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ECONOMIC AND SOCIOLOGICAL FACTORS OF DEATHS OF DESPAIR IN SWEDEN AND NORWAY

A REGIONAL PANEL DATA APPROACH

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Abstract: I employ a descriptive study design to examine the relationship between the rate of deaths of despair and higher education, unemployment, gross regional product per capita, divorce, and sex ratios. Aggregate regional data is used. A first analysis is performed in Sweden across age and sex groups. A second analysis is performed in Sweden and Norway jointly. A regional fixed effects panel regression is used for both analyses and covers the years 2005-2020. The rates of deaths of despair were found to be constant or decreasing in Sweden and Norway. Males aged 50-64 are by far the most affected group of deaths of despair among the working age population. A significant association between the gross regional product and the rate of deaths of despair was found among males aged 50-64 in Sweden. A possible strong association between the rate of deaths of despair and the higher education rate and/or the GRP per capita was found for males and females aged 35-49. No significant associations were found in the joint analysis of Sweden and Norway.

Keywords: Panel Data, Suicide, Substance Abuse, Educational Status, Welfare State

JEL: C33, I120, I240, P160

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1 Introduction

The well being of people in a society is affected by surrounding factors such as the state of the economy and interactions with other people. In the extreme, a low well being in a person can lead to self-destructive actions, such as drug- and alcohol use and suicide. Case and Deaton (2015) noticed an increase of all-cause mortality in the U.S.A. between 1999 and 2013, driven mostly by death from suicide, drugs, and alcohol. They disproportionately affect non-Hispanic, low educated white people of middle age in the U.S.A.. Case and Deaton (2020) named these types of deaths (suicide, drug and alcohol poisoning, and liver failure) "deaths of despair" in the book *Deaths of Despair and the Future of Capitalism*. The subject of deaths of despair has since been researched mostly in the setting of the U.S.A..

While there is research on deaths of despair in the setting of the U.S.A., there is a gap in the literature regarding deaths of despair in other settings. Deaths of despair are not as prevalent in European countries as in the United States. However, it is of interest to examine the associations between economic and sociological controls and the rate of deaths of despair in other settings, to see if there are similar correlations as in the U.S.A.. The Nordics are vastly different from the U.S.A. in the way that the societies are organized and they also experience different economic shocks. The prevalence and associations of socioeconomic variables with rates of deaths of despair therefore have reasons to differ from in the U.S.A.. This invites the question: Can the associations between deaths of despair and its drivers in the U.S.A. be generalized to the welfare states in the Nordics?

In this thesis I examine the relationship between economic and sociological variables and deaths of despair in Sweden and Norway. I carry out a descriptive study design where I use regional panel data on deaths of despair and explore its associations with the economic and sociological variables: higher education, unemployment, the gross regional product per capita, the divorce rate, and the sex ratio (number of males/number of females in a region). All of these controls have been shown to have merit in explaining deaths of despair or specifically suicide, and it is of interest to examine whether they correlate with the deaths of despair in Sweden and Norway, and to what extent. I perform two different analyses; one for age and gender groups in Sweden, and one in Sweden and Norway combined. I contribute to the literature by providing an updated analysis of deaths of despair in the setting of Sweden and Norway, a different context than the initial geographical setting. This is of interest since the U.S.A. and the Nordics experience different economic shocks, the societies are vastly different in terms of welfare systems, and the possibilities to abuse opioids are different.

One analysis is performed on a regional level in Sweden, examining if the prevalence and associations of deaths and despair differ across age groups and sex. The dataset uses yearly data over the years 2005-2020, and the demographic groups analyzed separately are aggregated male 25-34, 35-49, and 50-64 year olds as well as female 25-34, 35-49, and 50-64 year olds. The regressions use rate of deaths of despair as the dependent variable, conditioning on region fixed effects, higher education rates, unemployment rates, GRP per capita, divorce rates, and sex ratios. Two regressions are run for each demographic group, with the difference that one of them excludes the gross regional product (GRP) per capita. A benefit of this analysis is that it is run for age and sex specific groups, allowing me to explore correlations across these groups. A disadvantage of it is the small number of regions (21) used for clustering, which is remedied by using wild bootstrap p-values.

A second analysis is performed on Sweden and Norway combined, with aggregate regional data over 2005-2020. The main difference between this analysis and the previously described, is that the joint analysis of Sweden and Norway uses aggregate data for the whole population in the regions, not separately for age and sex groups. The motivation is that the data in Norway is not available in such detail to make such an analysis possible. While these regressions allow for more clusters (32) and therefore cluster robust standard errors, there is a lack of detail since I cannot observe any age and sex specific correlations. Similarly to the analysis of Sweden, I run two regressions for Sweden and Norway jointly, one with all control variables and one which excludes the GRP per capita.

My work builds on previous literature in deaths of despair, as well as literature concerning suicide. The closest papers to my analysis are Case and Deaton (2015) and Breuer (2014). Breuer (2014) explores the effect of economic variables specifically on suicide mortality in Europe, using data from 275 regions in 29 countries in Europe over the years 1999-2010. Breuer (2014) finds that unemployment has a positive effect on suicide, especially for working age males. Furthermore, real economic growth has a negative effect on suicide for working age males. I differ from Breuer (2014) in several ways. Firstly, I use deaths of despair as the explanatory variable instead of suicide. Furthermore, I use data from 32 regions in the analysis of Sweden and Norway, and 21 regions in the analysis of Sweden, which is notably fewer regions and countries than Breuer uses. I choose to focus on the Nordics, and due to a lack of data, I choose to perform the analyses in this setting. I also choose a different set of variables than Breuer (2014), where I do not include the fertility rate, weather conditions, life expectancy, and economic growth, which are the control variables in the analysis of Breuer (2014). I use the unemployment (similarly to Breuer (2014)) rate and the GRP per capita (while Breuer (2014) uses the GDP per capita). Instead of using the other control variables of Breuer (2014), I control for a higher education level, divorce rates, and sex ratios. The motivation is that deaths of despair showed a significant correlation with higher education from Case and Deaton (2020), which motivates my choice of using the higher education level. I furthermore use divorce ratios and sex ratios as additional controls for the sociological environment since they have been shown to be associated with suicide rates in other research (Milner et al. (2013), Okada and Samreth (2013), Kuroki (2013) and an exploration of their association on deaths of despair in the Nordics is of interest. Another differing point is that I use a dataset from 2005-2020, which provides an updated analysis of recent trends in the mortality of suicide (and additional drug and alcohol deaths), compared to Breuer (2014).

Case and Deaton (2015) examined the prevalence and associations of deaths of despair in the U.S.A. betweeen 1999 and 2013, and found a rising prevalence of the deaths of despair as well as associations with low education and non-Hispanic white race. I differ from Case and Deaton (2015) in that I examine these factors in a different setting of Sweden and Norway where the society and institutions are vastly different. Furthermore, I use economic and sociological variables as controls, while Case and Deaton (2015) focus on finding associations with higher education, as well as self-reported accounts of pain levels, mental health, and ability to perform work. I also use aggregated regional data instead of individual data, which Case and Deaton (2020) are including in their analysis.

In the different setting of Sweden, I do not obtain the same results as Case and Deaton (2015, 2020) do in the U.S.A. of the prevalence of deaths of despair and the associations of deaths and despair with education and other variables. My result shows four main patterns. First; that unlike in the U.S.A., the rate of deaths of despair in Sweden are not increasing, rather they are staying flat or declining. Secondly, the rates for the group with the most deaths of despair (males aged 50-64) have changed the most, exhibiting a significant decline of around 25% in 2020, compared to 2005. Thirdly, the result of the regressions for males aged 50-64 shows a strong negative association between the GRP per capita and the deaths of despair. Finally, the results for males and females aged 35-49 show a negative association with the higher education rate.

The results for males aged 25-34 are inconclusive, and show no strong association between deaths of despair and the control variables except for a negative association between the higher education rate. The results for females in age groups 25-34, 35-49, and 50-64 show no significant correlations with the rate of deaths of despair, except a possible significant association between the rate of deaths of despair for females aged 35-49 and the higher education rate and/or the GRP per capita, as these two variables show potential for collinearity.

The result for the joint analysis of Sweden and Norway shows that the rate of deaths of despair on a country level has stayed roughly the same from 2005-2020. The combined analysis of Sweden and Norway showed no significant correlations between the rate of deaths of despair and the control variables.

A main limitation of this thesis is that the data used is on a regional, aggregate level and not on a smaller, municipal level. Using municipal data would result in a larger sample size and yield more power to the analysis due to more observations. The main finding of this thesis is that the rates of deaths of despair for males aged 50-64 in Sweden are negatively associated with the GRP per capita. This shows that economic conditions seem to be related to the well being of this demographic group to the extent that it is visible in the rate of deaths of despair. Another significant limitation is that there are no causal claims in this thesis. Due to the fact that I use regional aggregate data and not individual data, I can observe the correlations between the rate of deaths of despair and the controls; however, the data set and analysis used lacks the ability to generate any causal claims about the effect of the controls on the rate of deaths of despair. Inferring any conclusions from the results of the aggregate data to individuals would be an ecological fallacy. Since I cannot control for confounding factors, I therefore cannot test any hypotheses regarding causality.

This paper will be presented in this order: In section 2, the background is presented. Section 3 pertains to the analysis of Sweden. In section 3.1, the description of the data is presented, in section 3.2, the methodology is described, and in section 3.3, the empirical results are presented. Section 4 pertains to the combined analysis of Sweden and Norway. In section 4.1, the description of the data is presented, in section 4.2, the methodology is described, and in section 4.3, the empirical results are presented. The discussion is presented in section 5, and finally the conclusion in section 6.

2 Background

Durkheim (1867) argues that suicide is affected by the individual and social environment, and also that the more educated commit suicide to a higher degree. Much research has since been done on the subject, as well as societal changes which may affect the drivers of suicide. I present below previous research on the variables which I use as controls: higher education, unemployment, the gross regional product, divorce, and sex ratios.

An extension of the suicide rate is to use the rate of suicide, drug overdose, and death caused by alcohol, also called “deaths of despair”, a term coined by Anne Case and Angus Deaton (2020). It can be argued that drug overdoses and death caused by alcohol could be grouped similarly as suicide, since they are self-inflicted and can be seen as a sign of distress, Case and Deaton (2020) write. This has been on the rise in the United States of America since the 1970’s, where it primarily affects middle aged whites with less education than a bachelor’s degree. Case and Deaton (2020) believe that the cause of the decrease in life expectancy in the United States largely is the “deaths of despair”. Causes of this despair are believed to be unemployment, reduced wages and benefits, and reduced family and community integration (Case and Deaton, 2020). Coope and Gunnell

(2014) find a positive relationship between unemployment and suicide among males aged 35-44 in England and Wales. Kennelly and Connolly (2014) also find that unemployment increases suicide risk for middle-aged males of low socio-economic status. However, the literature is not unanimous and unemployment has not had a clear relationship to suicide and drug and alcohol deaths, as Case and Deaton (2020) agree with.

