females, 1.25 percent for males and 0.99 percent for the total estimation. This implies that there was a larger effect on unemployment in the treatment group compared to the synthetic control after the border closure.

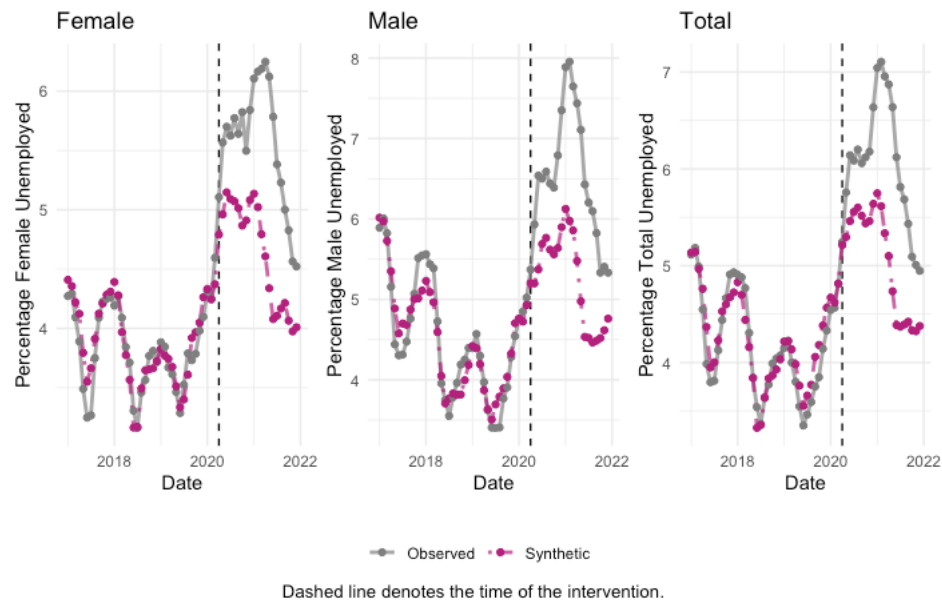


Figure 1: Time series of Observed and Synthetic Percentage Unemployment

6.2 Estimated results of unemployment differences

Looking at figure 2, we can see the difference between the treatment and the control group over time. Here we can clearly see that there exists an effect of the border being restricted. Right after the border was restricted, the difference between the border municipalities and non-border municipalities started to rapidly rise. It is most predominant in the male estimation, where percentage difference in unemployment rose to 1.17 percent in June 2020. For the total effect and female effect, we can also see that the difference started to rise after the introduction of the border restrictions. The result from the figure also suggests that the difference in percentage unemployment is largely correlated with increases in border restrictions. As the figure shows that after June, there was a small decrease in the difference between the treatment and synthetic control. This coincides with the lifting of the Norwegian ban on non-essential traveling to Sweden. But after August 2020,



with more restrictions being imposed over time, we can see that the difference in percentage unemployment started to rapidly rise again.

