UiT The Arctic University of Norway

School of Business and Economics

The gender wage gap and COVID-19

How the COVID-19 affected wage inequality between women and men in Norway

Cem Olcan

Master's thesis in Economics - May 2022

Acknowledgement

The two years at the School of Business and Economics at UIT, have gone by so fast. And with this master thesis the program reached the end. I have learned so much, gotten to know a lot of great people, and it has been a wonderful two years.

I want to thank all the academical staff, who have all given me a lot of knowledge especially Professor Andrea Mannberg, my supervisor on this thesis. Your knowledge, patience, and encouragements are highly appreciated. I was so lucky to have you as my supervisor, and I am very grateful.

I also want to thank my fellow students for all the good times, and for being good friends.

I want to thank my friends in Tromsø. And especially Geir and Kari for help and support in my life. And Leif and Klara for the support and help.

A thank you also, to Trond Pedersen at SSB for the help with microdata.no.

And I want to thank my mother. Who supported equality and fight for equality and showed that women could also have a good career and be a perfect mother at the same time, and always encouraged me to do my best.

Cem Olcan

Highlights

- The Covid-19 pandemic had a huge impact on both the global and local economy.
- Covid-19 affected mostly industries where women are in the majority.
- Women more than men take care of domestic unpaid work.
- Ability to work from home affected wage inequality under the lock down.

Abstract

The Covid-19 lockdown affected both the global and local economies and led to wage loss and wage inequality. This study explains traditional wage differences between women and men and examines the impact of the Covid-19 on women's and men's wages and working hours during the initial stages of the pandemic. The study uses differences-in-differences estimation. Yearly and monthly panel data from Statistic Norway, hours worked, earnings and wages of women and men are compared. My findings suggest that while there in 2020 was a negative and unsignificant impact on women's wages, the analysis shows that 2019 also had a negative effect on women's wages but it is significant. Therefore, Covid-19 did not affect wage inequality between women and men in Norway. My research findings explains that factors like different participation rates in work industries for men and women may be an important explanation on the gender wage gap between women and men in Norway. As expected Covid-19 affected working hours. In April 2020 both men and women decreased weekly working hours. women still worked less than men, but the reduction was smaller for women than men after the covid-19 lockdown. In addition, I did not find any negative effect on either mother's or father's wages in 2020.

Table of Contents

List of Tables

List of Figures

1 Introduction

In this paper I focus on gender wage inequality, and how it was affected by the Covid-19 pandemic. I use the difference-in-difference method to identify the effect of pandemic on the gender wage gap in Norway before and during the pandemic and show how the pandemic affected wage inequality. Some of these differences are because more women than men choose to work less and take care of the upbringing of children or relatives. If that is because of the women's own choice that is not seen as very problematic, but if this is because of women not having the same opportunity as men in taking education or work, then this is discrimination.

The gender wage gap describes how much an average woman worker earns in comparison to an average male worker (Askvik, 2021; Høgsnes and Nielsen, 2004; Litman and Robinson, 2020). The gender wage gap has been researched and discussed for many decades and is still an important topic of discussion (Magnusson, 2010; Albanesi and Sahin, 2018; Alan and Doepke 2020; Blau and Kahn, 2017). There are several explanations to why there is income inequality between women and men, and the most common factors are: Preferences and discrimination.

From 1890 until today, the wage gap has fallen from being just 30 percent of male earnings to close to 80 percent. The human capital model gives one explanation to why the gender wage gap has narrowed. The human capital includes workers' education, knowledge and training. Human capital theory states that one's incentive to invest in training is directly proportional to the time one expects to work over one's lifetime. From this theory we would imply that with a rising labor force participation of women relative to men, the human capital of women would rise as a result. This is the case and as more women get higher education, the wage inequality gap narrows, precisely as the human capital model states (Polachek, 2004). And the theory shows us how important education and work-experience is in the labor market.

Traditionally, direct discrimination was a factor in gender inequality, but legislation has prevented this in modern times in Norway. According to Norwegian law, women and men in the same businesses shall have equal pay for the same work of equal value. The salary shall be determined in the same way, regardless of gender (Lovdata.no). In Norway, focus on equality rights have been at the forefront, and is still so.

Occupational gender segregation, and occupational characteristics are two of the ways to describe why women earn less than men. Work with a female dominated employee base tend

to have lower salaries compared to male dominated workplaces. Women and men also tend to work in different sectors (Magnusson, 2010; Albanesi and Sahin 2018).

Covid-19 affected economies, labor markets, income inequality, social lives, and people's health dramatically. Many people lost their work, some people were redundant, and some people had to work extra causing inequality between people. Due to the rapid spread of the Covid-19 virus, governments have had to respond quickly to slow down or stop the spread of the virus and flatten the curve of deaths, sickness and infections. The solution in Norway was severe lockdown measures. This has had significant effects on many aspects of life, both economical and personal (Juranek and Poetzeld, 2020; Alstadsæter and Bjørkheim 2020). The first corona cases were reported in the middle of February 2020 in Norway and quickly spread through the country. Lockdown started in March and many Norwegians were affected both socially and economically because of the quarantine and corona distance measures. Most people had to stay at home, schools and kindergartens closed. Many workplaces closed while others seriously had to change their work habits and hours. Some people had the opportunity to work from home, but this was not possible for most of the workforce (Holgersen and Jia, 2020; Nergaard, 2020 ; Alan and Doepke 2020 ; Blundell and Costa Dias, 2020).

Pandemic-related job losses happened predominantly in industries like leisure and hospitality that have a large share of women workers (US.Bureau of Labor, 2021). Globally, the nature of the measures of the pandemic hit women harder than men, with a 4.2 percent loss of workplaces for women compared to 3 percent for men (ILO, 2021).

Figure 1 shows the difference in average gross hourly earnings between male and female paid employees, as a percentage of average gross hourly earnings of male paid employees in 2019 and 2020 for selected European countries (Eurostat, 2021). As can be seen in the figure, wage differences in Norway where in the middle of the field in 2019(13.2 percent) and 2020(13.4 percent) at the level of Iceland (13.0 percent) and Lithuania (13.0 percent) in 2020. We can see a decrease in the gender wage gap in Scandinavia from 2019 to 2020 except in Norway. We can see a decrease in the gap of 0.6 percentage point in Sweden and 0.1 percentage point in Denmark. According to Campa and Roine (2021), the Covid-19 pandemic had very unequal effects on different groups of the labor market, but their conclusion shows that Covid-19 has not had any effect on income inequality between women and men in Sweden.

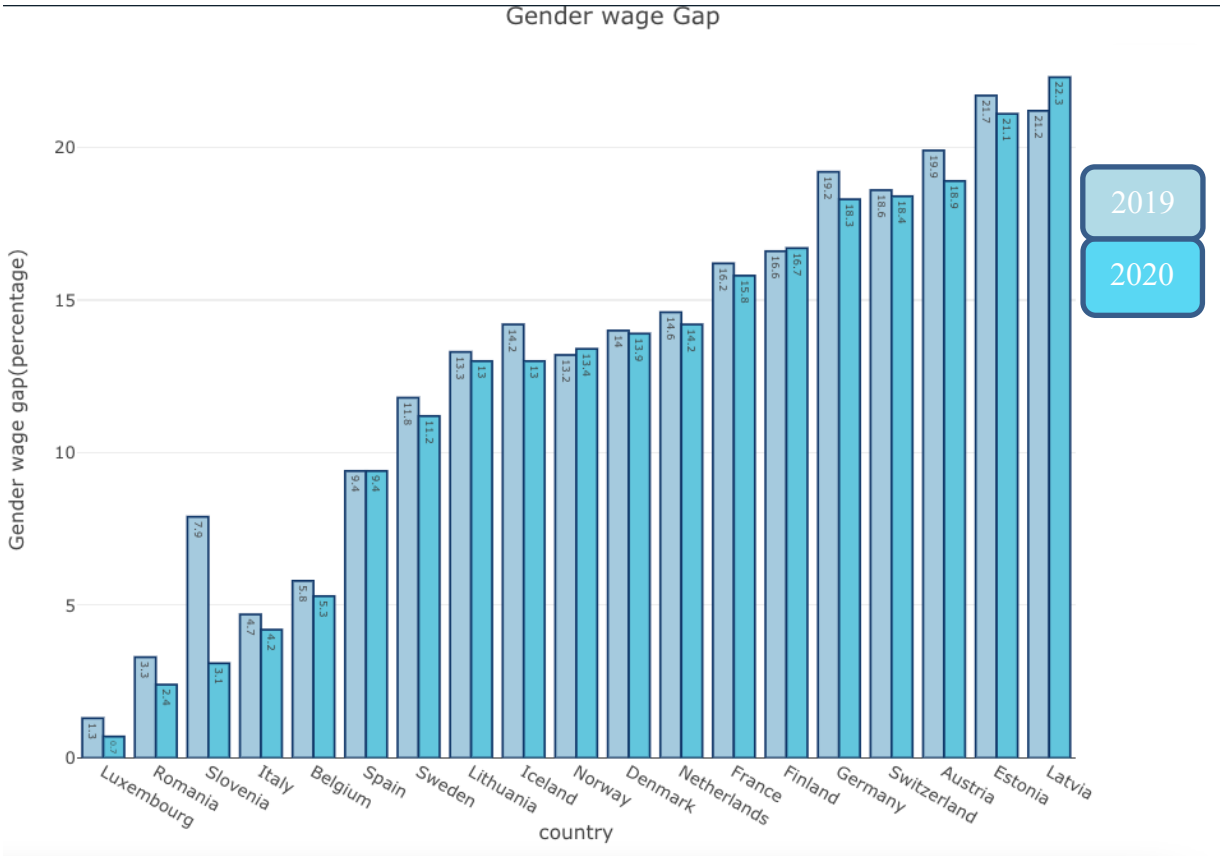

FIGURE 1 Gender wage gaps in Europe. (Eurostat, 2021)

Since the Covid-19 pandemic is still very recent, information and studies on the effects of Covid-19 on gender inequality in the Norwegian labor market is very limited. In this master thesis, I use data from microdata.no to test if Covid-19 affected gender inequality on the Norwegian labor market. To the best of my knowledge, this is the first study to do so. When we discuss wage inequality, it is still common to think about discrimination, but that is just a part of the picture. We should include other factors like preferences. That is why making this analysis still important. Are we being blinded by the fact that there is still a gap? Or are the choices women still make a significant factor here?