Mortensen et al. (2000) found that socioeconomic economic variables such as unemployment, single status, and a low income were correlated with suicide risk in a case-control study of the Danish population. When controlling for mental illness, which was the most strongly associated with suicide risk, the effect of the other factors was reduced.

Milner et al. (2013) find in a review of over 200 articles, that unemployment and divorce showed stable relationships with suicide, and also that the suicide rates are associated with changes in the economic environment. Oyesanya et al. (2015) find, in a review of 38 studies, that periods of economic recession seem to increase suicide rates.

Okada and Samreth (2013) find that divorce rates have an increasing effect on suicide in 9 OECD-countries in Europe, for example in Norway but not in Sweden.

Case and Deaton (2020) finds a strong link between a bachelor's degree and protection against deaths of despair among working age white Americans, unlike Durkheim. Yoshioka (2016) as well finds that a higher education is protective against suicide in Japan. The findings of Lorant et al. support this as well, and furthermore show that the ratio in suicide rates in Europe between the lowest educated group and the highest educated group has increased from 1.82 in the 1990s to 2.21 in the 2000s.

Kuroki (2013) finds that high sex ratios (higher proportions of males per female) increase male suicide, both with sex ratios and lagged sex ratios from early age, as it decreases the pool of potential females per male that the males can mate with.

King et al. (2022) have analyzed deaths of despair in the United States in the 21st century and in Eastern Europe in the end of the 20th century. They find a connection between the local economy in the United States and deaths of despair, as well as connections between the economy and dangerous drinking habits and psychosocial stress in Eastern Europe. King et al. (2022) draw the conclusion that abuse of alcohol and drugs could be coping strategies when faced with economic and psychosocial stress.

Dow et al. (2019) find that state variation of minimum wages and the EITC reduces non-drug suicides, but has no significant effect on drug or alcohol-related mortality. This contrasts Case and Deaton (2020), who write that the cumulative effect of worsening economic and social conditions are what drives the deaths of despair, and not the short term shocks that minimum wages and the EITC entail. Furthermore, it contrasts Case and Deaton (2020) by showing a distinction between what drives non-drug suicides in comparison to drug and alcohol-mortality.

My main contribution is performing an analysis of the deaths of despair in the Nordics, whose result differs from the results in the U.S.A.. This difference could be caused by several factors, such as institutional differences in how welfare and access to healthcate is organized (Raphael, 2014), taxes on alcohol (Herrnstadt et al., 2013), as well as the proclivity of doctors to prescribe opioids (Penn Medicine, 2019, Clausen, 2022).

This thesis contributes to the literature by examining regional differences in deaths of despair in Sweden and Norway, investigating the factors which are associated with deaths of despair in these countries, and what these factors could be. It is valuable to have a better idea of the risk factors for deaths of despair, as they provide starting points for mitigating policies and approaches.

Drawing from previous literature (mostly Breuer (2014) and Case and Deaton (2015)), the hypotheses used for this paper are as follows for the **analysis of demographic groups in Sweden**:

H1: For the "middle-aged" males aged 35-49 and 50-64, one of the explanatory variables of unemployment, GRP per capita, or higher education has an association (positive for unemployment, negative for GRP per capita and higher education) with the rate of deaths of despair.

H2: For the "middle-aged" females aged 35-49 and 50-64, higher education has a negative association with the rate of deaths of despair.

The hypothesis for the **analysis of Sweden and Norway jointly** is:

H3: One of the explanatory variables of unemployment, GRP per capita, or higher education has an association (positive for unemployment, negative for GRP per capita and higher education) with the rate of deaths of despair.

3 Analysis of Deaths of Despair in Sweden

3.1 Data Description

A first analysis compares deaths of despair across age and gender groups, region wise in Sweden across 2005-2020. The goal is to identify associations between explanatory variables and the rate of deaths of despair for age and sex groups in Sweden. I focus only on the regions of Sweden since data is more available for specific age and sex groups in Sweden, compared to rest of the Nordics. I run regressions separately for each age and sex group, where the dependent variable is the rate of deaths of despair and the explanatory variables are higher education rate, unemployment rate, divorce rate, GRP per capita, and the sex ratio. The sex ratio per region is calculated as in equation (1) below.

$$sr = \frac{number\ of\ males}{number\ of\ females} \tag{1}$$

A dataset from the 21 regions (län) in Sweden is used in this analysis. The data for the dependent variable, rate of deaths of despair, consists of the rates of deaths from suicide, harm with unknown intent, alcohol related deaths, and narcotic and drug induced death. They are divided by region, sex, and the age groups 25-34, 35-49, and 50-64. There were missing values in the death statistics, more commonly among the less common causes of death, such as "injuries with unclear intent". These missing values were set to zero, since they were most likely zero or close to zero.

Data on the percentage of unemployed persons among those aged 15-74 years, on a region and sex level is used for the variable of unemployment. Yearly divorces per region and per 1000 inhabitants are used for the divorce variable. The divorce data is divided by sex and the age groups 25-34, 35-49, and 50-64. Population statistics are used for calculating sex ratios in each region, through dividing the number of males by the number of females in the age groups 25-34, 35-49, and 50-64. The percentage of people with a university education, 3 years or longer, is used for the education variable. It is divided by region, sex, and the age groups 25-34, 35-49, 50-64. The gross regional product is measured in 1,000 SEK per capita in current prices.

The data for the deaths of despair is collected from *Socialstyrelsen*. For the explanatory variables, all data is collected from *Statistics Sweden*.

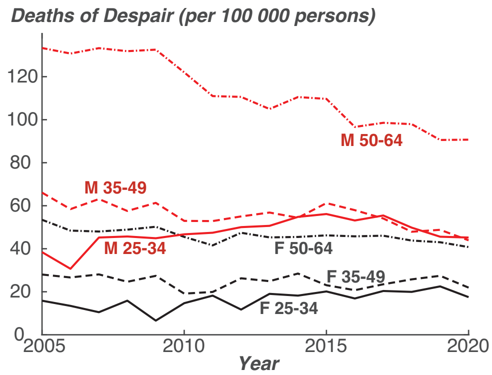

Figure 1: Rate of deaths of despair per 100 000 inhabitants in Sweden and Norway. Data is collected from *Socialstyrelsen*.

The dependent variable, rate of deaths of despair per 100 000 inhabitants, is shown in figure 1 across the years 2005-2020. There are three main patterns. First, the rates are generally flat or declining for all demographic groups. There is a stable trend for males aged 25-34, and a slight decrease for males aged 35-49 during the years 2005-2020. The rate of deaths of despair for females aged 25-34, 35-49, and 50-64 have not changed much during the years 2005-2020, and remained on a stable level. Secondly, the rate for each male age group is significantly higher than for the corresponding age group for females (approximately twice as high). Furthermore, all female age groups are lower or similar in rates of deaths of despair to any of the male age groups. Finally, the older the age group, the higher the rate of deaths of despair for each sex. The group of males aged 50-64 stands out since it has a significantly higher rate of deaths of despair than any other group, and the rate of deaths of despair have declined notably for this group over the years.

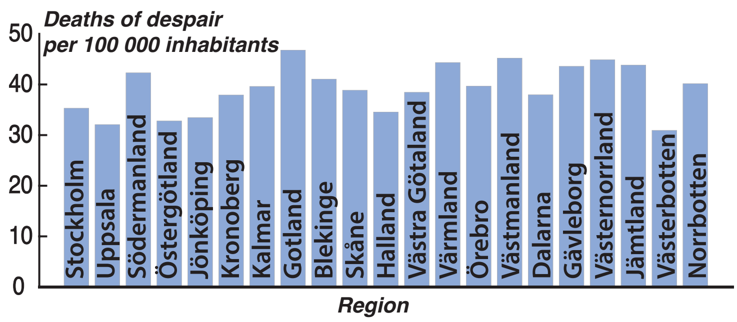

Figure 2: Rate of deaths of despair per 100 000 inhabitants per region in Sweden. Data is collected from *Socialstyrelsen*.

Figure 2 shows the yearly mean of the rate of deaths of despair per 100 000 inhabitants across 2005-2020, for the regions in Sweden. We observe that the rates in the regions span from approximately 30 to 45 deaths per 100 000 inhabitants. Västerbotten has the least deaths (≈30) while Gotland has the most (≈45). The largest difference between two regions in figure 2 is therefore around 15 deaths per 100 000 inhabitants.

Below is presented descriptive analyses of trends across Sweden for the explanatory variables, to explore changes in them across 2005-2020.

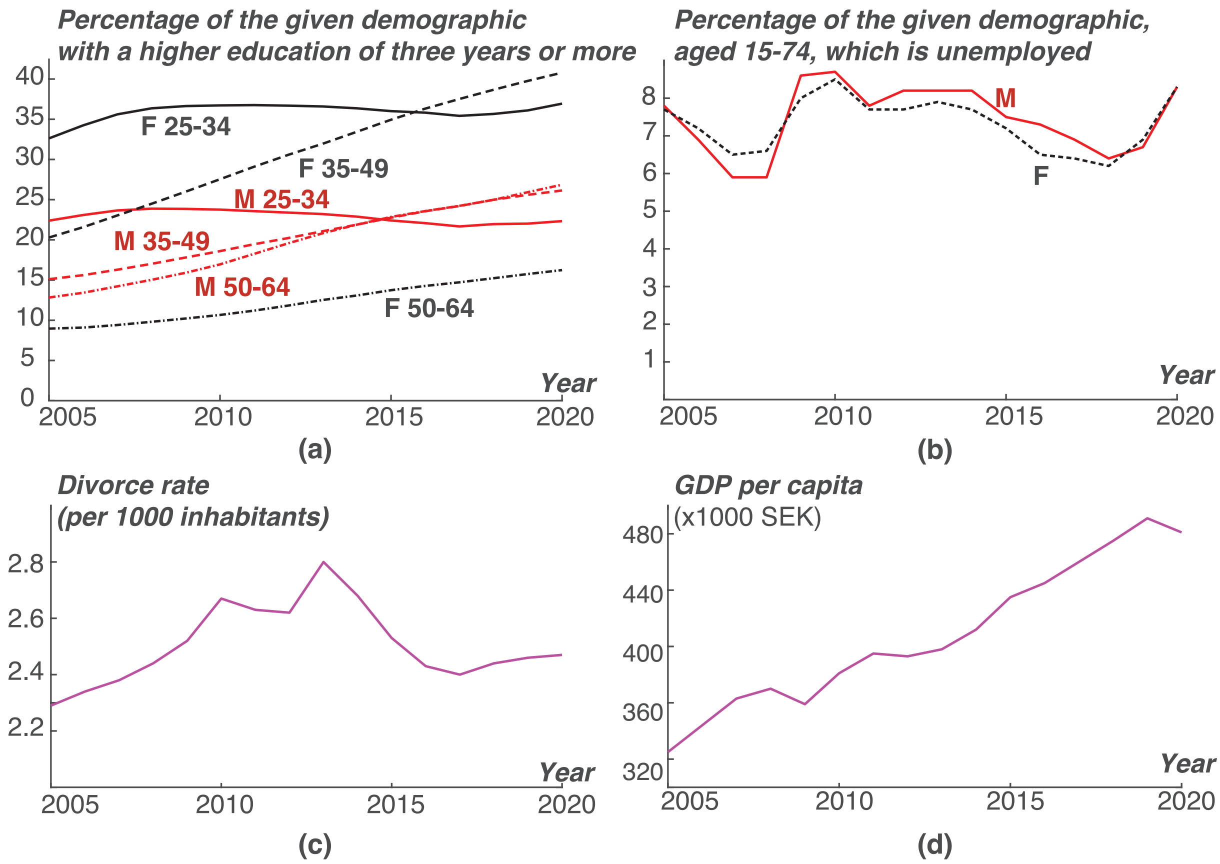

Figure 3: Graphs over trends in higher education rates (2a), unemployment rates (2b), divorce rates (2c), and the GDP per capita in Sweden (2d). Data is collected from *Statistics Sweden*.