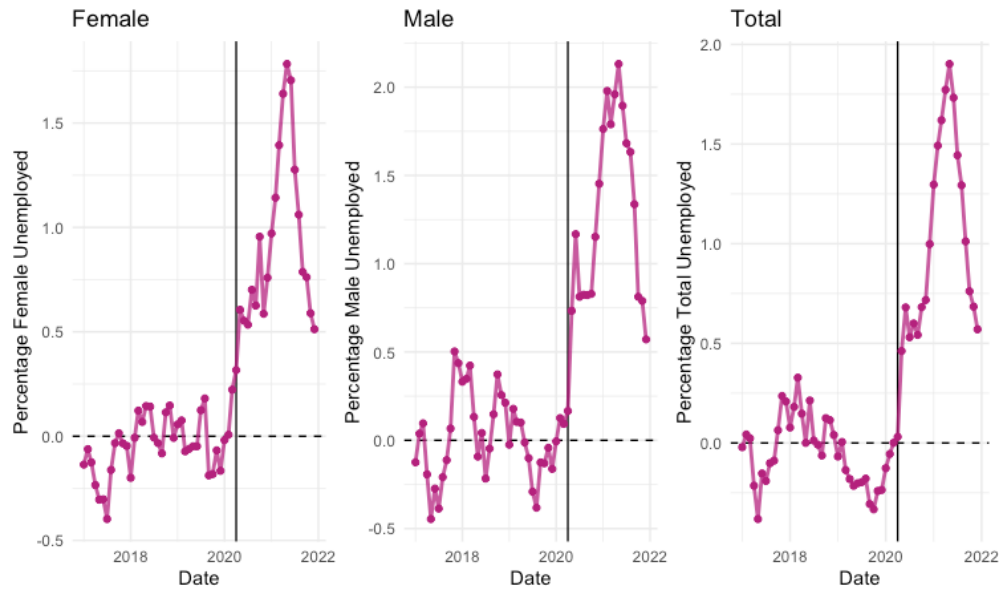


Figure 2: Gap in percentage unemployed between treatment and synthetic control

For all three estimations, we can see that the difference rose to a peak in May 2021 (2.13 percent for males, 1.78 percent for females and 1.90 percent in total). However, we can also see that after the peak in unemployment, the difference decreased rapidly for all estimations. This might be a result from the lower rates of covid cases as the summer began and due to the fact, that during this period, vaccines began to be accessible for most of the populations of both Sweden and Norway which lead to easier transfers across the border. But even at the end of 2021 (December 2021), we can see that there still is a difference between the treatment and the synthetic control of approximately 0.5 percent for all three estimations.

6.3 Significance of the results

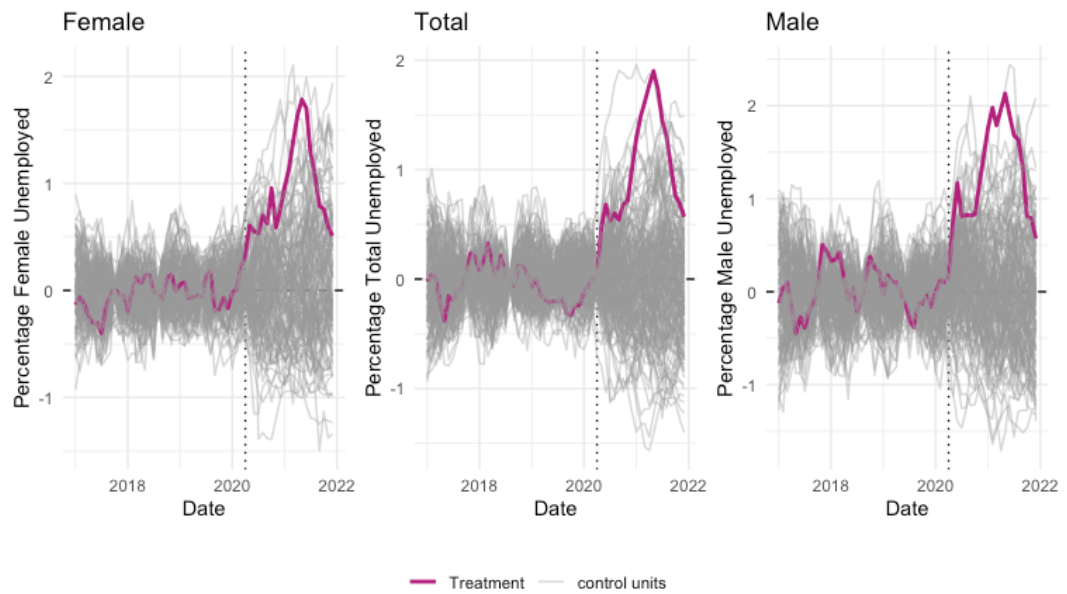
To examine the significance of the results, a placebo test was performed to accurately examine the validity of the results obtained in section 6.2. This test performs the same estimation conducted on the treatment group above, but for all the units in the donor pool. Thus, one can examine the effect of the event on the units that were not affected by the event towards the treated unit that were affected. This is done by measuring the mean squared prediction



error (MSPE), which is the average of the discrepancies between the outcome variable in the treated unit and its counterpart, for the pre- and post-event periods. Then by dividing the post-event with the pre-event MSPE, a MSPE ratio is obtained. By then ranking the MSPE ratio for all the estimations conducted (both for the treatment group and all the potential donors) by the size of the MSPE ratio (where the largest value is assigned 1, second largest is assigned 2 etc.) we can derive the fisher exact p-value for the municipality in question (shown in equation 3 below). This allows us to obtain the probability that the results are driven by chance.