2 Theoretical background on the gender wage gap

Differences in the pay gap between women and men can be explained by range of factors. These explanations include supply side theories which focus on individual choices and preferences made by each worker such as getting an education to increase one's human capital. The second explanation is demand-side theories that focus on structural limitations in the labor market such as discrimination (Magnusson, 2010). Demand side theories are described as

occupational gender segregation: Horizontal segregation (more men in higher paid industries) and vertical segregation (fewer women in high paying jobs.)

2.1 Supply side Theories

Supply side theories explains mostly preferences and people expectations. And according to Polachek's conclusion is that the gender wage gap decreases, as male-female lifetime work expectations become more similar to each other (Polachek, 2004).

Taking higher education and training are the surest ways of getting better jobs. Human capital theory states that rational agents invest in education and job training if the expected benefits of doing so outweighs the cost. According to Becker (1993), human capital investments respond nationally to benefits and costs and is seen in the changes in the education of women. There is a significant change in education of women during the 1960s. Before this time, even if girls were more likely to finish high school, girl didn't continue to college, and if they did so, chose subject making them attractive as wives, such as teaching, home economics, and languages. But in the 1960s there was a change. Girls started studying law, economics, medicine and engineering, and women took less time off even to have children. However, there were less jobs for women. Jobs became slowly more plentiful as women moved up in businesses and the professions until it suddenly increased sharply in the late 1970s. The earnings of full-time working women and men have increased more rapidly since 1979 than any previous period in our history, and women are now part of the high-skilled workforce than ever before. On the job training is also part of the very large increase in earnings, because workers get experience at work, and the investment in human capital made by the company in the workforce is seen as almost as large, or even larger than that of investment in education made by the workers themselves. This investment also creates a bond between worker and workplace, and experienced workers are less likely to change workplace than inexperienced workers (Becker, 1993).

In human capital theory there is a difference between general and specific human capital. General human capital is about general skills and education which are very important for employers. Because specific human capital are skills achieved on the job. For example, how to use technology, communication skills, social contacts (Becker1962).

Workers who receive on the job training give the workplace an increase in job performance and effectiveness. Specific human capital theory claims that the cost of this

training is shared between the worker and the employer. In this analysis the worker in specific human capital by saying yes to a starting wage that is lower than the wage he could otherwise get, but as he gains experience and training see a faster rise in pay than he would normally get. From the view of the employer, his investment in specific human capital see a return in paying the worker a wage higher than the value of his marginal product, and receives a return of the investment in subsequent periods by paying a wage smaller than the value of his marginal product (Hashimoto, 1981). According to human capital theory, workers who plan to be away from work in periods would seek work that will not diminish their own or their employer's investment in human capital in the periods they are away (Magnusson, 2010). So, investing in higher education would give women jobs that give them a higher starting salary, and lower depreciation for the time spent away with children.

According to Boeri (2005), women often prefer part time jobs. Part-time jobs offer flexibility and can be combined with family commitments. Part time jobs offer lower pay and less work experience and slower carrier advancement.

There are indications that traditional gender patterns where women, more than men, take care of home related unpaid work, made itself shown here, and that women, as a result, to a much higher extent than men, took responsibility for the home education and caring for the children. (Nergaard, 2020). A survey among academical couples showed that when asked together a majority said that they prioritize both careers equally, but when asked separately a higher percentage of men prioritize their own career over the of their spouses (Schiebinger and Henderson, 2008). Here we can see again for mothers that their family is more important than their own carriers.

2.2 Demand Side theories

Women's ability to get high paying work can also be hindered by statistics discrimination. Employers with imperfect information about potential workers tend to use gender to calculate future work commitment and the likelihood that an employee will resign or take time off from work (Wood and Corcoran, 1993). Because women, on average have more frequent career disruptions than men, employers may be more reluctant to advance women to positions that require a firm specific human capital (Lazer and Rosen, 1990). According to Lazer and Rosen (1990), much of the data supplied by firms in job discrimination legal proceedings, appears to highlight that woman have smaller probabilities of promotion into high paying jobs than men of similar characteristics.

Many people believe that men and women tend to work in different sectors and that this is generally a big disadvantage for women. Different types of work mean different salaries and inequality. Occupational gender segregation plays a big role in gender wage gaps. There are 2 types of dimensions: Vertical segregation and horizontal segregation.

Vertical segregation offers a very consistent pattern, characterized by a much larger share of political and economic power under male control (Longarela, 2017). In vertical segregation men tend to be rewarded higher positions than women in the same work environment.

Horizontal segregations means that men and women work in different spheres, where male dominated occupations have higher salaries than female dominated occupations with the same level of education. Even though gender inequality is not given at a horizontal level, in practice horizontal segregation tends to accompany gender inequality (Magnusson, 2010).

Women have much higher sickness absence rates than men. One prominent hypothesis is that this is a result of gender segregation in the labor market and the differences in employment or working conditions that follow from this (Melsom and Mastekaase 2018).

Gender segregation influences the differences in wages between women and men because there is a correlation between wage and the portion of women employees. Women work in sectors, industries and positions that on average has lower hourly wages (Barth and Hardoy, 2013; Wagner and Fjell, 2020). This is the one of the most important explanations on the gender wage gap.

The discrimination in salaries between men and women takes several different forms. One is the direct inequality in salaries between men and women in the same level of work within the same organization. This difference is now very low in Norway (2-6 percent) (Petersen, Becken and Snartland, 1994), yet this has historically been the focus in both the media, and in politics, and continues to be focused on even today. Høgsnes and Nielsen(2004), argues that this one-sided way of looking at the problem is the reason that the salary inequality has not been much dimished last years.

Glauber (2007), finds that having children has a penalty for both wages and experience for mothers but not for fathers. There is however no motherhood penalty in Norway. In Norway all mothers get 100% pay during maternity leave and get to share this period with their husbands.

2.3 Emprical Findings

A Norwegian study done by Høgnes and Nielsen (2005), examined the importance of level in job hierarchy in Norway. The data is from annual individual salary statements for about 100.000 salaried employees in NHO (The Confederation of Norwegian Enterprise)'s member companies in the period from 1980 to 1997. These employees work in different types of industries, like oil extraction, mining, construction, transport, and some larger industries such as hotels, restaurants and research institutions. They analyzed all industries, companies and positions. They had information about gender, position, hourly wage, detailed educational information and age for each employee. In addition, they calculated employees' labor market experience. Their goal of pay was hourly wage. They calculated women's average wage as a percentage of men's averages wages. Statistics Norway also uses the same percentage-method. It gives us easy comparison when discussing the gender wage gap. They solved this percentage in four different ways. First, they calculated separately for each of industry in the sector, women's average wages as a percentage of men's average wages (This can only be calculated for industries where both women and men are employed). Then they did the same for the gender-integrated positions (positions where both women and men were employed) and for gender-integrated companies (companies with both female and male employees). Finally, and most importantly, they solved the wage gap for the entire sector. They calculated women's average salary as a percentage of men's average salary separately for each position/business unit in the sector. And these percentages told if the wage gap between women and men increased, or decreased, when they took into account the positions and businesses, they worked in. They got results in wage differences at seven different levels: total wage gap, by industry, company, position, position company, position group and position group company. Their results showed that the total wage gap had narrowed over the period: in 1980, women earned on average 33 per cent less than men, while in 1997 the difference was reduced to less than 25 per cent. At the position level, the wage gap fell from 11.8 percent in 1980 to 4.5 percent in 1997.They concluded that direct pay discrimination was not a mechanism behind the pay gap between women and men. It was the distribution of positions and companies that was the main reason for observed wage differences.

3 Covid-19 and wage Inequality

Covid-19 reached Europe in the beginning of 2020, and WHO named it a pandemic. Both the severity of the pandemic and the policies implemented to limit the consequences of it,

differed between countries (WHO, 2020). However, most countries implemented policies that affected the labor market (Juranek and Zoutman 2020).

Due to corona lockdown restrictions many countries have had decreased GDP and increased unemployment. A comparison of the Covid-19 social distancing measures in the Scandinavian countries, found that in Norway and Denmark, because they closed down hard in March 2020 to stop the spread of the virus, and shield the health care systems, the labor market was hit very dramatically. In Sweden the impact on the labor market was delayed by two to three weeks, and never got to the level of the other two countries. But Sweden had a much higher number of hospitalizations in the early onset of the pandemic, because they kept the measures less restrictive for longer (Juranek and Zoutman 2020; Juranek and Paetzold 2021).

Evidence from both local and international literature has illustrated that the gender wage gap can be affected by different socio-economic characteristic and trends. The Covid-19 pandemic has had a large impact on the women's economy and social life. Men and women dominate different industries, with men more often employed in procyclical industries, and women more often employed in countercyclical industries. In an economic crisis typically, men lose their jobs while at the same time women become breadwinners (Coskun and Dalgic, 2020). But during the corona crisis everything we learned has been opposite economically. Economic crisis is generally associated with an important employment drop for men more than women, but during the corona crisis, employment drops have been larger for women. According to Alan and Doepke (2020), in recent recessions such as the one in 2008, job losses for men were much higher than for women. During the Great Recession, the decline in women's employment was sizably smaller than men's for every family group (Albanesi and Kim, 2021).