Figure 3 shows graphs over trends in higher education, unemployment rates, divorce rates, and the GDP per capita in Sweden from 2005-2020. Figure 3(a) shows the higher education rates, which have changed between 2005 and 2020. Mainly, the rates have increased for males and females of age groups 35-49 and 50-64 while they have remained flat for males and females of age group 25-34. The higher education rate for females, 35-49 years old, has doubled during the years 2005-2020, from around 20% to 40%, where it stands out as the highest rate in 2020. The rates for females 25-34 years old have hovered around 35%, and the rates for males similarly around 20%. The rates for males aged 35-49 and 50-64 have been close to identical, and increased from approximately 15 % in 2005 to 25% in 2020. The rate for females aged 50-64 has increased from around 10 % to approximately 14% in 2020.

Figure 3(b) shows how the unemployment rate for males and females has fluctuated in cycles. Mainly, there was an increase for both males and females around the financial crisis in 2008, where the rate for males increased from 6% to 8%. Furthermore, the unemployment rate for males has been higher than the corresponding rate for females, with the exception of the years 2005-2008.

Figure 3(c) displays that the divorce rate has peaked at around 2013 with 2.8 divorces per 1000 inhabitants in Sweden, and has since declined to around 2.4 divorces per 1000 inhabitants in 2020.

Finally, figure 3(d) shows that the GDP per capita has had close to a linear upward trend, starting at circa 320 000 SEK per capita in 2005 to approximately 480 000 SEK per capita in 2020.

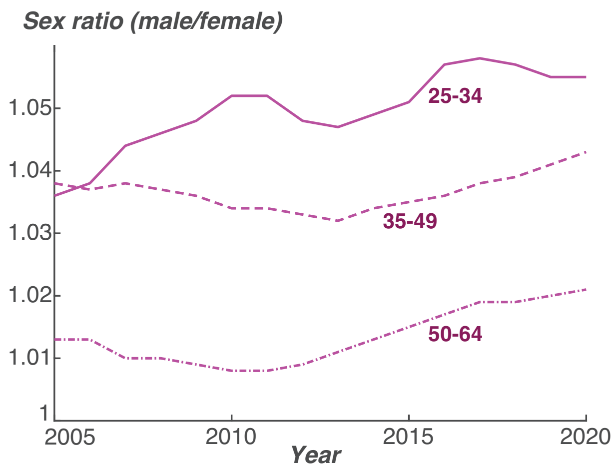

Figure 4: Graphs over trends in sex ratios for demographic groups between 2005 and 2020. Data is collected from *Statistics Sweden*.

Figure 4 displays the sex ratios for the age groups 25-34, 35-49, and 50-64 year olds in

Sweden during 2005-2020. There are two main patterns in this figure. Firstly, the sex ratios are higher the younger the age group is. Secondly, the rates are increasing across the years of 2005-2020. The group of 25-34 shows the largest increase and has increased from around 1.035 in 2005 to around 1.05 in 2020. The ratio for 35-49 year olds has been relatively stable between 1.03 and 1.04. For 50-64 year olds, the ratio has increased from around 1.01 in 2005 to 1.02 in 2020.

3.2 Methodology, Sweden

The principle goal of this analysis is to use a descriptive study design with panel data and region fixed effects to explore the associations between the rate of deaths of despair and the economic and sociological control variables. The unit of observation is age and sex groups in each region. The analysis is done over 16 years and on 21 regions; there are 336 observations for the dependent variable in each regression. The analysis is performed in Stata.

The core specifications which are used are run separately for each age and sex group. They are shown in equation 2 and 3:

$$DD_{jt} = \alpha_j + \delta_1 edu_{jt} + \delta_2 unemploy_{jt} + \delta_3 divorce_{jt} + \delta_4 sr_{jt} + \epsilon_{jt} \tag{2}$$

$$DD_{jt} = \alpha_j + \delta_1 edu_{jt} + \delta_2 unemploy_{jt} + \delta_3 divorce_{jt} + \delta_4 sr_{jt} + \delta_5 GRP_{jt} + \epsilon_{jt} \tag{3}$$

where j and t represent regions and years. DD_{jt} denotes the deaths of despair rate per 100 000 inhabitants of the demographic group (male or female, age groups 25-34, 35-49, and 50-64) in region j and year t. These are referred to as the "demographic groups" in the analysis of deaths of despair in Sweden. α_j indexes region fixed effects in region j. edu_{jt} represents the percentage of inhabitants with higher education in region j and year t among the demographic groups used, and $unemploy_{jt}$ represents the unemployment percentage among 15-74 year olds in region j and year t, for males and females separately. Each additional increase of 1 person per 100 with higher education or unemployment among the demographic group is associated with a change of δ_1 and δ_1 respectively in the number of deaths of despair per 100 000 inhabitants (all else equal). $divorce_{jt}$ represents the number of divorces per 1000 inhabitants of the demographic group analyzed in region j and year t. Each additional divorce per 1000 inhabitants in the demographic group is associated with a change of δ_3 in the number of deaths of despair per 100 000 inhabitants (all else equal). sr_{jt} denotes the sex ratios in each region for the age groups 25-34, 35-49, and 50-64, calculated as in equation 1 in section 3.1. For each additional increase of 1 percentage point in the sex ratios, the number of deaths of despair for the demographic are associated with an increase of $\delta_4/100$ (all else equal). GRP_{jt} represents the gross regional product per capita (log) in region j and year t, measured in 1000 SEK. A 1% increase in the GRP per capita is associated with a change in the number of deaths of despair per 100 000 inhabitants by $\delta_5/100$ (all else equal).

The groups analyzed in the analysis of Sweden are 25-34 years old, 35-49 years old, and 50-64 years old, males and females separately. This is motivated by the possible different effects of socio-economic variables on the death of despair rate for different age and sex demographics. The groups are chosen to include working age people, while excluding those who have not had a chance to obtain a higher education of 3 years or more. Therefore the group of 20-24 year olds is not included in the analysis, since it is deemed that the younger people among them have not had a reasonable chance to obtain a higher education.

The motivation behind using two specifications, with the difference of one of them including the GRP per capita as a control and the other one excluding it, is that the GRP per capita and the unemployment rate are both macroeconomic factors that indicate the condition of the economy. Therefore they they often move simultaneously in response to economic shocks. The association between the GDP and the unemployment rate of a country has first been explored by Arthur Okun in the 1960's, which gave rise to "Okun's Law". "Okun's Law" states in one version that the GDP rises by 3% when unemployment decreases by 1% (Minsky et al., 1963). The unemployment rate can be seen as an indicator of how well a region is using its resources. Similarly to Breuer (2014), the GRP per capita is included as a control, to distinguish the effect of unemployment from other economic influences. Unlike Breuer (2014) who runs each regression with and without the gross domestic product (GDP) per capita because of missing observations, I choose to run each specification with and without the gross regional product GRP per capita due to the possible collinearity between unemployment and the GRP per capita. Since the GRP per capita and the unemployment are correlated with each other, using them both in a specification where they are collinear could create wider confidence intervals and lower significance for the coefficients. To examine if the state of the economy, represented by the GRP per capita and/or the unemployment rate, have an association with the rate of deaths of despair, an F-test is used to test the probability that both the GRP per capita and the unemployment coefficients are equal to zero:

$$\delta_2 = \delta_5 = 0 \tag{4}$$

The possibility also exists of collinearity between the GRP per capita and the higher education rate, since it is possible that regions with a higher percentage of higher educated individuals are also have a higher GRP per capita. This could for example be due to highly educated individuals contributing more to the GRP per capita than low educated individuals, or regions with a higher GRP per capita producing more highly educated individuals. Therefore, to examine the collinearity between the GRP per capita and the higher education rate, a similar F-test is performed on those variables:

$$\delta_1 = \delta_5 = 0 \tag{5}$$

Because of the small number of regions in Sweden (21), clustered standard errors are unsuitable since they would require a larger number of clusters. Instead, wild cluster bootstrap p-values are used to validate the value of the coefficients. Below, the method of wild cluster bootstrapping is described. First, one-way clustering for regression models is explained and then wild cluster bootstrapping is defined.

3.2.1 One-way Clustering

These expositions are sourced from Roodman et al. (2019). Starting with the linear regression model

$$\boldsymbol{y} = \boldsymbol{X\beta} + \boldsymbol{u}, \tag{6}$$

where $\boldsymbol{y}$ and $\boldsymbol{u}$ are $N \times 1$ vectors of observations and error terms, respectively, $\boldsymbol{X}$ is an $N \times k$ matrix of covariates, and $\boldsymbol{\beta}$ is a $k \times 1$ parameter vector. There are G clusters of which the observations are grouped into. The error terms may be correlated within each cluster. Model 6 can be expressed as

$$\boldsymbol{y}_g = \boldsymbol{X}_g\boldsymbol{\beta} + \boldsymbol{u}_g, \quad g = 1, \ldots, G, \tag{7}$$

where the matrix $\boldsymbol{X}_g$ and the vectors $\boldsymbol{y}_g$ and $\boldsymbol{u}_g$ contain the rows of $\boldsymbol{X}$, $\boldsymbol{y}, and \boldsymbol{u}$, that correspond to the g^{th} cluster. There are N_g rows in each of these objects, and the number of observations in cluster g is denoted by N_g.

The vector of error terms $\boldsymbol{u}$ is conditional on $\boldsymbol{X}$ and has a mean of zero and a variance matrix $\boldsymbol{\Omega} = \mathrm{E}\left(\boldsymbol{uu'} \mid \boldsymbol{X}\right)$. $\boldsymbol{\Omega} =$ is relying on the assumption of no correlation cross-cluster-wise:

$$\mathrm{E}\left(\boldsymbol{u}_{g'}\boldsymbol{u}_g' \mid \boldsymbol{X}\right) = \boldsymbol{0} \quad \text{if} \quad \mathbf{g}' \neq \mathbf{g}. \tag{8}$$

Hence $\boldsymbol{\Omega}$ is block-diagonal with blocks $\boldsymbol{\Omega}_g = \mathrm{E}\left(\boldsymbol{u}_g\boldsymbol{u}_g' \mid \boldsymbol{X}\right)$. Entries in these blocks are subject to only one assumption, which is that each of the $\boldsymbol{\Omega}_g$ is a valid variance matrix; that is positive definite and finite.