$$\text{Equation 3: Fishers Exact Pvalue} = \frac{\text{Ranking of the Municipality}}{\text{Total sum of municipalities in the sample}}$$

The results from the placebo test are shown in figure 3 and in table 5. From figure 3, which shows us the effect that border closure had on all the municipalities in the donor pool, we can see that the effect of the border closure influenced all the municipalities in all three estimations, but to different extents. The figure tells us that the treatment group experienced a larger effect due to the border restrictions compared to most of the municipalities in the donor pool. However, for all three estimations, we can see that there exist control units in the donor pool that have had similar or larger effect on the percentage of unemployment than in the treatment group. This is especially true for the female estimation. This might indicate that the results are not significant and thus they are driven by chance. Therefore, a more in depth examination of the MSPE ratio is conducted to examine the significance of the results of the estimations more accurately.



Pruned all placebo cases with a pre-period RMSPE exceeding two times the treated unit's pre-period RMSPE.

Figure 3: Difference in percentage unemployment between the treatment and synthetic control group for municipalities in the donor pool

Looking at table 5, we can see the pre-event MSPE, post-event MSPE, MSPE ratio, ranking and fisher p-value for the treatment group for the three estimations. For the female and male estimations, the rank value for both estimations are one. This implies that the MSPE ratio for the treatment group is the largest among the estimation done in the test, for both estimations. And examining the associated fishers exact p-value for both estimations, we can see that both are 0.004. This implies that the associated effect of the event is not driven by chance and is thus significant, as the values is below the commonly used threshold value of 0.05. Looking at the total estimation for the treatment group, we can see that it received a ranking of 3. This implies that there are 2 other municipalities in the donor pool that had a larger MSPE ratio compared to the treatment group. However, the p-value associated with this estimation is 0.011, which is still below our threshold value of 0.05. This implies that the results from all three estimations are significant and thus are not driven by chance. This paper therefore concludes that the border municipalities labor markets were more affected by the restrictions, compared to non-border municipalities.



Type	Female	Male	Total
Pre MSPE	0,023	0,054	0,029
Post MSPE	1,060	1,957	1,30
MSPE Ratio	45,634	36,279	44,298
Rank	1	1	3
Fishers Exact P-value	0,004	0,004	0,011

Table 5: Significance table for the estimations

7 Conclusion/Discussion

This paper used data from the Swedish Public Unemployment Services and Statistics Sweden to examine the impact that border restrictions has had on the border municipalities along the Norwegian border, with relies heavily on border shopping. Using the synthetic control method, this paper concludes that restricting the border between Norway and Sweden had a negative effect on the border municipalities labor markets located on the Swedish side. The results show that the average total effect of these restrictions led to an increase in unemployment by 0.95 percent, when compared to municipalities not located in the border area. The results also show that in terms of gender differences, males were more affected than females. The results also show us that there exists a positive trend in unemployment when increasing the border restrictions. These results therefore tell us that there exists a regional difference in how these restrictions have affected the economy. As during the pandemic, the border between Norway and Sweden were heavily restricted, resulting in less individuals traveling across the border. The importance that shopping tourism has in these border municipalities, led to an economic downturn due to the border closure in the municipalities located near the border which was more profound than in other areas in Sweden. As



Sweden's strategy for counteracting the economic downturn were centralized in the sense that all regions received the same aid, future policymakers should consider these results for future policies. Also, these results shed some light on the importance that shopping tourism has on these municipalities. Therefore, there exists an interest for both countries (especially Sweden) of having extensive cross-country cooperation when it comes to the border passing between these two countries.