During the Covid-19 crisis, due to the restrictions and lock down, people working in industries with a high degree of human contact were hit the hardest. Men typically work in industries producing or selling goods, while women predominantly work in sectors like health care and hospitality. These industries are less cyclical compared to production occupations, where men are in the majority (Albanesi and Sahin 2018). There was also lower demand for services because of the infection risk. Because women are highly represented in these service jobs, they lost their work to a larger extent than men during the first months of the pandemic. The ability to work from home is the most important aspect of the relationship between the pandemic and labor markets. Due to lockdown and other distancing rules, many jobs had to be conducted from home. According to Alon and Doepke (2020), men were less exposed to the

effects of lockdown than women, because a higher number of men had jobs that were tele commutable. In the US, 28 percent of men reported that their job were tele commutable, while only 22 percent of women reported the same.

Due to Covid-19 restrictions many countries decided to close schools and kindergartens. And it was a big question of who could take care of children when they had the stay home. According to Alan and Doepke (2020), grandparent-provided childcare was not recommended due to higher mortality rate for elderly, and giving social distancing measures, neighbors or friends could not take care of children outside their own cohorts. As a result of this, most families had to watch their own kids themselves. Based on existing distribution of childcare duties in most families, mothers are likely to be more affected than fathers (Raile, 2020; Nergaard, 2020). Especially single mothers in United States had a big disadvantage and took the biggest hit.

Below, I present the results of existing studies and discuss the potential mechanisms behind these results. I thereafter provide an overview of how Covid-19 affected Norway.

3.1 Emprical Evidence on the Effects of Covid-19 on the gender inequality

A study done by Hill and Köhler (2021), analyzed national lockdown on gender wage inequality in South Africa. Their data has two independent cross-sections and representative of the around 7000 South African adults. It is a survey conducted from 7 May to 27 June, and 13 July to 13 August 2020 respectively. They chose these 2 months; February (before lock-down) and June (three months after lock-down) to estimate the gender wage gap during the lock-down. The collected data gives them opportunity to control for wage variation based on marital status, main occupation, highest level of education, and the number of children present in the household. They estimated the unconditional and conditional gender wage gaps separately, both February and June 2020. They use Mincerian-style regressions first. Dependent variable is natural logarithm of real monthly or hourly wages. Dummy variable is female. This estimation shows conditional gender wage gaps at the mean which is the percentage difference between the real hourly or monthly wages of men and women on average in February and June. They wanted to analyze the gap across the entire distribution in both periods, and Recentered Influence Function (RIF) regressions was a good option for them. The proposed method consists of running a regression of the unconditional quantile on the

explanatory variables. (Firpo and Fortin, 2009). Dependent variable is the log of monthly wages and independent variables such as race, marital status, home language, occupation and education levels. In addition, they analyzed variation in gender wage across the entire wage distribution. Their results shows that the gender wage gap was obvious both before and during the lock-down in South Africa and their estimation shows the average gap to have widened by 46%-73% in June 2020 relative to February.

Another study, from Adams-Pressl and Boneva (2020), investigated inequality in the impact of the COVID-19 shock in UK, US and Germany. They estimated linear probability models for analyzing the predictor of job and earning loss. Their results proves that the first month of the corona pandemic had a negative impact on the labor market and hours worked. Less educated employees, young employees and women were affected to a higher degree. Another study done by Dang and Nguyen (2020) has a similar conclusion about women's wage. They used data from nationally representative samples from China, South Korea, Japan, Italy, The United Kingdom and the four largest states in USA. They ran OLS regression models and dependent variables were self-reported changes in employment, income, expenditure and saving due to COVID-19. In addition, they used the Oxaca-Blinder decomposition technique to analyze factors due to gender gap in outcome variables. Their findings show that women worry about the future effects of COVID-19 on their labor income, and they expect that their labor income fell by 50 percent compared to men's. Possible explanation of these results is that the share of women working is service jobs is significantly higher than men in these 6 countries.

Another important study done by Collins and Landivar (2020), focused on How the COVID-19 affected the gender gap in work hours. children are important factor in this study due to closed schools. They used panel data from the US population Survey to analyze differences in mother' and father' work hours from February to April 2020 and this period is the first wave in USA, and peak of the work stoppages, telecommuting orders and stay-at-home mandates. they used Hausman test to determine if the changes in work hours related with each month significantly differ between mothers and father. Their findings are interesting. They find that mothers with young children reduced their work hours 4 to 5 times more than fathers and the gender wage gap on work hours has increased by 20-50 percent.

Another study done by Heggenes (2020), examined the Covid-19 shock on parents' labor supply during the start of the pandemic. She used difference-in-difference estimation and panel data from Current Population Survey (CPI) approximately 60.0000 households. She

compared labor market, labor market attachment, non-work activity, hours worked, and earnings and wages of those in areas with early and delayed school closures. She started with comparing individuals from early closure and late closure states in 2019 and 2020 along six outcome variables. Since labor participation an important factor during lock down her results show that, mothers who continued working increased their work relative to comparable fathers. Overall, the pandemic seems to have made it very difficult for parents to balance work commitments and the need to take of the school age children.

4 Covid-19 and Gender Gap in Norway

A Norwegian study done by Høgnes and Nielsen (2004), investigates wage differences between women and men in Norway and they show how the pay gap between women and men is declining and the process is slow and bumpy. But has the Covid-19 Pandemic changed this dynamic? According to Statistics Norway, in 2020 women had an average monthly salary per full time equivalent at 45.190 Norwegian kroner. This makes it 87.5 percent of the average full time equivalent among males. If we look at the salary statistics from previous years, we find that women's monthly salaries were 83.5 percent of men's monthly salaries in 2000, and 85 percent in 2010. From 2016 to 2019 this gap was reduced by another 1.3 percentage point, with a constantly reduced reduction from year to year. From 2019 to 2020 we see an increase in the gap of 0.2 percentage point. This has to do with the great changes to the work environment due to the Corona pandemic (Askvik T, 2021).

A report from Female entrepreneurship in the Nordic shows that industries where physical contact or physical proximity is important, such as personal services, childcare, health and social work services, or food and accommodation services, have a significantly higher share of female entrepreneurs than industries where physical proximity is less important. Hence, female entrepreneurs are at risk of being affected especially hit hard by the economic repercussions of corona. (Female Entrepreneurship, 2020)

There is a high degree of occupational gender segregation between public and private sector in Norway. The public sector is dominated by female employees with 70.1 percent women to 29.1 percent men, while the private sector is dominated by men, 63.8 percent men to 36.2 percent women(ssb.no).

The Norwegian government decided to close schools and day-care facilities on 12th March 2020 and home schooling started in Norway. According to a report from Likestillingsenteret (2020), women say to a greater extent than men that they had the main responsibility for a number of tasks at home after the corona lockdown.

International studies about COVID-19 and income inequality focused on single mothers and they got the biggest hit (Alon and Doepke, 2020). In Norway we can see the same situation. Single mothers have had already economic difficulties and lockdown can affect them extra. The frequency of social assistance recipients among the around 100,000 single women with children in 2017 was four times as high as among single women without children. It was also twice as high as among single men without children. (SSB, 2019)

kjønnforskning.no got an assignment from the Directorate for Children, Youth and Families to administrate, make an analysis and report on the consequences for equality during the corona pandemic. (kilden-kjønnforskning.no, 2020) and they investigated different types of sectors during the lockdown. Also in the front line, 88 percent of the nurses are women. And many nurses therefore have jobs in several institutions to complete the work schedule and get their income up to 100 percent. But during the lockdown, because of the risk of spreading the virus, you could only work in one institution, resulting in a loss of income for very many nurses. Many nurses also felt the strain of the hard-working conditions during the pandemic and resigned.

Technology Entrepreneurs have earned very well under the corona due to home office and online meetings, but many women entrepreneurs have had more difficulties. Statistics from Innovation Norway's portfolio show that the proportion of women entrepreneurs decreased form 27 percent in 2019 to 24 percent until September 2020. (kilden-kjønnforskning.no, 2020)

Covid-19 had a major impact on culture and art sector. Due to infection control measures, theaters, cinemas and exhibitions were closed in Norway. According to SSB, 61 percent women work in visual arts (SSB, 2020A). There was already wage inequality in this sector before the pandemic. Norwegian male artists have generally larger income than female artists (Heian, 2018). Maybe the pandemic affected Norwegian female artist extra.

As, I mentioned before women labor participation explains gender wage gap. Even though women (67.5 percent) and men (73.4 percent) almost make an equal part of the workforce, 84.8 percent of men work full-time, and 14.9 part time, while 63.2 percent of women

work full time and 36.4 work part-time, and number of women working part-time was as a result twice as big as that of men (SSB 2019).

4.1 HYPOTHESES

The aim of this master thesis is to shed light on the research question: "Did the Covid-19 pandemic increase gender inequality on the labor market in Norway?" My hypothesis are:

1. Women's wages were more negatively affected by Covid-19 than men's wages.
2. Women's work hours were more negatively affected by Covid-19 than men's work hours.

My motivation for these hypotheses is that women in Norway still have more responsibility for household chores than men. When schools and kindergartens closed down women therefore worked more part-time than men. In addition, the labor market in Norway is gender segregated. Women work more in the tourism and hospitality sector than men do. These sectors were hit especially hard due to limitations on travel and social interaction.