The ordinary least squares (OLS) estimator of $\boldsymbol{\beta}$, taking fixed effects into account, is

$$\hat{\boldsymbol{\beta}} = (\boldsymbol{X'D'DX})^{-1}\boldsymbol{X'D'Dy} \tag{9}$$

where $\boldsymbol{D}$ is the $N \times N$ matrix, left-multiplication by which partials out the fixed-effect dummies; that is, $\boldsymbol{D}$ means data within fixed-effect groups.
The vector of estimation residuals is denoted by

$$\hat{\boldsymbol{u}} = \boldsymbol{y} - \boldsymbol{X}\hat{\boldsymbol{\beta}}. \tag{10}$$

The conditional variance matrix of $\hat{\boldsymbol{\beta}}$ is

$$\operatorname{Var}(\hat{\boldsymbol{\beta}} \mid \boldsymbol{X}) = \left(\boldsymbol{X}'\boldsymbol{X}\right)^{-1} \boldsymbol{X}'\boldsymbol{\Omega}\boldsymbol{X} \left(\boldsymbol{X}'\boldsymbol{X}\right)^{-1}. \tag{11}$$

This expression cannot be calculated, because it depends on $\boldsymbol{\Omega}$, which by assumption is unknown. The feasible counterpart of 11 is the cluster-robust variance estimator (CRVE) (Liang and Zeger, 1986). It replaces $\boldsymbol{\Omega}$ by the estimator $\hat{\boldsymbol{\Omega}}$, which has the same block-diagonal form as $\boldsymbol{\Omega}$, but with $\hat{\boldsymbol{\Omega}}_g = \hat{\boldsymbol{u}}_g\hat{\boldsymbol{u}}_g'$ for $g = 1, \ldots, G$. The CRVE is denoted by

$$\hat{\boldsymbol{V}} = m\left(\boldsymbol{X}'\boldsymbol{X}\right)^{-1} \boldsymbol{X}'\hat{\boldsymbol{\Omega}}\boldsymbol{X} \left(\boldsymbol{X}'\boldsymbol{X}\right)^{-1}, \quad \hat{\boldsymbol{\Omega}} = \operatorname{blockdiag}\left(\hat{\boldsymbol{\Omega}}_1, \ldots, \hat{\boldsymbol{\Omega}}_G\right), \tag{12}$$

where m, the scalar finite-sample adjustment factor, is defined below. The center factor in 12 is often defined as

$$\boldsymbol{X}'\hat{\boldsymbol{\Omega}}\boldsymbol{X} = \sum_{g=1}^{G} \boldsymbol{X}_g'\hat{\boldsymbol{u}}_g\hat{\boldsymbol{u}}_g'\boldsymbol{X}_g. \tag{13}$$

$\boldsymbol{S}$ is defined as the $G \times N$ matrix which by left-multiplication sums the columns of a data matrix cluster-wise. $\boldsymbol{SX}$ would then be the $G \times k$ matrix of cluster-wise sums of the columns of $\boldsymbol{X}$. $\boldsymbol{S}'\boldsymbol{S}$ is the $N \times N$ indicator matrix whose entry on (i, j) is 1 or 0 depending on whether observations i and j are in the same cluster. Left-multiplying by $\boldsymbol{S}'$ duplicates entries in each cluster, through this transforming a matrix with one row per cluster to a matrix with one row per observation.

It follows that the CRVE in 12 is

$$\hat{\boldsymbol{V}} = m\left(\boldsymbol{X}'\boldsymbol{X}\right)^{-1} \boldsymbol{X}'\hat{\boldsymbol{\Omega}}\boldsymbol{X} \left(\boldsymbol{X}'\boldsymbol{X}\right)^{-1}, \quad \hat{\boldsymbol{\Omega}} = \hat{\boldsymbol{u}} :* \boldsymbol{S}'\boldsymbol{S} :* \hat{\boldsymbol{u}}' \tag{14}$$

where $\boldsymbol{A} : \boldsymbol{B}$ is the Hadamard (elementwise) product, $\boldsymbol{v} :* \boldsymbol{B}$ is the columnwise Hadamard product of $\boldsymbol{v}$ with the columns of $\boldsymbol{B}$. :* has lower precedence than ordinary matrix multiplication. The small-sample correction m in 12 and 14 is defined as

$$m = \frac{G}{G-1} \times \frac{N-1}{N-k}. \tag{15}$$

3.2.2 The Wild Cluster Bootstrap

This exposition is sourced from Roodman et al. (2019). Methods for hypothesis testing through bootstrapping involve creating many bootstrap samples that simulate the actual one and calculating the test statistic for each of them. Then the distribution of the bootstrap test statistics is compared to the original test statistic, and the extremeness of it is observed.

All bootstrap samples have the same covariates $\boldsymbol{X}$ in the wild cluster bootstrap. If the bootstrap samples are denoted by an $*$ and indexed by b, only the bootstrap error vector $\boldsymbol{u}^{*b}$, and hence also the bootstrap dependent variable $\boldsymbol{y}^{*b}$, vary across them. The vectors $\boldsymbol{y}^{*b}$ are generated for each cluster, as

$$\boldsymbol{y}_g^{*b} = \boldsymbol{X}_g\hat{\boldsymbol{\beta}} + \boldsymbol{u}_g^{*b}, \quad \boldsymbol{u}_g^{*b} = v_g^{*b}\hat{\boldsymbol{u}}_g, \tag{16}$$

computed using $\hat{\boldsymbol{\beta}}$. $\hat{\boldsymbol{\beta}}$ denotes the OLS estimates of the model 6, subject to the restrictions which are tested for, and $\hat{\boldsymbol{u}}_g$ is the associated vector of residuals for cluster g. When $\beta_j = 0$ is tested for, where β_j is the j^{th} element of $\boldsymbol{\beta}$, $\hat{\beta}_j$ is set to 0, and the remaining elements of $\hat{\boldsymbol{\beta}}$ are obtained by regressing $\boldsymbol{y}$ on every column of $\boldsymbol{X}$ except column j. The "wild weight" scalar v_g^{*b} is an auxiliary random variable with a mean of 0 and a variance of 1. It is drawn from the Rademacher distribution, hence it takes the values -1 and $+1$ with equal probability. Using the matrix $\boldsymbol{S}$ defined above, the wild bootstrap data generating process can be rewritten as

$$\boldsymbol{y}^{*b} = \boldsymbol{X}\hat{\boldsymbol{\beta}} + \boldsymbol{u}^{*b}, \quad \boldsymbol{u}^{*b} = \hat{\boldsymbol{u}} : *\boldsymbol{S}'\boldsymbol{v}^{*b} \tag{17}$$

where $\boldsymbol{v}^{*b}$ is a $G \times 1$ vector with g^{th} element v_g^{*b}. Since the v_g^{*b} are independent of $\boldsymbol{X}$ and the $\hat{\boldsymbol{u}}_g$ and have a mean of 0 and a variance of 1, multiplying the $\hat{\boldsymbol{u}}_g$ by v_g^{*b} as in 16 preserves the mean and the variance of the $\hat{\boldsymbol{u}}_g$. E^* denotes expectation conditional on $\boldsymbol{y}$ and $\boldsymbol{X}$, so that only the v_g^{*b} are treated as random. It follows that

$$\begin{aligned} \mathrm{E}^*\left(\boldsymbol{u}_g^{*b}\right) &= \mathbf{0}, \\ \mathrm{E}^*\left(\boldsymbol{u}_{g'}^{*b}\boldsymbol{u}_g^{*b'}\right) &= \mathbf{0} \text{ when } \mathbf{g}' \neq \mathbf{g}, \text{ and} \\ \mathrm{E}^*\left(\boldsymbol{u}_g^{*b}\boldsymbol{u}_g^{*b'}\right) &= \hat{\boldsymbol{u}}_g\hat{\boldsymbol{u}}_g'. \end{aligned} \tag{18}$$

My objective is to test the hypothesis that $\beta_j = 0$. Then the WCU (wild cluster unrestricted) algorithms which are used are as follows.

1. Regressing $\boldsymbol{y}$ on $\boldsymbol{X}$ to obtain $\hat{\boldsymbol{\beta}}, \hat{\boldsymbol{u}}$, and $\hat{\boldsymbol{V}}$ as given in 9, 10, and 14.

2. Calculating the usual cluster-robust t-statistic for the hypothesis that $\beta_j = 0$,

$$t_j = \frac{\hat{\beta}_j}{\sqrt{\hat{V}_{jj}}}, \tag{19}$$

where $\hat{V}_{jj}$ is the j^{th} diagonal element of $\hat{\boldsymbol{V}}$.

3. $B = 999$, which is the number of replications made for each test in this paper. For each of B bootstrap replications:

(a) Generating a new set of bootstrap error terms $\boldsymbol{u}^{*b}$ and dependent variables $\boldsymbol{y}^{*b}$ by using 17.

(b) Regressing $\boldsymbol{y}^{*b}$ on $\boldsymbol{X}$ to obtain $\hat{\boldsymbol{\beta}}^{*b}$ and $\hat{\boldsymbol{u}}^{*b}$, and use the latter in 14 to compute the bootstrap CRVE $\hat{\boldsymbol{V}}^{*b}$.

(c) Calculating the bootstrap t-statistic for the null hypothesis that $\beta_j^{*b} = \hat{\beta}_j$ as

$$t_j^{*b} = \frac{\hat{\beta}_j^{*b} - \hat{\beta}_j}{\sqrt{\hat{V}_{jj}^{*b}}}, \tag{20}$$

where $\hat{V}_{jj}^{*b}$ is the j^{th} diagonal element of $\hat{\boldsymbol{V}}^{*b}$.