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9 Appendices

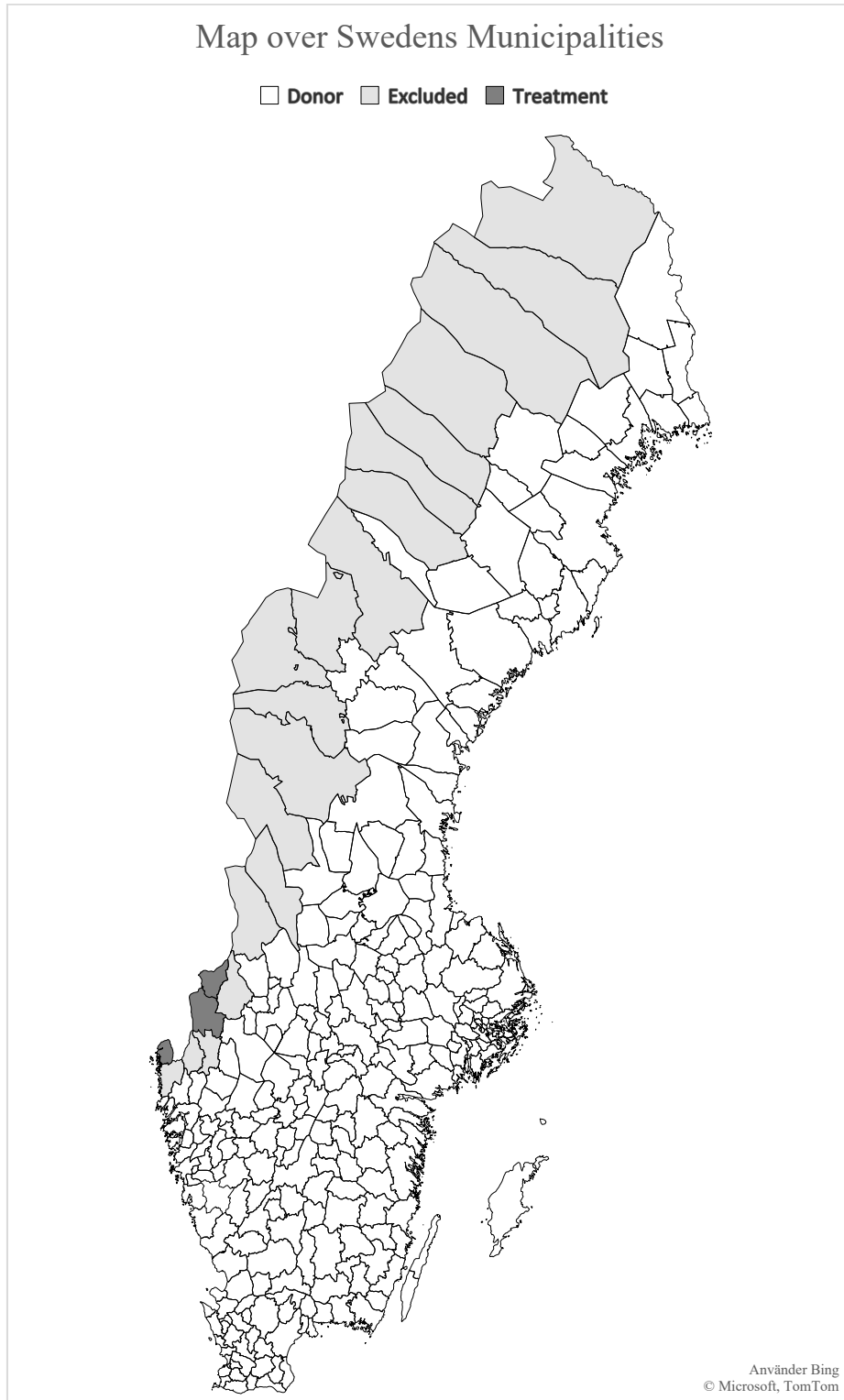


Figure 4: Geographical Map over Sweden's Municipalities: Sorted into Treatment, Donor, and Excluded Municipalities