5 Empirical Approach

In this master thesis, I use a variant of the difference-in difference model. To answer my research question, I used individual-level panel data from microdata.no (Statistics Norway) for the time period 2018-2020. Difference-in difference requires panel data which is individual level data over time. The panel data used in this study is wide and short and this indicating that there are many individuals observed over a relatively short period. (Hill, 2018). Before I describe the sample and variables used in the analysis, a few comments on microdata.no should be mentioned.

Microdata.no was developed by NSD and Statistics Norway with funding from the Research Council of Norway. The service is available to researchers and students at approved research institutions with login via the ID portal (Ballo, 2019). Microdata.no is advantageous to use because it contains register data on a range of labor market variables and socio-demographics for the entire Norwegian population. However, a disadvantage of microdata.no is that the data cannot be downloaded for privacy reasons. All data analysis needs to be carried out using a Stata-based software provided by Statistics Norway. This software allows for many standard estimation methods. However, it does not allow for advanced analysis such as the Heichman two step model.

Another disadvantage is that it is cumbersome and sometimes impossible, to combine data from different registers on panel data. This is especially the case for data of different time formats like yearly and monthly data or at different levels like individual level data versus job level data. It is not possible to mix common cross-sectional data and event-based data with panel data. (microdata.no)

I have made random samples from a total population, which makes faster calculations. It is important to stratify with regard to the county so that you get a representative picture of the whole of Norway.

Corona related restrictions hit harder in industries where female employees were in the majority. Unfortunately, microdata.no has not categorized sector variables. Therefore, I could not include sectors as a control variable in my panel data regression.

Under the lockdown there were some demotivation's for some workers. There was not so much information about Covid-19, and some people had the risk of incurring infection. There are some studies that says that women' are more careful and women have been found to be more risk averse than men on average, which could lower their relative wages. (Blau and Kahn, 2017). But I can't take these measures like risk averse, or physical situations into my analysis. Working experience has a big effect on the wage. Unfortunately, I do not have information about working experiences in my panel-data set, but I have age variable.

There are two different samples in this study. In the first sample, the dependent variable is wage, and the data is yearly data and there are 270.830 individuals. The control variables are education, age, kids, marital/partnership status. In addition, the municipality variable which is Oslo. My first sample is helping me to check wage inequality in Norway and how the corona affected it. The second sample is to check working hour per week during the lockdown in Norway and it has 234.015 individuals. Due to closed schools, there were so many kids in home. Collins and Landivar (2020), found that mothers with young children had reduce their working hours more than fathers in the U.S. The Norwegian government closed kindergartens and schools in March 2020 and due to high infection risk, grandparent could not take care of kids. Therefore, many parents reduced their working hours. Unfortunately, I could not find monthly variables for kids. Therefore, I did not include kids in the panel regression in the sample 2. Microdata.no has information about working hours both before corona and after corona and the variables are monthly. Here, I focused on two different months; April 2019 and

April 2020. Then I got the opportunity to compare April 2020 and same month the year before. This analysis helped me to check the effect of the first wave. My analysis includes only the first and second waves of the Covid-19 because I only have data from 2020. Covid-19 restrictions started in March 2020. I do not have directly variables for corona and there are no other measures than the year 2020. So, I assume the whole year of 2020 as a year with corona to see affects.

5.1 Difference-in-difference (DID)

Difference-in-difference (DID) estimators give unbiased treatment effect estimates when, in the absence of treatment, the average outcomes for the treated and control groups would have followed parallel trends over time (O'Neill and Kreif 2016).

DID models are used for estimating treatment effects before and after a shock. According to Hill (2018), we suppose that we have two groups before and after policy change. The outcome variable y is wage or working hours per week in this study. Before the change we observe the treatment value y=B. After the policy applied the treatment group value will be y=C. And we can add a control group which is not affected by the policy change. Before the policy change, we can say the control group value is y=A and after the policy change y=E. In this study C is the women's wage after the pandemic and B is the women's wage before the pandemic. And control group is not affected by corona. Because I assume that the pandemic affected women's wage and there is an increasing wage gap in Norway. I assume that the pandemic has not affected men's wages or working hours as it affected women's wages and working hours. So, A is the men's wages or working hours before pandemic and E is the men' wages or working hours after pandemic. The treatment effect is δ and it is different between the treatment and control values of y in the after period. We can show the estimation of the treatment effect is based on means for the two groups (men and women) in the two periods. (Before and after corona)

$$\hat{\delta} = (\hat{C}-\hat{E}) - (\hat{B}-\hat{A}) \qquad \textbf{(1)}$$

$$= (\hat{y}_{treatment,\ after} - \hat{y}_{control,\ after}) - (\hat{y}_{treatment,\ before} - \hat{y}_{control,\ before})$$

$\hat{y}_{control,\ before}$ = sample mean of y for men in Norway before corona

$\hat{y}_{treatment,\ before}$=sample mean of y for women in Norway before corona

$\hat{y}_{\text{control, after}}$ = sample mean of y for men in Norway after corona

$\hat{y}_{\text{treatment, after}}$ = sample mean of y for women in Norway after corona.

The estimator $\hat{\delta}$ is called a differences-in-differences (Hill, 2018).

In another formalized discussion from Wooldridge (2010), we can denote A as the control group and B denote the treatment group. We can denote a dummy variable as dB equals unity for those in the treatment group and it is zero otherwise. We can denote d2 for the second time period. We can get a simple equation for the impact of the policy change as

$$y = \alpha + \beta_1 db + \delta_0 d2 + \delta_1 d2 \cdot dB + u \quad \textbf{(2)}$$

Here y is the outcome of interest. dB shows possible differences between the treatment and the control groups to the policy change, d2 shows factor that would cause changes in y. δ_1 (coefficient of interest) multiplies d2 · dB (interaction term) and it is equal one for those observations in the treatment group in the second period.

I would like to point out that I use the variation of the difference-in-difference estimation, my estimation does not really satisfy the assumption of the difference-in-difference estimator because my hypothesis is that pandemic affected women more than men and the policies during lockdown included both men and women.

5.2 Outcome Variables

There are two different types of samples in this study; wage is the dependent variable in the first sample and working hours is the dependent variable in the second sample.

Wage

Microdata.no has no wage data for 2021. Therefore, I have used only 2020 as affected by Covid-19. Wages are yearly variables, and the period from 01.01.2019 to 31.12.2020. It includes cash wages, taxable benefits in kind, and sickness and parental benefits during the calendar year. Unit of measures is Norwegian kroner. (NOK) It is important to point out that I divided wages by 1000.

Working Hours

The variable shows collected working hours per week for all kind of work conditions. The variable is monthly, and the month April was the best choice to measure Covid-19 effects.

The unit of measure is hours. I did not find yearly variables for working hours therefore, I run working hours only in sample 2.

5.3 Explanatory variables

I describe all the variables below.

Children

The variables are yearly variables and there are two different categories became one variable. Children live with both parents, and parents are married or partnered.

Women having kids is one of the important effects on the women's wage decreasing in the lockdown. Since women took more responsibility for kids at home, I only included kids in my sample 1(I did not find variables for children, therefore I cannot run it with sample2).

Marriage or partnership status

Many international studies focus on marriage and corona affect. There are so many registered partnerships in Norway. Therefore, I would like to include marriage and partnership status to my control variables. The variable marriage/partnership includes people who are legally married and registered partner in Norway.

Educational degree

Education variable which includes all different levels of educations. There are three different categories in the education variable: Low education, bachelor and master/PhD. I run the whole education variable to avoid dummy variable trap. The Norwegian Standard Classification of Education (NUS) is a 6 digit code system that classifies educational activities by level and field (ssb.no, 2022). I describe all categories below. (NUS codes are in parenthesis) My reference group is missing values.

Low Education

People who have completed an elementary school education. (NUS 1-2)

People who have completed upper secondary school. (NUS 3-4)

People who have completed educations based on upper secondary school, but without university or college education. (NUS 5)

Bachelor Degree

People who have completed a degree of a duration of up to 4 years or people who have completed 120 credits in the university or college system. (NUS 6)

Master/PhD

People who have completed a university or college education of more than 4 years. (NUS 7)

People who have completed a research education or doctoral degree regardless of period. (NUS 8)

Oslo

The capital and the biggest city of Norway hit hardest by COVID-19 and restaurants, hotels and touristic places were closed for many months. Oslo had the highest level of infection which is 228 per 100,000 population and its more than double the national average which is 105 per 100,00 population in April 2020(FHI.no).

I wanted to avoid so many municipalities in my regression results. Therefore, I would like to choose the biggest city in Norway

Age

I have the opportunity to filter ages in microdata and my samples have ages between 25 to 67. Because these ages are active ages at the work.

TABLE 1 Description of the variables

Variables	Description
Dependent Variables	
Wage (Sample 1)	Wages from 01.01.2019 to 31.12.2020. It includes cash wages, taxable benefits in kind and sickness and parental benefits during the calendar year. Placebo test period 01.01.2018 to 31.12.2019
Working hours (Sample2)	Working hours per week. Data from April 2019 and April 2020 Placebo-test period April 2018 and April 2019
Explanatory variables	
Children (sample 1)	Children between 0-17 years. Kids are registered as living with both parents and yearly variable. Only used in sample 1.
Education (sample 1 and sample 2)	Three different categories: Low education, bachelor, master/PHD. Reference group is missing values.
Marrital Status/Registered Partner (sample 1 and sample 2)	Status in relation to marriage law. Married and registered partners.
Age (sample 1 and sample 2)	People between 25 to 67
Women (sample 1 and sample 2)	Dummy variable. It takes the value 1 if the individual women. Otherwise, it takes 0.
Oslo (sample 1 and sample 2)	People who registered resident municipality in Oslo

5.4 Econometric Approach

Two factors are important to focus on this study: Wages influenced by shutdown and labor hours per week. Due to restrictions many people must work less, and some people worked longer. I start with a standard difference-in-difference equation, and I compare wages from individuals from Norway in 2019 and 2020 along outcome variables such as education, kids, marriage or partnership status, municipality (Oslo) and include continues variable like age.

$$Wage_{it} = \alpha + \beta_1\, women_i + \beta_2\, 2020_t + \beta_3\, (2020_t \cdot women_i) + \beta_4\, education_{it} + \beta_5\, children_{it} + \beta_6\, Oslo_{it} + \beta_7\, marriage\text{-}partner_{it} + \beta_8\, (children_{it} \cdot women_i) + \beta_9\, (married\text{-}partner_{it} \cdot women_i) + \beta_{10}\, (children_{it} \cdot women_i \cdot 2020_t) + \beta_{11}\, Age + v_{it} \quad \textbf{(3)}$$

α is intercept, wage being dependent variable and $women_i$ is the dummy variable. It takes the value 1 if individual is women and 0 otherwise. β_2 is the overall effect on the outcome in 2020, compared with 2019. β_3 coefficient of interest which specific effect of the corona impact on women. β_3 is the most important parameter in my master thesis. It represents how much the average outcome of the treatment group has changed after corona.