4. For the two-tailed test of $\beta_j = 0$, the equal tail P value is computed:

$$\hat{P}^*_{\text{ET}} = 2 \min\left(\hat{P}^*_{\text{L}}, \hat{P}^*_{\text{U}}\right). \tag{21}$$

3.3 Results, Sweden

3.3.1 Deaths of Despair for Males Aged 25-64

Table 1: Fixed effects panel regression, deaths of despair for males in age groups 25-34, 35-49, and 50-64 in Sweden

	(1) M25-34	(2) M25-34	(3) M35-49	(4) M35-49	(5) M50-64	(6) M50-64
Education	-3.686*	-2.948	-1.267***	-0.640	-9.894	-3.451
	(0.056)	(0.122)	(0.006)	(0.601)	(0.146)	(0.539)
Unemployment	-0.222	-0.206	-0.842	-1.031	2.684*	1.549
	(0.895)	(0.867)	(0.324)	(0.332)	(0.058)	(0.212)
GRP		12.410		-18.493		-86.452***
		(0.671)		(0.639)		(0.000)
Divorce	0.616	0.675	0.273	0.275	-1.227	-1.709
	(0.691)	(0.605)	(0.390)	(0.476)	(0.218)	(0.128)
Sex Ratio	47.940	23.775	-3.054	-10.991	-217.202	-186.393*
	(0.771)	(0.989)	(0.967)	(0.881)	(0.296)	(0.098)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.857		0.624		0
F-test2 P-value††		0.258		0.0210		0
Dep. Var Mean	47.10	47.10	57.19	57.19	111.8	111.8
R-squared	0.0230	0.0239	0.0400	0.0411	0.0575	0.186
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), unemployment rate (15-74 year olds), the Gross Region Product per capita (log), divorce rates per 1000 inhabitants, and the sex ratio.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 1 reports the regressions for males in Sweden for specifications 2 and 3. Columns (1), (3), and (5) display the results for males in the age groups 25-34, 35-49, and 50-64 respectively without using the log of the GRP per capita as a control. Columns (2), (4), and (6) display the results for the same groups and includes the GRP per capita as a control. The table shows wild bootstrap p-values in the parentheses below the coefficients.

Table 1 shows that deaths of despair are most common in males aged 50-64, as shown by the dependent variable mean of 111.8 deaths per 100 000 inhabitants, in contrast to 47.10 and 57.19 for males aged 25-34 and 35-49 respectively.

A main trend in table 1 is that higher education consistently is negatively associated with deaths of despair, across all age groups. Except for higher education, the other control variables used in the specification do not have consistent signs across the specifications. This trend for the coefficient of higher education in line with Case and Deaton (2015, 2020) who found that deaths of despair are associated with lower education.

The higher education rate is significant at a 10% level for males aged 25-34 and on a 1% level for males aged 35-49, in the specifications without GRP per capita. When the GRP per capita is included, the coefficient remains negative but has no significance at a 10% level. Column (1) shows that a higher education for males aged 25-34 shows a negative correlation against deaths of despair on a 10% significance level. An increase of 1 male with a higher education per 100, among males aged 25-34, is associated with a decrease in the rate of deaths of despair among that demographic with 3.7 deaths per 100 000. In column (3), an increase of 1 male with higher education per 100, among males aged 35-49, is associated with a decrease in deaths of despair of 1.3 deaths per 100 000, all else equal. This correlation is significant on a 1% level. The coefficient for higher education for males 25-34 and 35-49 remains similar in significance, sign, and magnitude in all regressions in the robustness check in 7.1 where the GRP per capita is not included.

Apart from these associations with higher education, there are no significant coefficients for any variable at the 10% level for males aged 25-34 and 35-49.

The F-test testing the hypothesis that both the coefficient of the GRP per capita and the higher education rate are equal to zero has a p-value of 0 for males aged 50-64. For males aged 25-34 and 35-49, the corresponding p-values of the F-test are 0.258 and 0.0210. Therefore, the null hypothesis can be rejected at a 1% level for males aged 50-64, and on a 5% level for males aged 35-49. This indicates that the GRP per capita and the rate of higher education might be collinear in the analysis of males in the ages of 35-49 and 50-64. It could be an explanation to why the specification for males 35-49 (including the GRP per capita as a control) and the specification for males 50-64 (not including the GRP per capita as a control) show no significance of either the coefficient for the GRP per capita or for the higher education rate, while the corresponding specifications with/without the GRP per capita for the age groups show significant correlations of the rate of deaths of despair and the GRP per capita or the higher education rate.

The unemployment coefficient does not show a clear trend in table 1. In the regressions for males aged 25-34 and 35-49, it is negative and insignificant. A positive association (significant on a 10% level) of unemployment with deaths of despair is displayed in column (5), where the GRP per capita is not included in the specification. An increase in unemployment for males aged 15-74 by one inhabitant for 100 inhabitants is associated with an increase in the deaths of despair for males aged 50-64 by 2.7 deaths per 100 000 inhabitants. Column (6) shows a positive but insignificant coefficient for unemployment. Columns (1)-(4) display negative coefficients for unemployment, all of which are insignificant on a 10% level.

The p-value of the F-test which tests that the coefficients of controls *Unemployment* and *GRP* are both equal to zero, is 0, which strongly indicates that at least one of these controls has a significant association with the rate of deaths of despair for males aged 50-64. This potential collinearity could explain why the coefficient for unemployment in column (5) is significant while the coefficient for the GRP per capita instead is significant in column (6). The notion that there is a negative relationship between the economy and the rate of deaths of despair or suicide is in line with previous literature (Milner et al., 2013, Oyesanya et al. 2015). Furthermore, the sign, magnitude, and significance of the unemployment and the GRP per capita coefficients for males aged 50-64 are stable in the robustness regressions, shown in 7.1 where the result of 1 is replicated, where each control variable is excluded one at a time. Gathering from the significance, signs, F-test results, and robustness checks of the variables GRP per capita and the unemployment rate, I conclude that the surrounding economy has a negative correlation with deaths of despair for males aged 50-64, whether that economy is measured through the GRP per capita or the unemployment rate. This is in line with Breuer (2014), who finds associations between the suicide rate and the unemployment rate and the GDP per capita.

For males aged 25-34 and 35-49, the corresponding p-values of the F-test of the coefficients for the unemployment rate and the GRP per capita are 0.857 and 0.624, indicating that the null hypothesis, that at least one of the coefficients for the GRP per capita and the unemployment rate are equal to zero, cannot be rejected. While a potential collinearity of the GRP per capita and the unemployment rate is indicated for the age group 50-64, it is not for the age groups 25-34 and 35-49.

The GRP per capita shows a strongly significant negative association with deaths of despair in column (6). It there shows has a value of -86.452. An increase of 1% for the GRP per capita is associated with a decrease of 0.86 deaths in rates of deaths of despair of males aged 50-64 per 100 000 inhabitants, all else equal. This is a significant negative correlation between the GRP per capita and the rate of deaths of despair, at a 1% significance level. In column (2) and column (4), the coefficient for the GRP per capita is insignificant, and holds the values of 12.410 and -18.493.

The divorce coefficient shows inconsistency and insignificance throughout the specifications. It is is positively correlated with the rate of deaths of despair in column (1) and (2) at values of 0.616 and 0.765, positively correlated in column (3) and (4) at a value of approximately 0.27, and negatively correlated in column (5) and (6) at values -1.227 and -1.709. It is not significant in any of the regressions.

The coefficient for the sex ratio does not show much of a significant effect. It is positive in the regressions for males aged 25-39 and negative in the regressions for males aged 35-49 and 50-64. In column (6), the coefficient of the sex ratio shows that an increase of one percentage point of the ratio is correlated with a decrease of the rate of deaths of despair for males aged 50-64 by 1.9 deaths per 100 000 inhabitants, significant on a 10% significance level. This is a relatively small effect, as the graph 4 shows that the fluctuations of the sex ratio in each age group rarely are more than 0.01 (a change of 1 percentage point). Therefore, with the variations of the sex ratios that we observe, the associated change in deaths of despair for a one percent change in the sex ratio is not very large (1.9 deaths). The sign is negative, which is not in line with Kuroki (2013), who found that a higher sex ratio has a positive correlation with suicides. The results from this thesis find that the sex ratio has a negative relationship with deaths of despair. In column (5), the sex ratio has a negative relationship of similar magnitude with deaths of despair for males aged 50-64, without significance.

3.3.2 Deaths of Despair for Females Aged 25-64

Table 2: Regional fixed effects panel regression, deaths of despair for females in age groups 25-34, 35-49, and 50-64 in Sweden.

	(1) F25-34	(2) F25-34	(3) F35-49	(4) F35-49	(5) F50-64	(6) F50-64
Education	-0.597	-0.511	-0.456**	-0.506	-0.617	-1.269
	(0.104)	(0.180)	(0.010)	(0.296)	(0.398)	(0.354)
Unemployment	0.172	0.356	0.367	0.381	-0.217	-0.138
	(0.815)	(0.773)	(0.571)	(0.599)	(0.853)	(0.893)
GRP		16.837		2.909		11.778
		(0.146)		(0.867)		(0.693)
Divorce	-0.198	-0.069	0.232	0.237	0.497	0.519
	(0.551)	(0.829)	(0.523)	(0.539)	(0.412)	(0.462)
Sex Ratio	22.019	-33.056	-5.809	-5.745	-209.233	-207.049
	(0.847)	(0.933)	(0.951)	(0.981)	(0.462)	(0.474)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.221		0.835		0.859
F-test2 P-value††		0.193		0.0641		0.436
Dep. Var Mean	13.68	13.68	23.21	23.21	44.91	44.91
R-squared	0.00416	0.0190	0.0399	0.0400	0.0230	0.0237
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), unemployment rate (15-74 year olds), the Gross Region Product per capita (log), divorce rates per 1000 inhabitants, and the sex ratio.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 2 reports the regressions for females in Sweden for equations 2 and 3. Columns (1), (3), and (5) display the results for females in the age groups 25-34, 35-49, and 50-64 respectively without using GRP per capita as a control. Columns (2), (4), and (6) display the results for the same groups and includes GRP per capita as a control. The table shows wild bootstrap p-values in the parentheses below the coefficients.

There are three main trends for coefficients in 2 which hold across all specifications. Firstly, similar to table 1, table 2 shows negative associations between the higher education rate and the rate of deaths of despair across all specifications. Secondly, the coefficient for the GRP per capita is positive in all specifications where it is present, though insignificant. Thirdly, the coefficients for unemployment, the divorce rate, and the sex ratio show no significance in any specification and the signs of each coefficient varies across the specifications.

For females aged 35-49 in column (3), the coefficient for higher education is significant at a 5% percent level (p-value 0.010), in the specification without the GRP per capita. An increase of 1 female with higher education aged 35-49 per 100 females in this age group, is correlated with a decrease in deaths of 0.46 deaths per 100 000 females aged 35-49, all else equal. The coefficient of higher education in the specification with the GRP per capita is of a similar size and magnitude, however the p-value indicates insignificance.

The value of the coefficient for the GRP per capita varies between specifications, from 0.2.909 in column (4) to 16.837 and 11.778 in columns (2) and (6). It is always insignificant at a 10% level.

The F-test for the regression in (4) for females 35-49, testing the hypothesis that both the coefficient of the GRP per capita and the coefficient of the higher education rate are equal to 0, is equal to 0.0641, indicating significance on a 10% level. Therefore the hypothesis that both coefficients are equal to zero can be rejected on this significance level. It could indicate collinearity between the two control variables, and could be an explanation to why the higher education rate has a significant association with the rate of deaths of despair for females aged 35-49 in the specification without the GRP per capita, but no significant association exists in the corresponding specification which includes the GRP per capita.