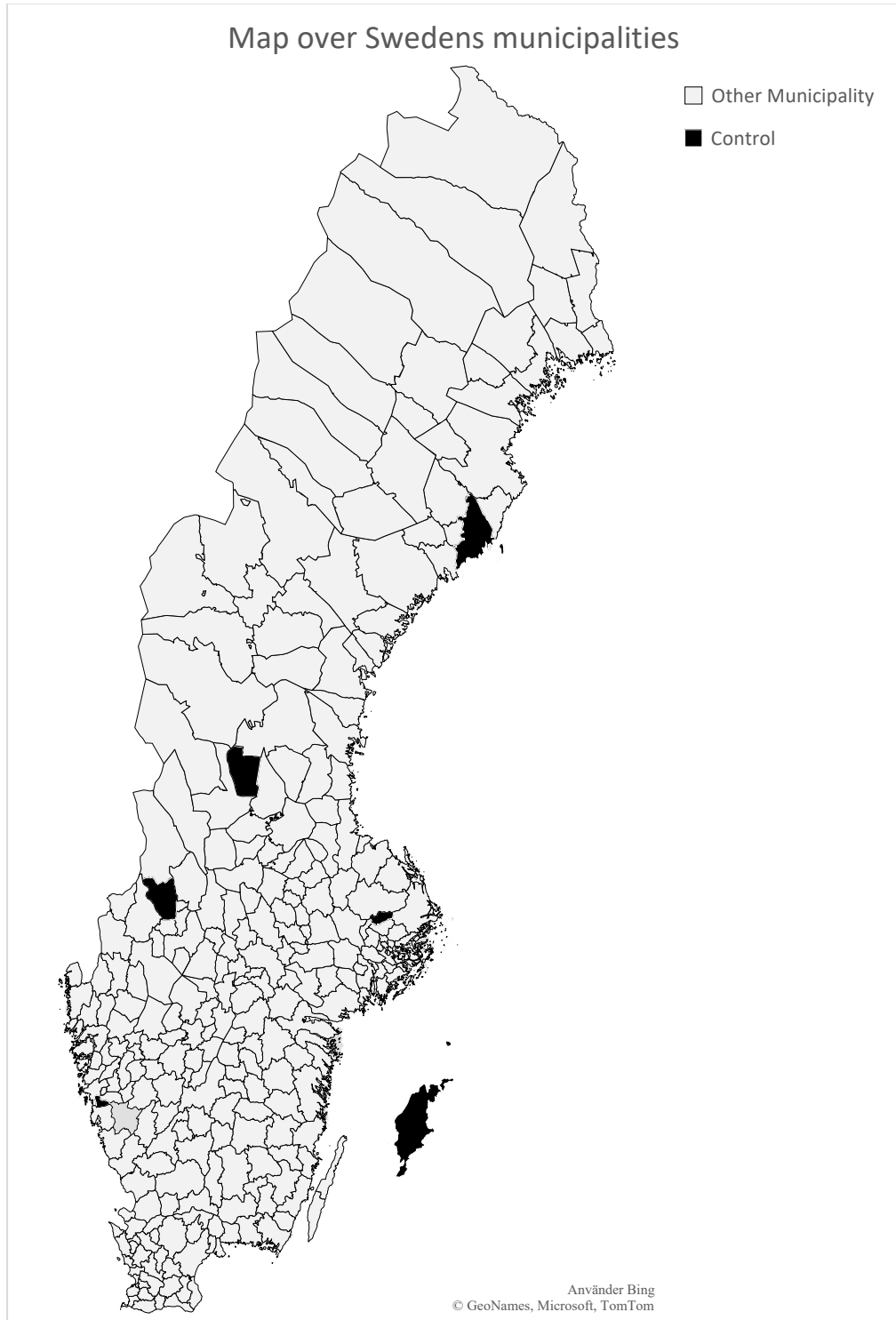


Figure 4: Map over weighted control municipalities for total unemployment.