Here is the other equation for the hourly worked time per week and I present the parameters from equation 4.

α is intercept and the average outcome the control group before Covid-19. Working hours is the dependent variable and $women_i$ is the dummy variable. It takes the value 1 if individual is women and 0 otherwise. β_1 is the difference between the control and treatment group before the covid-19. β_2 is the difference between the average outcome of the control group before and after covid-19. β_3 is the difference-in-difference estimator.

$$Working\text{-}hours_{it} = \alpha + \beta_1\, women_i + \beta_2\, 2020_t + \beta_3\, (2020_t \cdot women_i) + \beta_4\, education_{it} + \beta_5\, marriage\text{-}partner_{it} + \beta_6\, oslo_{it} + \beta_7 (women_i \cdot marriage\text{-}partner_{it}) + \beta_8\, (Age) + v_{it} \quad \textbf{(4)}$$

The counterfactual treatment shows us what it would have occurred to wages or working hours, had the policy intervention not happened. I would like to present the counterfactual treatment by illustration and the illustration can help us to understand the DID effect.

Figure 2 shows the control and treatment groups before and after intervention, hence 0 is before and 1 is after intervention. TA is treatment after intervention ($\alpha + \beta_2$), TB is treatment before intervention (α), CA is control after intervention ($\alpha + \beta_1 + \beta_2 + \beta_3$), CB is control before

intervention and CTA $(\alpha + \beta_1 + \beta_2)$ is counterfactual treatment after intervation. Figure2 is just an illustration and does not represent my results.

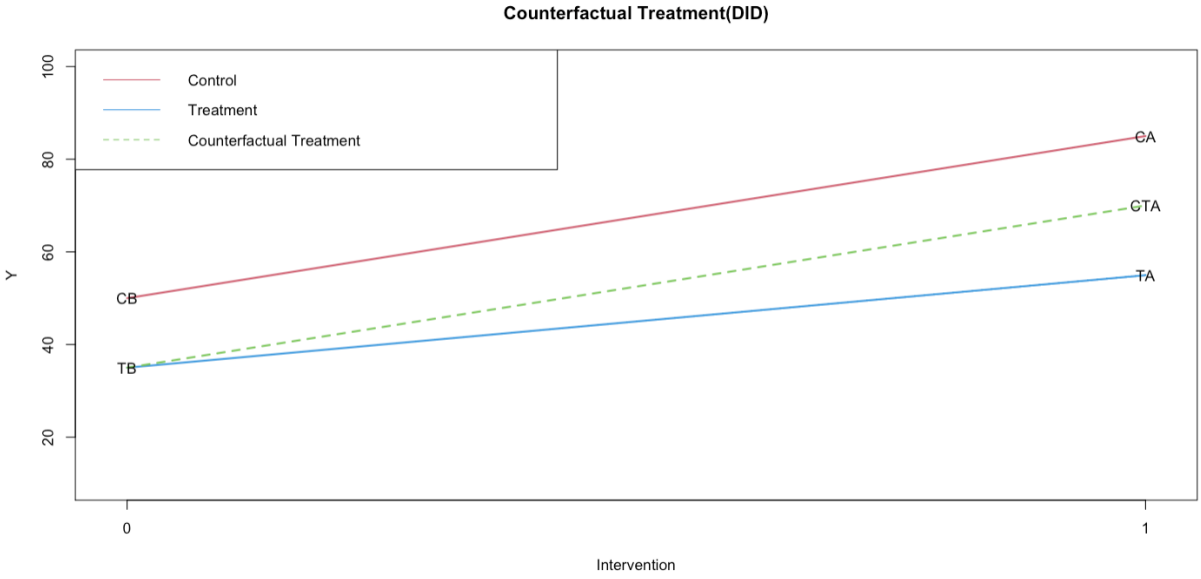

FIGURE 2 ILUSTRATION OF THE DID AND COUNTERFACTUAL TREATMENT

6 RESULTS

6.1 Descriptive Statistics

TABLE 2 Descriptive statistics for sample1; period from 01.01.2019 to 31.12.2020.

	Men					Women				
		2019		2020			2019		2020	
Variables	N	Mean	St.dev	Mean	St.dev	N	Mean	St.dev	Mean	St.de
Wage	140438	561.08	359.63	575.78	364.33	130394	423.48	254.25	437.79	260.19
Age	140438	42.19	12.66	42.25	12.67	130394	42.32	12.71	42.06	12.62
Share to have Children	7281	0.06		0.05		4036	0.04		0.03	
Shr marriage	71151	0.51		0.50		59045	0.46		0.43	
Shr women						130394	0.48		0.48	
Shr living in Oslo	19504	0.14		0.14		18871	0.14		0.14	
Education										
Share with low	87401	0.66		0.64		62560	0.50		0.48	
Share with BSc	30505	0.21		0.21		47580	0.36		0.34	
Share with MSc	16748	0.12		0.12		17830	0.13		0.14	

TABLE 3 Descriptive statistics for sample 2; April2019 and April 2020

	Men					Women				
		2019		2020			2019		2020	
Variables	N	Mean	St.dev	Mean	St.dev	N	Mean	St.dev	Mean	St.d
Working hours	121216	35.01	8.24	34.68	8.51	112795	31.66	10.38	31.65	10.36
Age	121216	42.96	12.42	42.72	12.31	112795	42.96	12.37	42.66	12.27
Share to marriage/part	59253	0.49		0.49		49545	0.44		0.44	
Share to live in Oslo	16762	0.14		0.14		15987	0.14		0.14	
Education										
Share with BSc	26856	0.22		0.22		42880	0.37		0.38	
Share with MSc	15573	0.12		0.13		15991	0.14		0.15	

The descriptive statistics show that the male average yearly wage for 2019 was 561.08 NOK and for 2020 was 575.78 NOK. For women yearly average wage for 2019 was 423.48 and for 2020 was 437.79. The women average wages were significantly lower than male average wages in both 2019 and 2020. 7281 men had children and 4036 women had children in sample 1. A very small share of the people in this sample has children. For men 6 percent in 2019 and 5 percent in 2020, for women 4 percent had children in 2019 and 3 percent in 2020. There is higher share of women that have bachelor's degree than men while 34 percent women have bachelor's degree while 21 percent men have a bachelor's degree in 2020. 15573 men in sample 1 had master/phd degree which represent 13 percent in 2020 and 15991 women had master/phd degree which represent 14 percent. 87401 men had a low education which represent 0.66 percent in 2019 and 0.64 percent in 2020, 62560 women had lower education which represents 0.50 in 2019 and 0.48 percent in 2020. I will continue present descriptive statistics from sample 2. Average weekly working hours for men in 2019 was 35.01 hours and for 2020 34.68 hours and for women the average weekly working hours 31.66 hours in 2019 and 31.65 hours in 2020. The weekly average working hours decreased for both women and men from 2019 to 2020 and we can see the reduction is larger for men than for women.

6.2 Econometric Analysis

I present the results for wage equation first from table 4, and thereafter the results for working hours from table 5. I multiplied wage results by 1000, since I divided by 1000 before the regression. 19 percent of the variation in wages explained jointly by variation in in education, the year 2020, kids, women, marriage/partnership status, age and the biggest city Oslo in Norway in sample1. Table 4 shows significant general effect of the 2020 on wages. The impact of the 2020 on women's wage is negative and it is not significant.

Women without kids earned about average 206.210 NOK less than men in 2019. Men without kids earned average 6.650 NOK more in 2020 similar men did in 2019. The increasing was greater for men than women. (6.650-350=6.300 NOK)

TABLE 4 Impact of COVID-19 on wages in Norway from 2019 to 2020

	Wage
Constant	232.81***
	(6.03)
Women	-206.21***
	(2.23)
2020	6.65***
	(0.76)
Women*2020	-0.35
	(1.09)
Age	6.10***
	(0.08)
Children	-41.62***
	(4.21)
Children*women	35.13***
	(6.46)
Married-partnered	-71.87***
	(2.59)
Married-partnered*women	75.76***
	(3.45)
Oslo	26.77***
	(2.23)
Low education	42.93***
	(4.80)
Bachelor	180.74***
	(4.93)
Master-phd	360.85***
	(5.25)
Children*women(0)*y2020	22.51***
	(3.56)
Children*women(1)*y2020	14.00***
	(4.89)
Number of observations	270833
Number of groups	161849
R^2	0.19
Prob > F	0
Sigma u	328.66
Sigma e	136.74
Rho	0.85

Standard errors in parenthesis p*<0.1; p**<0.05; p***<0.01

Table 5 shows significant impact of the Covid-19 on working hours per week. Men worked approximately 31.3hours(per week) in April 2019 and women worked 3.6 hours less than men in 2019. Men worked 0.35 hours less in 2020 than similar men did in 2019. The general effect of Covid-19 on work hours was a reduction. (-0.35 hours per week) The reduction was smaller for women than for men and significantly so.