The corresponding F-tests for females aged 25-34 and 50-64 show high p-values, not supporting a potential collinerarity between the higher education rate and the rate of deaths of despair. The F-tests testing the hypothesis that both the coefficient of the GRP per capita and the coefficient of the unemployment rate are equal to 0, have highly insignificant p-values, not supporting a potential collinearity between the unemployment rate and the GRP per capita.

For the females in age groups 25-34 and 50-64, there are no significant controls at the 10% level.

A robustness check is again performed, shown in section 7.1in the appendix, where each control variable is excluded in a regression. The coefficient of higher education for females aged 35-49 is significant and similar in size and magnitude in all specifications excluding the GRP per capita as a control, at least at a 5% significance level, supporting the robustness of its size, magnitude, and significance in 2.

4 Joint Analysis of Deaths of Despair in Sweden and Norway

4.1 Data Description

This analysis examines deaths of despair, region wise in Sweden and Norway across 2005-2020. I investigate this because using all regions in Sweden and Norway gives a *larger number of clusters and observations* to work with than only using the regions in Sweden, which is beneficial to the analysis. The disadvantage of this analysis is that the data is not available for specific age and sex groups in Norway, hindering a more detailed analysis of demographic groups. The dependent and explanatory variables are the same as in the analysis of Sweden, with the difference that they are not divided in age and sex groups, and instead use regional aggregate population data. The dependent variable is the rate of deaths of despair and the explanatory variables are higher education rate, unemployment rate, divorce rate, GRP per capita, and the sex ratio.

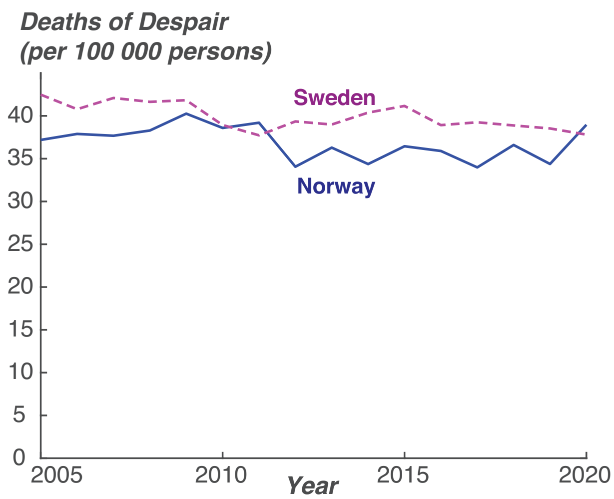

Figure 5: Rate of deaths of despair per 100 000 inhabitants in Sweden and Norway. Data is collected from *Socialstyrelsen* and *Folkehelseinstituttet*.

Figure 5 shows the rates of deaths of despair in Sweden and Norway between 2005 and 2020. The first main observation is that the rates of deaths of despair are relatively flat across the years for each country. The second observation is that the rate of deaths of despair in Norway is often consistently slightly below the rate in Sweden. The rate in Sweden is approximately 40 deaths of despair per 100 000 inhabitants per year, and the respective rate in Norway is approximately 35 deaths of despair per 100 000 inhabitants per year.

The combined analysis of Sweden and Norway uses yearly and regional data for all variables. The regions are the 21 "län" in Sweden and the 11 "fylken" in Norway, totaling 32 regions for the joint analysis. The data from Sweden is defined as earlier in 3.1, but on an aggregate regional level instead of in age and sex groups for the variables that an age and sex division was applicable. The Norweigan data is defined the similarly as the Swedish data for all variables except higher education and unemployment, which I therefore describe to highlight the difference.

The data for the higher education level is defined in Norway as the percentage of the population in the region with a short university degree (up to 4 years). The corresponding data from Sweden is defined as a higher education of 3 years or more. Despite the differences in the definition of higher education in the statistics from Sweden and Norway, I consider them to be close enough to each other to be equated in this analysis and therefore the best option of the representation of a higher education. The unemployment rate in Norway, is shown as the unemployed percentage of the population, who are registered with the *Norwegian Labour and Welfare Administration*. For the Swedish data, the percentage of unemployed persons of the population are defined as the rate of unemployed persons for the population of people aged 15-74 years. The gross regional product per capita is measured in 1000 NOK per capita in current prices, and the Swedish GRP per capita is converted from SEK to NOK in order to be comparable.

Deaths of despair in Norway are collected from *Folkehelseinstituttet*, and from *Socialstyrelsen* in Sweden. For the explanatory variables, all Swedish data is collected from *Statistics Sweden*. All Norweigan data for the explanatory variables is collected from *Statistics Norway*.

4.2 Methodology, Sweden and Norway

The principle goal of this joint analysis is to use a descriptive study design to explore the associations between the rate of deaths of despair and the economic and sociological control variables in Sweden and Norway. The unit of observation is the population in each region. Panel data from 16 years from 2005 to 2020 is used in regional fixed effects regressions. The analysis is performed in Stata.

The dependent variable used in the regressions is rate of deaths of despair per 100,000 persons, and explanatory variables are the higher education rate per 100 persons per age and sex group, divorce rate per 1,000 persons, unemployment rate per 100 persons per sex, the gross regional product per capita, and the sex ratio of the age group. I use a correlational study design, where the unit of assessment are regions. Since the analysis is done over 16 years and on 32 regions, there are 512 observations for the dependent variable in each regression.

The region fixed effects specifications which are used are the same as in section 3.2. They are shown in equation 22 and 23:

$$DD_{jt} = \alpha_j + \delta_1 edu_{jt} + \delta_2 unemploy_{jt} + \delta_3 divorce_{jt} + \delta_4 sr_{jt} + \epsilon_{jt} \tag{22}$$

$$DD_{jt} = \alpha_j + \delta_1 edu_{jt} + \delta_2 unemploy_{jt} + \delta_3 divorce_{jt} + \delta_4 sr_{jt} + \delta_5 GRP_{jt} + \epsilon_{jt} \tag{23}$$

where j and t represent regions and years. DD_{jt} denotes the deaths of despair rate per 100 000 inhabitants in region j and year t. α_j indexes region fixed effects in region j. edu_{jt} represents the percentage of inhabitants with higher education in region j and year t, and $unemploy_{jt}$ represents the unemployment percentage in region j and year t. Each additional increase of 1 person per 100 with higher education or unemployment is associated with a change of δ_1 and δ_1 respectively in the number of deaths of despair per 100 000 inhabitants (all else equal). $divorce_{jt}$ represents the number of divorces per 1000 inhabitants in region j and year t. Each additional divorce per 1000 inhabitants is associated with a change of δ_3 in the number of deaths of despair per 100 000 inhabitants (all else equal). sr_{jt} denotes the sex ratios in each region, calculated as in equation 1 in section 3.1. For each additional increase of 1 percentage point in the sex ratio, the number of deaths of despair are associated with an increase with $\delta_4/100$. GRP_{jt} represents the gross regional product per capita (log) in region j and year t, measured in 1000 SEK. A 1% increase in the GRP per capita is associated with a change of the number of deaths of despair per 100 000 inhabitants by $\delta_5/100$ (all else equal).

Using the same methodology as in section 3.2, two F-tests are used. 4 is used for testing the hypothesis that both the GRP per capita and the unemployment coefficients are equal to zero, and 5 is used to test the hypothesis that both the GRP per capita and the higher education rate coefficients are equal to zero.

4.3 Results, Sweden and Norway

Table 3: Regional fixed effects panel regression, deaths of despair in Sweden and Norway

	(1) Deaths of Despair	(2) Deaths of Despair
Education	0.0326	-0.404
	(0.417)	(0.612)
Unemployment	-0.0910	-0.120
	(0.216)	(0.265)
GRP		2.591
		(3.764)
Divorce	0.984	1.195
	(1.340)	(1.311)
Sex Ratio	-3.374	3.870
	(49.51)	(51.19)
Region FE	YES	YES
GRP	NO	YES
F-test P-value†		0.556
F-test P-value††		0.769
Dep. Var Mean	35.08	35.08
R-squared	0.00221	0.00554
Observations	512	501

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate, unemployment rate, divorce rates per 1000 inhabitants, the sex ratio, and the Gross Region Product per capita (log).
Cluster-robust standard errors in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 3 reports the regressions for the total population in Sweden and Norway for specifications 2 and 3. Column (1) displays the results without using the GRP per capita as a control. Column (2) displays the results for the same groups and includes GRP per capita as a control. The table shows clustered standard errors in the parentheses.

There is no visible explanatory power of higher education, unemployment rate, divorce rates, sex ratios, or the GRP per capita for the deaths of despair in Norway and Sweden combined. The coefficient for the divorce rate has a negative sign in column (1) and (2), while the coefficients for the unemployment rate and the GRP per capita are positive. The higher education coefficient has a positive coefficient in column (1), where the GRP per capita is not included in the specification, and a negative sign in column (2), when the GRP per capita is included. The sex ratio coefficient has a negative coefficient in column (1), where the GRP per capita is not included in the specification, and a positive sign in column (2), when the GRP per capita is included.

While the sign of the coefficients mostly are constant in column (1) and column (2) in table 3, the coefficients are often absolutely smaller in value in column (1), where the GRP per capita is not included, than in column (2). It is probable that the GRP per capita coefficient absorbs part of the associations present in column (1). The coefficient for divorce rates remains relatively stable at 0.984 in column 1 and 1.195 in column (2). In contrast, the coefficient for higher education changes from 0.0326 to -0.404, the coefficient for unemployment changes from -0.09 to -0.120, and the coefficient for the sex ratio changes from -3.374 to 3.870. The GRP per capita, in column (6) is -0.01.

The p-values of the F-tests testing the hypotheses that (1) the GRP per capita and the unemployment rate both are equal to zero and (2) the GRP per capita and the higher education rate both are equal to zero, are highly insignificant on a 10% level. Thus the null hypotheses cannot be rejected, and I find nothing that points toward collinearity.

5 Discussion

5.1 Interpretation of Results

My result of the first analysis on Sweden shows that the deaths of despair in Sweden are flat or decreasing with time over the complete interval 2005-2020 for each age and sex group analyzed. Furthermore, there is a strong negative association between the GRP per capita and the deaths of despair for males aged 50-64, indicating a strong relationship between the state of the economy and the deaths of despair for this demographic. Also, deaths of despair for males and females 35-49 years old, has shown significant correlations with the higher education rate among each respective group. However, the significance of the education coefficient disappears when I include the GRP per capita as a control. This could be due to collinearity between the GRP per capita and the higher education, which finds support in the low p-values of the F-tests testing the joint significance of the coefficients for the GRP per capita and the higher education rate.

Regarding the hypothesis *H1*, defined in section 1, that at least one of the explanatory variables of unemployment, GRP per capita, or higher education, has an association with the rate of deaths of despair for males aged 35-49 and 50-64, the results support a rejection of the null hypothesis. This association was expected to be positive for unemployment and negative for the GRP per capita and the higher education. There is a highly significant negative correlation between higher education and the rate of deaths of despair for men aged 35-49, and there is a weakly significant positive association between the rate of deaths of despair and unemployment, and a highly significant negative association between the rate of deaths of despair and the GRP per capita. Therefore the null hypothesis cannot be rejected.