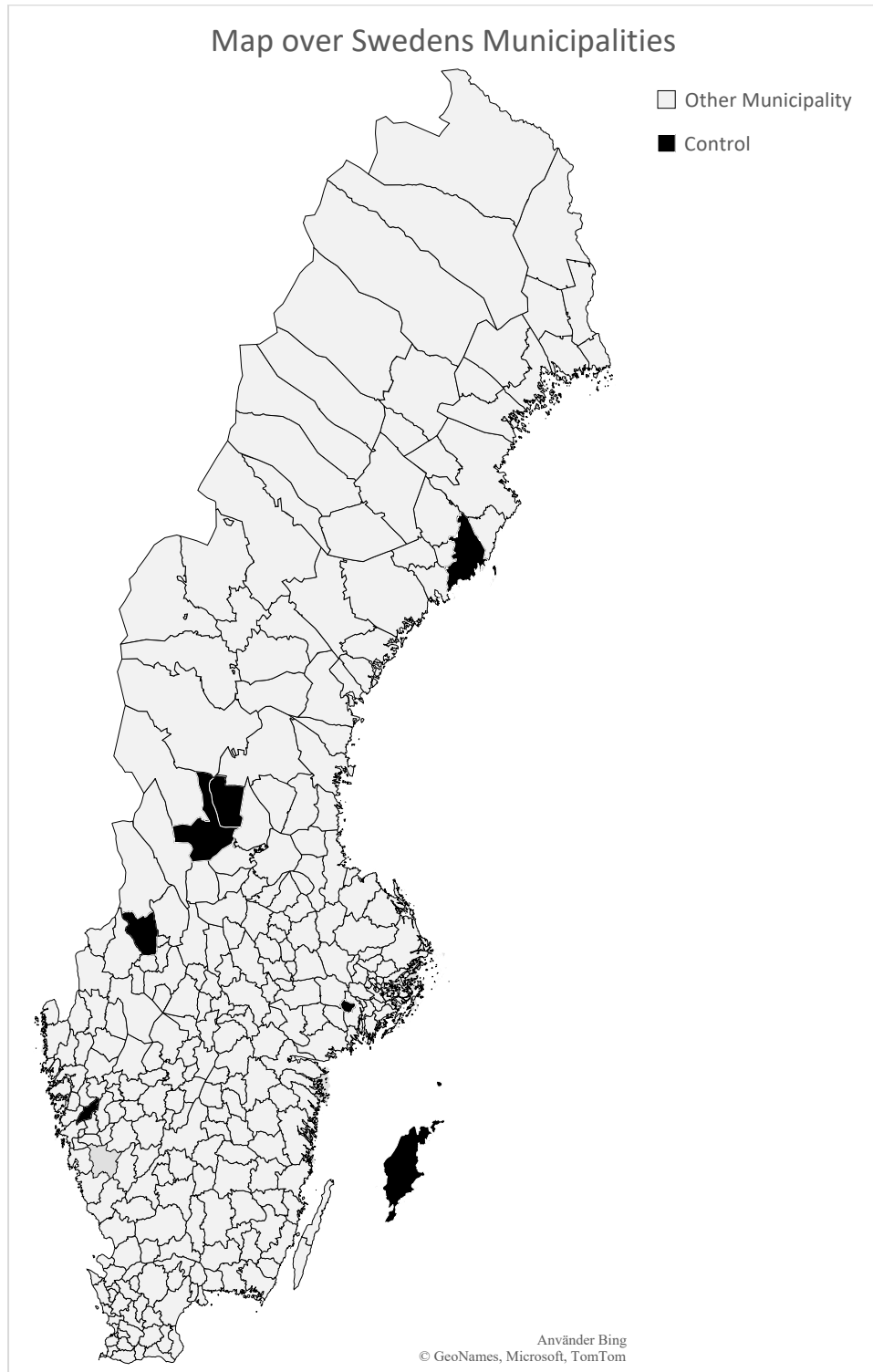


Figure 5: Map over weighted control municipalities for female unemployment

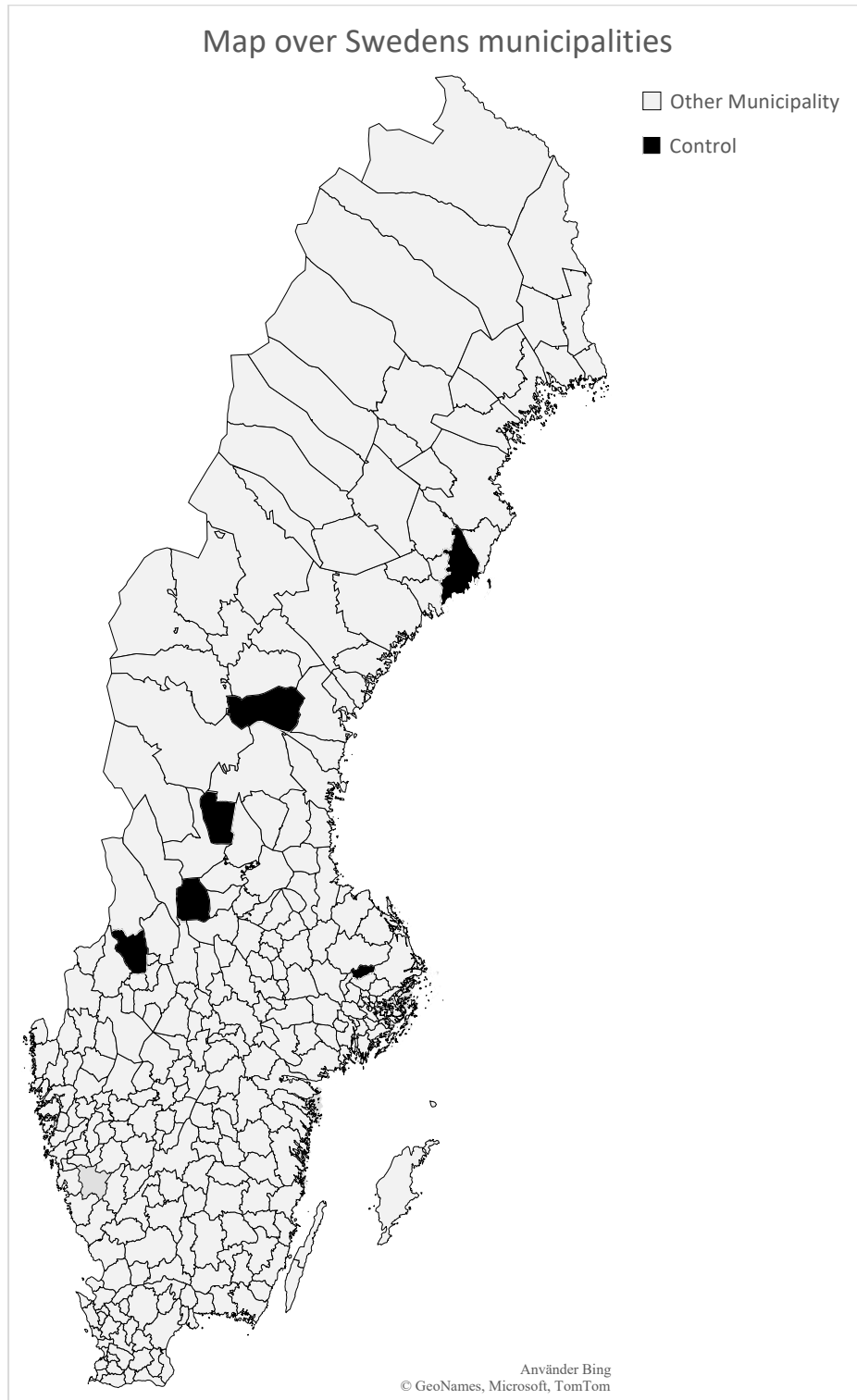


Figure 6: Map over weighted control municipalities for male Unemployment



Tanum	Sorsele
Dals-Ed	Vilhelmina
Torsby	Arjeplog
Arvika	Jokkmokk
Malung-Sälen	Kiruna
Älvdalen	Gällivare
Krokom	Berg
Strömsund	Härjedalen
Åre	Storuman