TABLE 5 Impact of COVID-19 on working hours April2019/April2020

	Working hours
Constant	31.27***
	(0.18)
Women	-3.63***
	(0.07)
2020	-0.35***
	(0.03)
Women*2020	0.28**
	(0.05)
Age	0.09***
	(0.00)
Low education	-1.24***
	(0.15)
Bachelor	0.52***
	(0.15)
Master-phd	3.21***
	(0.16)
Oslo	0.42***
	(0.07)
Married-partnered	-0.64***
	(0.07)
Married-partnered*women	-0.25**
	(0.10)
Number of observations	234015
Number of groups	161849
R^2	0.07
Prob > F	0
Sigma u	7.96
Sigma e	5.72
Rho	0.66

Standard errors in parenthesis p*<0.1; p**<0.05; p***<0.01

The model predicts that a man worked 30.9 hours in 2020 while a women worked 27.6 hours. Hence, women still worked less than men, but the reduction was significantly smaller for women than for men. If Covid-19 had affected men and women equally, the model predicts that women were supposed to work less. (Figure 3)

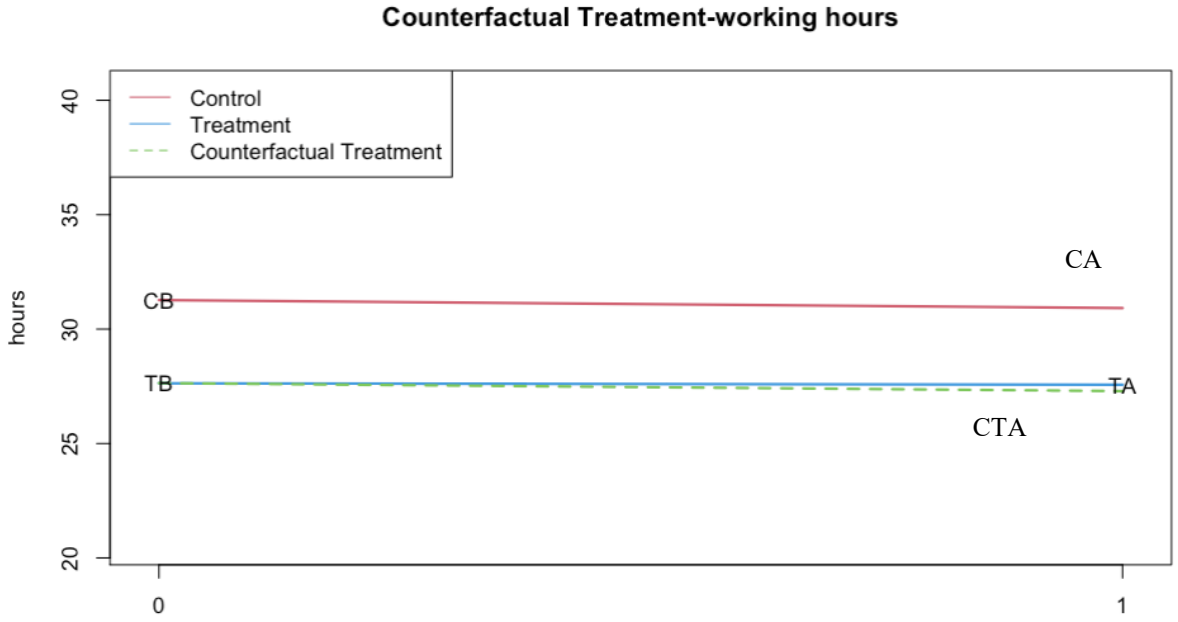

FIGURE 3 ILUSTRATION OF COUNTERFACTUAL TREATMENT ON WORKING HOURS

I would like to present DID estimation results based on means for the two groups from descriptive statistics.

$$\hat{\delta} = (\hat{C}\text{-}\hat{E}) - (\hat{B}\text{-}\hat{A})$$

$$\hat{\delta}_{wage} = (437.79\text{-}575.78) - (423.48\text{-}561.08) = -0.39\ (-390\ NOK)$$

$$\hat{\delta}_{working\ hours} = (31.65\text{-}34.68) - (31.66\text{-}35{,}01) = 0.32\ hours$$

6.2.1 Robustness Check

In addition to DID estimations, I would like to check how the gender wage gap was before corona. I do this examination by implementing Placebo test (fake treatment). In this test I compare individual from Norway in 2018 and 2019. β_2 is the overall effect on the outcome in 2019, compared with 2018.

$$Wage_{it} = \alpha + \beta_1 women_i + \beta_2 2019_t + \beta_3 (2019_t \cdot women_i) + \beta_4 education_{it} + \beta_5 children_{it} + \beta_6 Oslo_{it} + \beta_7 marriage\text{-}partner_{it} + \beta_8 (children_{it} \cdot women_i) + \beta_9 (married\text{-}partner_{it} \cdot women_i) + \beta_{10} (children_{it} \cdot women_i \cdot 2019_t) + \beta_{11} Age + v_{it} \quad \textbf{(5)}$$

My results in table 6 shows placebo effect results how 2019 affected wages. The general effect of 2019 on wages was an increasing. (27160 NOK) The 2019 effect on women's wages

is negative (-7830 NOK) and significant. Hence, women still earned less than men and this increasing was significantly smaller for women than men.

TABLE 6 Impact of 2019 on wages in Norway from 2018 to 2019

	Wage
Constant	163.32***
	(5.81)
Women	-195.05***
	(2.42)
2019	27.16***
	(0.65)
Women*2019	-7.83***
	(0.65)
Age	6.86***
	(0.08)
Children	-34.69***
	(3.56)
Children*women	31.40***
	(5.28)
Married-partnered	-65.74***
	(2.43)
Married-partnered*women	72.13***
	(3.23)
Oslo	26.91***
	(2.04)
Low education	56.76***
	(4.66)
Bachelor	185.86***
	(4.79)
Master-phd	365.20***
	(5.13)
Children*women(0)*y2019	20.02***
	(2.77)
Children*women(1)*y2019	14.84***
	(3.61)
Number of observations	270777
Number of groups	161849
R^2	0.21
Prob > F	0
Sigma u	317.60
Sigma e	115.82
Rho	0.88

Standard errors in parenthesis p*<0.1; p**<0.05; p***<0.01

I would like to check Placebo test if 2019 has effect in these months April 2018-April 2019. Therefore, I run another panel regression which includes two months April 2018 and April 2019.

$$Working\text{-}hours_{it} = \alpha + \beta_1\, women_i + \beta_2\, 2019_t + \beta_3\,(2019_t \cdot women_i) + \beta_4\, education_{it} + \beta_5\, marriage\text{-}partner_{it} + \beta_6\, oslo_{it} + \beta_7(women_i \cdot marriage\text{-}partner_{it}) + \beta_8\,(Age) + v_{it} \quad \textbf{(6)}$$

The results from table 7 shows that working hours changed very little in 2019. The general effect of 2019 on work hours was 0.29 hours increasing. Compared to 2018, women average 0.40 hours worked more. It is again women worked less than men, but the increasing was bigger for women than men.

TABLE 7 Impact of 2019 on working hours April2018/April2019

	Working hours
Constant	30.07***
	(0.18)
Women	-3.72***
	(0.07)
2019	0.29***
	(0.03)
Women*2019	0.11**
	(0.05)
Age	0.12***
	(0.00)
Low education	-1.20***
	(0.15)
Bachelor	0.54***
	(0.16)
Master-phd	3.23***
	(0.16)
Oslo	0.49***
	(0.07)
Married-partnered	-0.55***
	(0.08)
Married-partnered*women	-0.32***
	(0.10)
Number of observations	234209
Number of groups	161849
R^2	0.08
Prob > F	0
Sigma u	8.16
Sigma e	5.27
Rho	0.68

Standard errors in parenthesis p*<0.1; p**<0.05; p***<0.01

7 Discussion

There are so many different factors affecting wage inequality gap between women and men. The gender wage gap has narrowed steadily the last decades, and in Norway women and men have same opportunities to take higher education. However, men still have a higher average salary than women. Did Covid-19 affect this wage gap?

My results do not confirm the hypothesis that Covid-19 affected wage inequality between women and men. The results do confirm a negative effect on women's wage, but it is not significant. Placebo results show that the year 2019 had a negative and significant impact on women's wage. Therefore, I cannot conclude Covid-19 did affect wage inequality between women and men.

I would like to point out that I have a very small share of people having kids in my sample. I did not find any negative effect with women with kids or men with kids. These results are significant and positive. The results show that there is no negative effect on women with children in 2020. Many international studies conclude that women took care of children under the lock-down and therefore, they worked less and earned less. According to Alon and Doepke (2020), the impact of COVID-19 has most probably increase gender inequality, because a much larger strain was put on women with children in need of care. But my results are positive and significant for women having kids in 2020. I did not find any negative effect on mother's wages. There is no covid-19 impact on either mothers or fathers' wages in Norway.

Placebo test show that there is very little change on working hours in 2019 compared to 2020. However, men decreased their working hours dramatically in April 2020, and women worked less in the same month compared to April 2019 but compared to men this reduction was smaller for women. Covid-19 affected males working hours dramatically.

I wanted to write about wage gender inequality. Because it has been a big society problem in many other countries. COVID-19 affected so many social-economic problems globally. But the pandemic has not impacted Norway badly compared to the rest of the word. I thought COVID-19 effects continued for wage inequality. But According to Fløtre and Tuv (2022), women's wages averaged 87.9 percent of men's wages in 2021. Which means wage inequality between women and men decreased in 2021.