Concerning *H2*, that there would be a negative association between higher education and the rate of deaths of despair for women aged 35-49 and 50-64, the result does not support a rejection of the null hypothesis. While there is a significant negative association between higher education and the rate of deaths of despair for women aged 35-49, there is no such discernible association for women aged 50-64.

The second analysis of Sweden and Norway does not show any significant results, neither do the p-values of the F-test indicate any collinearity; I therefore conclude that no associations were observable between the rate of deaths of despair and the control variables.

Regarding *H3*, the results do not support a rejection of the null hypothesis. There were no significant associations between the explanatory variables and the rates of deaths of despair. Furthermore, the p-values of the F-tests, testing (1) that the coefficients of GRP per capita and the unemployment rate are both equal to zero and (2) that the coefficients of GRP per capita and the higher education rate are both equal to zero, were much above a significance level of 10%. Therefore the null cannot be rejected.

Contrasting my results to Case and Deaton (2015, 2020), I find that the rates of deaths of despair are significantly lower in Sweden and Norway than in the U.S.A.. This could, as mentioned in 2, be caused by the differences between these Nordic countries and the U.S.A., for example in how opiate prescriptions are lower in the Sweden and Norway, alcohol taxes are higher, and there are much more welfare benefits available which dampen the effect of economic shocks on individuals. My results highlight the difference between the results of Case and Deaton (2015, 2020) in the context of U.S.A., and the results in Sweden and Norway. However, I find some similarity between my analysis and that of Case and Deaton (2015, 2020) regarding the rate of deaths and despair and the control factors. I find a negative association between higher education and deaths of despair for certain demographic groups in Sweden (males and females, 35-49 years old). This is similar to Case and Deaton (2015, 2020) who find that middle aged males and females with a higher education rate show less association with the rate of deaths of despair; however it is unclear if the association in my results originates from the economic environment in the form of GRP per capita or the higher education rate. The GRP per capita and the higher education rate could be collinear, judging from the p-value of the F-test testing their joint significance together with that both the GRP per capita and the higher education rate coefficients become insignificant when including both in the same regressions. Again, the limitation of not being able to identify causal pathways is relevant. It is for instance possible that the deaths of despair disproportionally affected people with higher education rates, and that these deaths were more common in regions with generally low education, which could yield these results.

A notable difference, when comparing my results to Case and Deaton (2020), is that I find that the GRP per capita has a negative, significant association with the rate of deaths of despair for males aged 50-64 in Sweden. While Case and Deaton (2020) concluded that a cumulative effect of the economy affects the deaths of despair (not economic shocks), my result points to a correlation between that region economy and the rate of deaths of despair in the region for this demographic group.

The conclusion is drawn that the associations found in Case and Deaton (2015, 2020) are not, in this paper, supported to be generalizable to the setting of Sweden and Norway, despite some similarity of the results.

In a similar fashion, I find some similarity of my result with that of Breuer (2014). I find that real economic growth has a negative association with suicide for working age males in the analysis of Breuer (2014), which is in line with my findings for males aged 50-64 and possibly for males aged 35-49. It supports the notion that regional economic variations are negatively associated with the prevalence of deaths of despair, which further is in line with Oyesanya et al. (2015) and Milner et al. (2013). However, unlike Breuer (2014), I did not find support for that unemployment has a positive association with the deaths of despair for working age males. Therefore, the results of Breuer (2014) are not supported in the context of deaths of despair in Sweden and Norway.

5.2 Limitations and strengths

A main limitation of this thesis is that I cannot draw any causal conclusions about pathways between the variables, since I use aggregate data on a region level. Since I do not have individual level data, it is impossible to obtain any causal pathways or effects of the controls on the rate of death of despair. While it provides an early exploration of the relationships between the deaths of despair and economic and sociological variables, it is not ground for making causal claims. An important factor is that I do not have data on an individual level. For example, I do not know if those who were affected by the deaths of despair had a higher education or were unemployed; I can only observe the rates of deaths of despair and the explanatory variables on an aggregate, societal level.

A similar limitation of this paper is the lack of data for smaller regions or individual data, which might lead to an underpowered analysis. The deaths of despair are not very prevalent in the regions in either of my analyses, which makes is harder to distinguish associations between them and controls and achieve statistical power, as each observation does not have a huge amount of cases of deaths of despair. In the same way, the few amounts of clusters could cause a lack of power. While the joint analysis of Sweden and Norway included more regions than the analysis of Sweden, optimally I would have included Denmark and Finland in this analysis, had the right data been available, to have a larger data set with more regions.

It is furthermore a limitation that the data for the control variables used is not more detailed. Since the associations that could exist between deaths of despair and control variables are likely to be age-and sex-conditional, using aggregate population data in the analysis of Sweden and Norway hinders discerning these associations in separate groups of the population. The aggregate population of a region is heterogenous, which leads to a poor differentiation of groups and lack of power in the analysis. Therefore, the null results may be caused by a lack of statistical power. This might be a reason to why the analysis of Sweden showed some statistically significant controls, while none were found in the analysis of Sweden and Norway. Even there, in the analysis of demographic groups in Sweden, the explanatory variable unemployment is not age-specifically available and the key variable GRP per capita is only observable on a region aggregate level which further removes statistical power.

The result would have had greater statistical power had data been available on more levels, such as municipality and individual data. This data seems to exist, but it is not publically available, only at a price which is too high for the scope of my ability. The conclusions drawn in this thesis would have improved from having more specific data available.

As captured by the low R^2 of the analyses, it is probable that many of the deaths of despair accounted for in this paper happened due to idiosyncratic reasons or due to factors which are not controlled for in this analysis. Therefore the effect sizes of the coefficients are relatively small, which decreases the power of the analysis.

Another important limitation is that I cannot adjust for or take confounders into account, such as socioeconomic or mental health status of an individual. This could lead to a lack of internal validity and bias the results through omitted variable bias. As a consequence, it would lead to endogeneity and make the results more unreliable. How would omitted variable bias affect the resulting coefficients? Using socioeconomic status as an example (where a high score is a better status); I expect it to be negatively correlated with deaths of despair and unemployment. Furthermore, I expect it to be positively correlated with higher education and the GRP per capita. This would lead to a negative bias on the education and the GRP per capita coefficients, and a positive bias for the unemployment coefficient. The divorce rate has shown merit to be negatively associated with socioeconomic status (Sandström and Stanfors, 2020). This would result in an upward bias of the divorce coefficient, since it is assumed that the socioeconomic status of an individual is negatively associated with the rate of deaths of despair.

I would also expect mental health status (where a high score is better) as an omitted variable, to similarly have an upward bias on the coefficient for unemployment, similar to Mortensen et al. (2000). Therefore, it is possible that these biases result in that the GRP per capita and the higher education show less of an association that would be real, and that the unemployment shows more of an association with the rate of deaths of despair than exists. Concerning the sex ratios, it could be that high sex ratios are negatively associated with the mental health of males. Since the mental health is expected to be negatively correlated with the rate of deaths of despair, it is possible that the coefficients of the sex ratios in this paper (since they are always higher than 1), are upward biased in the regressions for males.

Another limitation is that this paper uses a fewer number of years than other work, such as Case and Deaton (2020). The statistical power would have gotten stronger by increasing the number of years. Due to data limitations, I chose to constrict the analysis to the years 2005-2020. However, it can also be a strength to use fewer years. As shown by contrasting the work of Durkheim (1867) and Case and Deaton (2020), trends in factors associated with suicide and deaths of despair may change over time. Therefore it might be an advantage to shorter time frame, there by capturing the more recent trends and associations.

There are two main strengths of this thesis. Firstly, one strength of this paper is that it examines at deaths of despair in the Nordics, which to my knowledge has not been done. This is of interest as it is a public health matter of importance in the Nordics. It is also of interest to contrast the results of these countries to those found in the U.S.A., as the societies are organized in vastly different ways. Another strength of this paper is that it uses recent data. These up- to-date results are valuable for current policy making, and as a base for more detailed analyses. For example; the results have identified males aged

50-64 as the group at the highest risk of deaths of despair among working age people. This risk seems to be greater when the GRP per capita in the surrounding region is lower. Therefore, preventative measures could be taken for this demographic when these economic circumstances are identified.

5.3 Future Work

This thesis gives some insight of the relationship between the economic and sociological and deaths of despair in Sweden and Norway. Scarcity of data is the main encountered obstacle, and is something which could be improved in future work. As discussed above, individual level panel data is preferable to using aggregate data in regions and increases the potential of making causal claims. Furthermore, individual-level data from more Nordic countries such as Norway, Finland, and Denmark would have broadened my results.
Having individual data or data on smaller groups (municipalities rather than regions) is obviously more helpful than using large regions. More clusters and observations would have removed the need to use wild bootstrap p-values, and would have produced a more powerful analysis.

Another path to explore is analyzing the deaths of despair in the Nordics for senior citizens. The contrast between the null results of the analysis of Sweden and Norway on an aggregate regional population level and the significant findings of the analysis of demographic groups in Swedish regions highlights the value of separating analyses between demographic groups. This analysis found that deaths of despair were most prevalent among males aged 50-64 among working-age males, and most prevalent among females aged 50-64 among working age females. Since the deaths of despair increased with age, it would be of interest to explore how males and females who are older than 64 are affected by deaths of despair, and see if there are relationships between economic and sociological factors and deaths of despair among these groups. The group of poor senior citizens ("fattigpensionärer", (hi.se, 2022)) could be of special interest, as it would be possible that this group gets hit harder in terms of life quality by economic shocks than many other groups in society. Older males (over 85 years) are also the most affected by suicide rates in Sweden (Folkhälsomyndigheten, 2022), which should attract further research of deaths of despair for this group.

6 Conclusion

Deaths of despair account for about 5000 deaths annually in Sweden. This is 40% more deaths than those caused by breast and prostate cancer combined, which are the most diagnosed cancers among males and females in Sweden respectively. Yet, in the Swedish society there is absence of both a corresponding awareness, as well as relevant preventative measures for deaths of despair. An effort to identify risk groups and the associations with socioeconomic variables is crucially needed. This paper provides a starting point and highlights the need for further studies.

This thesis explores the relationship between deaths and despair and a set of socioeconomic control variables in Sweden and Norway, using regional data sets over the years 2005-2020. My result shows that the rate of deaths of despair among males aged 50-64 in Sweden is associated with a negative correlation with the GRP per capita, in line with Breuer (2014). Also, there is a negative association between the higher education rate and the rate of deaths of despair for middle aged males and females in Sweden, which is in line with Case and Deaton (2015, 2020). Furthermore, the result from the joint analysis of Sweden and Norway on a regional level shows no significant correlations between the rate of deaths of despair and the explanatory variables.