Tabell 6: Municipalities excluded from the donor sample

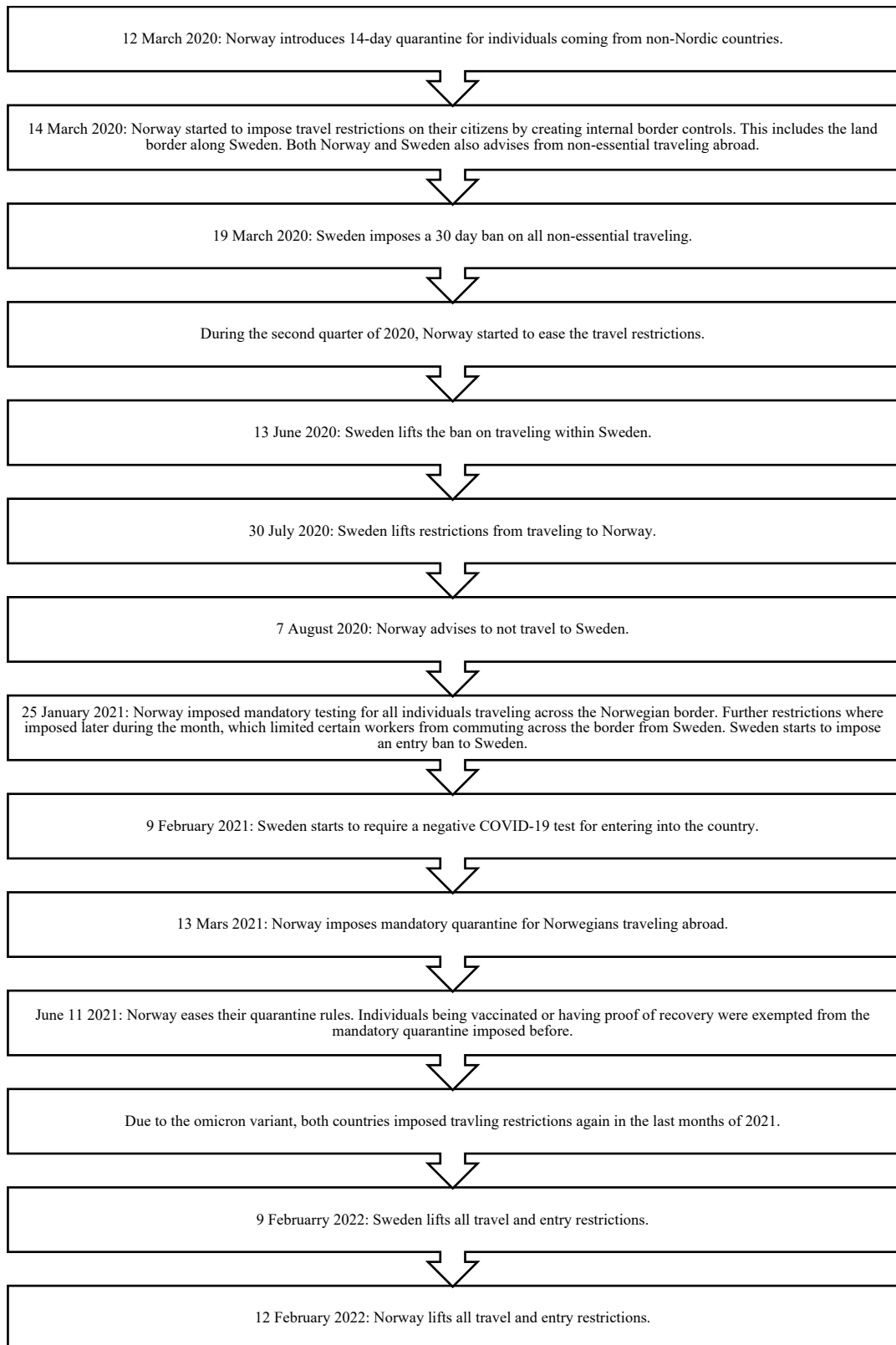


Figure 7: Timeline of entry and traveling restrictions imposed by the Swedish and Norwegian government during 2020-2022.