A possible explanation in the results for the difference between the control and treatment groups before covid-19 has a huge negative number in the results. It may be due to reference group in the education variable. I focused on missing values in education. The missing values most probably come from immigrant women, because in Norway all education is registered.

If I had the opportunity to include sector/industry variables to my models, maybe I would have different results. Because Covid-19 affected sectors and industries in different ways. Pandemic and restrictions continued after 2020, but at the time of writing this study, the data for subsequent years where not available for wage variables. I would try to estimate difference-in-difference-in-difference with more variables. I would aggregate the children variables better way.

I do not analyze the long-term effects of the Covid-19 pandemic on wage inequality between women and men in Norway. Future research can include long term effects on wage gender gap.

Another important topic is How the COVID-19 affected women of immigrant background in the labor market in Norway. The future studies can include women with immigrant background also.

8 References

Adams-Prassl and Boneva, 2020.
Abi Adams-Prassl, Teodaora Boneva, Marta Golin, Christopher Rauh.
Inequality in the impact of the Coronavirus Shock: Evidence from real time surveys
https://docs.iza.org/dp13183.pdf

Albanesi and Kim, 2021.
Stefania Albanesi and Jiyeon Kim.
Effects of the COVID-19 Recession on the US Labor Market: Occupation, Family and Gender
https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.35.3.3

Albanesi and Sahin, 2018.
Stefania Albanesi and Aysegül Sahin
The Gender Unemployment Gap
https://www.nber.org/papers/w23743

Alstadsæter and Bjørkheim, 2020
Annette Alstadsæter and Julie Brun Bjørkheim
Norwegian and US Policies alleviate Business vulnerability due to Covid-19 shock equally well
https://www.nber.org/system/files/working_papers/w27637/w27637.pdf

Askvik, 2021.
Tanja Askvik.
Lønnforskjeller mellom kvinner og menn påvirkes av korona.
https://www.ssb.no/arbeid-og-lonn/artikler-og-publikasjoner/lonnsforskjeller-mellom-kvinner-og-menn-pavirkes-av-korona

Barth and Hardoy, 2013.
Erling Barth and Ines Hardoy.
Lønnforskjeller mellom kvinner og menn. Hva har skjedd på 2000-tallet?
https://samfunnsforskning.brage.unit.no/samfunnsforskning-xmlui/bitstream/handle/11250/177425/R_2013_7_web_sec.pdf?sequence=3&isAllowed=y

Ballo, 2019.
Jannike Gottschalk Ballo.
Microdata.no: Ny teknologi gir forskere umiddelbar tilgang til norske registerdata.
https://www.idunn.no/doi/10.18261/issn.1504-291X-2019-04-04

Becker, 1963.
Gary S.Becker
Investment in Human Capital: A theoretical Analysis. pages 15-18
https://www.nber.org/system/files/chapters/c13571/c13571.pdf

Becker, 1993.
Gary S. Becker.
Human Capital, third edition. Pages 18-19

Blau and Kahn, 2017.
Francine D. Blau and Lawrence M. Kahn
The Gender Wage Gap: Extent, Trends, and Explanations
https://ftp.iza.org/dp9656.pdf

Blundel and Costa Dias, 2020.
Richard Blundell, Monica Costa Dias, Robert Joyce and Xiaowei Xu.
Covid-19 and inequalities.
https://onlinelibrary.wiley.com/doi/full/10.1111/1475-5890.12232

Boeri, 2005.
Tito Boeri, Daniela Del Boca, Christopher Pissarides.
Women at work. Page 72

Campa and Roine, 2021

Pamela Campa, Jesper Roine, Svante Strömberg
Unequal Labour Market Impacts of COVID-19 in Sweden – But Not Between Women and Men https://www.intereconomics.eu/contents/year/2021/number/5/article/unequal-labour-market-impacts-of-covid-19-in-sweden-but-not-between-women-and-men.html

Collins and Landivar 2020.
Caitlyn Collins, Liana Christin Landivar, Leah Ruppanner, William J. Scarborough. Covid-19 and the gender wage gap in work hours.
https://onlinelibrary.wiley.com/doi/full/10.1111/gwao.12506

Coskun and Dalgic, 2020.
Sena Coskun and Husnu Dalgic
The Emergence of Procyclical Fertility: The role of Gender Differences in Employment risk
https://www.wiwi.uni-bonn.de/bgsepapers/boncrc/CRCTR224_2020_142v1.pdf

Dang and Nguyen, 2020.
Hai-Anh H. Dang, Cuong Viet Nguyen.
Gender Inequality during the COVID-19 Pandemic: Income, Expenditure, Savings and Job loss
https://docs.iza.org/dp13824.pdf

Eurostat, 2021. (Accessed, March 2022)
https://ec.europa.eu/eurostat/databrowser/view/sdg_05_20/default/line?lang=en

Female Entrepreneurship, 2020. (Accessed, March 2022)

https://www.menon.no/wp-content/uploads/2020-Female-entrepreneurship.pdf

Firpo and Fortin 2009. Sergio Firpo, Nicole M. Fortin, Thomas LemieuxUnconditional Quantile Regressions https://www.jstor.org/stable/40263848?seq=3

FHI.no (accessed April, 2020)
https://www.fhi.no/contentassets/c9e459cd7cc24991810a0d28d7803bd0/vedlegg/notat-om-risiko-og-respons-2020-04-05.pdf

Fløtre and Tuv, 2022.
Ingvild Alseth Fløtre and Nina Tuv.
Slik kan lonnforskjellen mellom kvinner og menn forklares.
https://www.ssb.no/arbeid-og-lonn/lonn-og-arbeidskraftkostnader/statistikk/lonn/artikler/slik-kan-lonnsforskjellen-mellom-kvinner-og-menn-forklares

Glauber, 2007.
Rebecca Glauber
Marriage and the Motherhood Wage Penalty Among African Americans, Hispanics, and Whites.
https://bibsys-almaprimo.hosted.exlibrisgroup.com/primo-explore/fulldisplay?docid=TN_cdi_proquest_miscellaneous_36770490&context=PC&vid=UIO&lang=no_NO&search_scope=default_scope&adaptor=primo_central_multiple_fe&tab=default_tab&query=any,contains,glauber%202007&offset=0

Hashimoto, 1981.
Masanori Hashimo.
Firm-specific Human capital as shared investment
https://www.jstor.org/stable/1802794?seq=1

Heggenes, 2020. Misty L. Heggeness. Estimating the immidiate impact of the COVID-19 shock on parental attachment to the labor market and the double bind of mothers
https://link.springer.com/article/10.1007/s11150-020-09514-x

Heian, 2018.
Mari Torvik Heian.
Norske Kunstnere og det doble likestillingsparadokse.
https://www.idunn.no/doi/pdf/10.18261/issn.1891-1781-2018-01-02-04

Hill and Köhler, 2021.

Robert Hill, Tim Köhler.

Mind the Gap: The distributional Effects of South Africa's National lockdown on Gender Wage Inequality

https://www.africaportal.org/publications/mind-gap-distributional-effects-south-africas-national-lockdown-gender-wage-inequality/

Hill, 2018.
R. Carter Hill, William E. Griffiths, Guay C. Lim.

Principles of Econometrics. Fifth Edition.

Holgersen and Jia, 2020
Henning holgersen, Zhiuang Jia and Simen Svenkerud
Who and how many can work from home? Evidence from task description.
https://www.nber.org/system/files/working_papers/w27637/w27637.pdf

Høgsnes and Nielsen, 2004.

Geir Høgsnes, Roy A. Nielsen, Trond Petersen.

Ulikt lønn for likt arbeid= Lønnsforskjellene mellom kvinner og menn under det statistiske mikroskop

https://www-idunn-no.ezproxy.uio.no/doi/10.18261/ISSN1504-2928-2004-01-03

Høgsnes and Nielsen, 2005.

Geir Høgsnes and Roy A. Nielsen

Lønnforskjeller mellom kvinner og men blant NHO-funksjonærer. Betydningen av nivå i stilingshiererkiet.

https://www-idunn-no.ezproxy.uio.no/doi/10.18261/ISSN1504-2928-2005-03-02

ILO,2020 (accested April 2020)
https://www.ilo.org/wcmsp5/groups/public/---dgreports/---gender/documents/publication/wcms_814499.pdf

Juranek and Paetzold 2021.
Steffen Juranek and Jörg Paetzold.
Labor Market effects on Covid-19 in Sweden and its neighbors: Evidence from administrative data
https://onlinelibrary.wiley.com/doi/full/10.1111/kykl.12282

Juranek and Zoutman 2020.
Steffen Juranek and Floris Zoutman

The Effect of Non-Pharmaceutical intervenntions on the demand for Healt care and Mortality: Evidence on Covid-19 in Scandinavia
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3577213

kilden-kjønnforskning.no, 2020 (accested April 2022)
https://kjonnsforskning.no/sites/default/files/notat_bufdir_likestillingskonsekvenser_av_koronapandemien_arbeidsliv_og_okonomi.pdf

Longarela, 2017.
Inaki Longarela.
Explaining vertical gender segregation: a research agenda
https://journals-sagepub-com.ezproxy.uio.no/doi/pdf/10.1177/0950017016668133

Likestillingssenteret, 2020 (Accested May 2022)
https://s3-eu-west-1.amazonaws.com/cdn.likestillingssenteret.no/wp-content/uploads/2020/06/04122520/Likestilling-i-koronatider-hvem-gjoer-hva.pdf