The main limitations of this thesis are the lack of detailed data as well as the lack of ability to draw causal conclusions from the results. To better draw causal conclusions, there is a need for separating demographic groups more, or most preferably using individual data. This was indicated by the the null results in the analysis of the aggregate region populations in Norway and Sweden, while the analysis of deaths of despair in age and sex groups in regions in Sweden found significant associations.

More research is needed in order to better understand the causal drivers of the deaths of despair in the Nordic countries. Extending this work to older age groups in the Nordics and using individual data to uncover the causal pathways would provide valuable information for mitigating policies. Actually, this more detailed data already exists, and it is my strong recommendation that it is made more accessible.

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7 Appendix

7.1 Robustness Check

The specifications for table 1 and table 2 are performed while excluding one control variable at a time, as a robustness check.

Table 4: Regression from Table 1, excluding Education

	(1) M25-34	(2) M25-34	(3) M35-49	(4) M35-49	(5) M50-64	(6) M50-64
Education						
Unemployment	-0.623	-0.354	-0.536	-1.184	2.859**	1.568
	(0.591)	(0.727)	(0.535)	(0.212)	(0.036)	(0.148)
GRP		34.571		-35.234***		-89.336***
		(0.302)		(0.006)		(0.000)
Divorce	0.122	0.564	-0.176	0.251	-1.534	-1.826
	(0.855)	(0.639)	(0.653)	(0.398)	(0.130)	(0.118)
Sex Ratio	128.360	16.217	-60.628	-21.493	-319.658	-218.871*
	(0.563)	(0.953)	(0.807)	(0.901)	(0.150)	(0.050)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.414		0.0280		0
F-test2 P-value††		.		.		.
Dep. Var Mean	47.10	47.10	57.19	57.19	111.8	111.8
R-squared	0.00469	0.0174	0.00284	0.0400	0.0374	0.184
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are unemployment rate (15-74 year olds), the Gross Region Product per capita (log), divorce rates per 1000 inhabitants, and the sex ratio.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 5: Regression from Table 1, excluding Unemployment

	(1) M25-34	(2) M25-34	(3) M35-49	(4) M35-49	(5) M50-64	(6) M50-64
Education	-3.722*	-2.976	-1.222***	-1.056	-10.530	-3.571
	(0.054)	(0.120)	(0.008)	(0.250)	(0.112)	(0.454)
Unemployment						
GRP		12.501		-4.826		-89.630***
		(0.725)		(0.873)		(0.000)
Divorce	0.581	0.644	0.196	0.192	-0.599	-1.374
	(0.641)	(0.669)	(0.607)	(0.579)	(0.468)	(0.206)
Sex Ratio	48.879	24.468	6.093	4.556	-166.090	-156.557
	(0.827)	(0.921)	(0.989)	(0.999)	(0.541)	(0.236)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		.		.		.
F-test2 P-value††		0.245		0.0110		0
Dep. Var Mean	47.10	47.10	57.19	57.19	111.8	111.8
R-squared	0.0229	0.0238	0.0363	0.0364	0.0377	0.180
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), the Gross Region Product per capita (log), divorce rates per 1000 inhabitants, and the sex ratio.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 6: Regression from Table 1, excluding Divorce

	(1) M25-34	(2) M25-34	(3) M35-49	(4) M35-49	(5) M50-64	(6) M50-64
Education	-3.498*	-2.844	-1.178***	-0.557	-10.532	-4.474
	(0.072)	(0.124)	(0.008)	(0.587)	(0.106)	(0.344)
Unemployment	-0.074	-0.047	-0.740	-0.925	2.327*	1.079
	(0.997)	(0.997)	(0.376)	(0.386)	(0.078)	(0.372)
GRP		10.728		-18.301		-84.555***
		(0.711)		(0.621)		(0.000)
Divorce						
Sex Ratio	49.530	28.775	-24.868	-32.886	-187.731	-146.267
	(0.817)	(0.909)	(0.881)	(0.847)	(0.424)	(0.226)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.898		0.668		0
F-test2 P-value††		0.247		0.0190		0
Dep. Var Mean	47.10	47.10	57.19	57.19	111.8	111.8
R-squared	0.0218	0.0225	0.0384	0.0395	0.0524	0.176
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), unemployment rate (15-74 year olds), the Gross Region Product per capita (log), and the sex ratio.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 7: Regression from Table 1, excluding the Sex Ratio

	(1) M25-34	(2) M25-34	(3) M35-49	(4) M35-49	(5) M50-64	(6) M50-64
Education	-3.842**	-2.934	-1.268***	-0.650	-11.624	-4.888
	(0.010)	(0.190)	(0.008)	(0.533)	(0.102)	(0.346)
Unemployment	-0.242	-0.213	-0.841	-1.025	2.447*	1.338
	(0.877)	(0.887)	(0.314)	(0.298)	(0.094)	(0.278)
GRP		13.811		-18.288		-87.062***
		(0.613)		(0.607)		(0.000)
Divorce	0.624	0.686	0.274	0.281	-0.987	-1.507
	(0.681)	(0.607)	(0.282)	(0.328)	(0.292)	(0.132)
Sex Ratio						
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.801		0.596		0
F-test2 P-value††		0.0721		0.0130		0
Dep. Var Mean	47.10	47.10	57.19	57.19	111.8	111.8
R-squared	0.0225	0.0238	0.0399	0.0411	0.0501	0.181
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), unemployment rate (15-74 year olds), the Gross Region Product per capita (log), and divorce rates per 1000 inhabitants.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 8: Regression from Table 2, excluding Education

	(1) F25-34	(2) F25-34	(3) F35-49	(4) F35-49	(5) F50-64	(6) F50-64
Education						
Unemployment	0.013	0.225	1.010	0.570	0.376	0.223
	(0.977)	(0.851)	(0.236)	(0.577)	(0.997)	(0.885)
GRP		17.256*		-21.722**		-7.097
		(0.092)		(0.014)		(0.575)
Divorce	-0.211	-0.077	-0.284	-0.424	-0.756	-0.794
	(0.561)	(0.845)	(0.511)	(0.737)	(0.665)	(0.515)
Sex Ratio	15.867	-39.664	-29.867	-35.695	-253.112	-245.182
	(0.885)	(0.997)	(0.765)	(0.931)	(0.218)	(0.428)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.0991		0.0531		0.728
F-test2 P-value††						
Dep. Var Mean	13.68	13.68	23.21	23.21	44.91	44.91
R-squared	0.00116	0.0168	0.00807	0.0371	0.0256	0.0274
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are unemployment rate (15-74 year olds), the Gross Region Product per capita (log), divorce rates per 1000 inhabitants, and the sex ratio.

Wild bootstrap p-values in parentheses.

†The F-test tests the null hypothesis that unemployment and GRP are both equal to zero.

*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 9: Regression from Table 2, excluding Unemployment

	(1) F25-34	(2) F25-34	(3) F35-49	(4) F35-49	(5) F50-64	(6) F50-64
Education	-0.561*	-0.440	-0.477**	-0.499	-0.580	-1.288
	(0.058)	(0.144)	(0.010)	(0.288)	(0.348)	(0.314)
Unemployment						
GRP		16.357*		1.221		12.535
		(0.094)		(0.937)		(0.649)
Divorce	-0.174	-0.025	0.266	0.268	0.461	0.499
	(0.639)	(0.929)	(0.440)	(0.507)	(0.446)	(0.396)
Sex Ratio	18.944	-37.737	-11.349	-11.409	-213.010	-209.233
	(0.893)	(0.983)	(0.865)	(0.921)	(0.436)	(0.442)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		.		.		.
F-test2 P-value††		0.0931		0.0771		0.410
Dep. Var Mean	13.68	13.68	23.21	23.21	44.91	44.91
R-squared	0.00396	0.0182	0.0390	0.0390	0.0228	0.0236
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), the Gross Region Product per capita (log), divorce rates per 1000 inhabitants, and the sex ratio.

Wild bootstrap p-values in parentheses.

†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.

††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.

*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 10: Regression from Table 2, excluding Divorce

	(1) F25-34	(2) F25-34	(3) F35-49	(4) F35-49	(5) F50-64	(6) F50-64
Education	-0.607	-0.513	-0.396**	-0.409	-0.455	-1.028
	(0.114)	(0.160)	(0.014)	(0.334)	(0.468)	(0.420)
Unemployment	0.092	0.330	0.503	0.507	-0.086	-0.011
	(0.895)	(0.733)	(0.438)	(0.452)	(0.903)	(0.975)
GRP		17.031*		0.791		10.473
		(0.092)		(0.937)		(0.769)
Divorce						
Sex Ratio	20.374	-34.252	-21.838	-21.902	-219.835	-218.308
	(0.851)	(0.985)	(0.813)	(0.837)	(0.378)	(0.380)
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.186		0.746		0.918
F-test2 P-value††		0.173		0.0771		0.557
Dep. Var Mean	13.68	13.68	23.21	23.21	44.91	44.91
R-squared	0.00339	0.0189	0.0376	0.0376	0.0214	0.0219
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), unemployment rate (15-74 year olds), the Gross Region Product per capita (log), and the sex ratio.

Wild bootstrap p-values in parentheses.

†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.

††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.

*, **, and *** indicate significance at the 10, 5, and 1% level.

Table 11: Regression from Table 2, excluding the Sex Ratio

	(1)	(2)	(3)	(4)	(5)	(6)
	F25-34	F25-34	F35-49	F35-49	F50-64	F50-64
Education	-0.570	-0.553	-0.457***	-0.506	-0.868	-1.669
	(0.166)	(0.196)	(0.006)	(0.282)	(0.140)	(0.242)
Unemployment	0.112	0.412	0.371	0.385	-0.522	-0.422
	(0.919)	(0.713)	(0.583)	(0.599)	(0.511)	(0.645)
GRP		15.114**		2.914		14.511
		(0.038)		(0.881)		(0.677)
Divorce	-0.189	-0.094	0.235	0.239	0.732	0.756
	(0.579)	(0.785)	(0.454)	(0.454)	(0.312)	(0.260)
Sex Ratio						
Region FE	YES	YES	YES	YES	YES	YES
GRP	NO	YES	NO	YES	NO	YES
F-test P-value†		0.125		0.849		0.728
F-test2 P-value††		0.143		0.0601		0.170
Dep. Var Mean	13.68	13.68	23.21	23.21	44.91	44.91
R-squared	0.00367	0.0181	0.0399	0.0400	0.00812	0.00912
Observations	336	336	336	336	336	336

Note: Dependent variable: Deaths of despair per 100 000 inhabitants. Explanatory variables are higher education rate (3 years or longer), unemployment rate (15-74 year olds), the Gross Region Product per capita (log), and divorce rates per 1000 inhabitants.
Wild bootstrap p-values in parentheses.
†The F-test tests the null hypothesis that the coefficients of Unemployment and GRP are both equal to zero.
††The F-test tests the null hypothesis that the coefficients of Education and GRP are both equal to zero.
*, **, and *** indicate significance at the 10, 5, and 1% level.