Litman and Robinson, 2020.
Leib Litman, Jonathan Robinson, Zohn Rosen, Cheskie Risensweig.
The persistence of pay inequality: The gender pay gap in an anonymous online labor market.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0229383

Lovdata.no / **§ 34,** Lov on Gender Equality and prohibition of discrimination)
https://lovdata.no/dokument/NL/lov/2017-06-16-51

Magnusson 2010
Charlotta Magnusson.
Mind the Gap. Essays on Explanation of gender wage Inequality.
https://www.diva-portal.org/smash/get/diva2:284166/FULLTEXT01.pdf

Melsom and Mastekaasa, 2017.
Anne May Melson and Arne Mastekaasa
Gender, occupational gender segregation and sickness absence: Longitudinal evidence.
https://journals-sagepub-com.ezproxy.uio.no/doi/pdf/10.1177/0001699317691583

Microdata.no, 2022. (accested may 2022)
https://www.microdata.no/wp-content/uploads/2022/03/brukermanual-en.pdf

Nav.no (accested April 2022)
https://www.nav.no/no/nav-ogsamfunn/statistikk/arbeidssokere-og-stillingerstatistikk/nyheter/mer-enn-400-000- registrert-som-arbeidssokere-hos-nav

Nergaard, 2020.
Kristine Nergaard
Hjemmekontor-fakta.
https://www.fafo.no/images/pub/2020/300420-hjemmekontor-faktaflak.pdf

O'Neill and Kreif 2016.
Stephen O'Neil, Noemi Kreif, Richard Grieve, Matthew Suttan, Jasjeet S. Sekhan.
Estimating causal effects: considering three alternatives to difference-in-differences estimation.
https://link.springer.com/article/10.1007/s10742-016-0146-8

Petersen, Becken and Snartland (1994)
Trond Petersen, Vemund Snartland and Lars Erik Becken
"Lønnsforskjeller mellom kvinner og menn i privat sektor."
https://www.idunn.no/doi/10.18261/ISSN1504-291X-2010-01-04

Polachek, 2004.
Solomon W.Polachek.
How the human capital model explains why the gender wage gap Narrowed
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=527142

Raile, 2020.
Amber N. W. Raile, Eric D. Raile, David C. W. Parker, Elizabeeth A. Shanahan
Women and the weight of a pandemic: A survey of four Western US states early in the Coronavirus outbreak.
https://onlinelibrary.wiley.com/doi/full/10.1111/gwao.12590

Schiebinger and Henderson, 2008.
Londa Schiebinger, Andrea Davies Henderson, Shannan K. Gilmartin.
Dual-Career Academic Couples. What Universities need to know
https://gender.stanford.edu/sites/g/files/sbiybj5961/f/publications/dualcareerfinal_0.pdf

SSB, 2019 (accessed April 2022) https://www.ssb.no/sosiale-forhold-og-kriminalitet/artikler-og-publikasjoner/stadig-mer-sosialhjelp-blant-enslige-modre

SSB, 2020A (accessed April 2022)

https://www.ssb.no/kultur-og-fritid/kultur/artikler/kulturstatistikk-%20%20%20%20%202020/_/attachment/inline/00c34c0b-38b5-4513-8228-a25846a1a1f9:fdbeb52c27622376f4e706ad6811731da556ad47/SA168%20Kulturstatistikk2020_web.pdf

SSB, 2020 (Accessed April 2022)
https://www.ssb.no/befolkning/faktaside/likestilling

SSB, 2022
https://www.ssb.no/klass/klassifikasjoner/36/

US. Bureau of Labor, 2021 (Accessed April 2022)
https://www.bls.gov/opub/mlr/2021/article/covid-19-ends-longest-employment-expansion-in-ces-history.htm

WHO, 2020 (Accested May 2022)

https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200227-sitrep-38-covid-19.pdf?sfvrsn=2db7a09b_4

Wood and Corcoran, 1993.
Robert G Wood, Mary E Corcoran, Paul N Courant.
Pay differences among the highly paid: The Male-Female Earnings Gap in Lawyer's Salaries.
https://www-jstor-org.ezproxy.uio.no/stable/pdf/2535080.pdf?refreqid=excelsior%3A143426fe7b305d698adf4895fb7222cc&ab_segments=&origin=

Woodridge, 2010 page 147-148.
Jeffrey W. Wooldridge.
Econometric Analysis of Cross section and Panel data.

Appendix

R codes

The Gender wage gaps graph.

```
library(plotly)

x <- c('Luxembourg', 'Romania', 'Slovenia', 'Italy', 'Belgium', 'Spain', 'Sweden', 'Lithuania', 'Iceland', 'Norway', 'Denmark', 'Netherlands',

'France', 'Finland', 'Germany', 'Switzerland', 'Austria', 'Estonia', 'Latvia')

y <- c(1.3, 3.3, 7.9, 4.7, 5.8, 9.4, 11.8, 13.3, 14.2, 13.2, 14.0, 14.6, 16.2, 16.6, 19.2, 18.6, 19.9, 21.7, 21.2)

y2 <- c(0.7, 2.4, 3.1, 4.2, 5.3, 9.4,  11.2, 13.0, 13.0, 13.4, 13.9, 14.2, 15.8, 16.7, 18.3, 18.4, 18.9, 21.1, 22.3)

data <- data.frame(x, y, y2)

data$x <- factor(data$x, levels = data[["x"]])

fig <- data %>% plot_ly()

fig <- fig %>% add_trace(x = ~x, y = ~y, type = 'bar',

                         text = y, textposition = 'auto',

                         marker = list(color = 'rgb(158,202,225)',

                                       line = list(color = 'rgb(8,48,107)', width = 1.5)))

fig <- fig %>% add_trace(x = ~x, y = ~y2, type = 'bar',

                         text = y2, textposition = 'auto',

                         marker = list(color = 'rgb(58,200,225)',

                                       line = list(color = 'rgb(8,48,107)', width = 1.5)))

fig <- fig %>% layout(title = "Gender wage Gap",

                      barmode = 'group',
```

```
                xaxis = list(title = "country"),

                yaxis = list(title = "Gender wage gap(percentage)"))



fig
```

DID FIGURE(Ilustration)

```
plot(1,type="n",xlab="Intervention",ylab="Y",

    xaxt="n",xlim=c(-0.01,1.01),ylim=c(10, 100),

    main="Counterfactual Treatment(DID)")

segments(x0=0,y0=CB,x1=1,y1=CA,lty=1,col=2,lwd=2)

segments(x0=0,y0=TB,x1=1,y1=TA,lty=1,col=4,lwd=2)

segments(x0=0,y0=TB,x1=1,y1=CTA,lty=2,col=3,lwd=2)

legend("topleft",

      legend=c("Control","Treatment",

               "Counterfactual Treatment"),

      lty=c(1,1,2),col=c(2,4,3))

axis(side=1,at=c(0,1),labels=NULL)

axis(side=2,seq(1,6,by=0.5))

text(0,50,"CB");text(0,35,"TB");text(1,55,"TA");

text(1,70,"CTA");text(1,85,"CA")
```

DID FIGURE (working hours)

```
plot(1,type="n",xlab="Intervention",ylab="hours",
    xaxt="n",xlim=c(-0.01,1.01),ylim=c(20.5,40.5),
    main="Counterfactual Treatment-working hours")
segments(x0=0,y0=CB,x1=1,y1=CA,lty=1,col=2,lwd=2)
segments(x0=0,y0=TB,x1=1,y1=TA,lty=1,col=4,lwd=2)
segments(x0=0,y0=TB,x1=1,y1=CTA,lty=2,col=3,lwd=2)
legend("topright",
      legend=c("Control","Treatment",
               "Counterfactual Treatment"),
      lty=c(1,1,2),col=c(2,4,3))
axis(side=1,at=c(0,1),labels=NULL)
axis(side=2,seq(1,6,by=0.5))
text(0,31.27,"CB");text(0,27.64,"TB");text(1,27.57,"TA");
text(1,27.29,"CTA");text(1,30.92,"CA")
```

Microdata.no codes

The codes for wage paneldata set 2019-2020

```
require no.ssb.fdb:15 as db
create-dataset reg
import db/BEFOLKNING_FOEDSELS_AAR_MND
import db/BEFOLKNING_KJOENN
generate alder = 2020-int(BEFOLKNING_FOEDSELS_AAR_MND/100)
```

```
keep if alder > 20 & alder <67

import db/BEFOLKNING_STATUSKODE 2021-01-01 as bosatstatus

keep if bosatstatus =='1'

sample 0.05 54321

clone-units reg paneldata

use paneldata

import-panel db/INNTEKT_WLONN db/BEFOLKNING_KJOENN
db/BEFOLKNING_KOMMNR_FAKTISK db/BEFOLKNING_FORELDREKODE
db/NUDB_BU db/BEFOLKNING_FOEDSELS_AAR_MND
db/SIVSTANDFDT_SIVSTAND 2019-01-01 2020-01-01

generate age = 2020 - int(BEFOLKNING_FOEDSELS_AAR_MND /100)

generate y2020 = 0

replace y2020 = 1 if year(date@panel) == 2020

generate women = 0

replace women = 1 if BEFOLKNING_KJOENN == '2'

rename NUDB_BU education

destring education

generate educ = 1

//The first one from 6 digits is 601199 Therefore, I do not use >= 600000

replace educ = 2 if education < 600000

replace educ = 3 if education > 600000

//The first one from 7 digits is 701199 Therefore, I do not use >= 700000

replace educ = 4 if education > 700000
```

```
define-labels ed '2' low_edu '3' bachelor '4' master_phd

generate educa = substr(educ, 1, 2)

assign-labels educa ed

destring educa

tabulate-panel educa

generate men = 0

replace men = 1 if BEFOLKNING_KJOENN == '1'

tabulate-panel educa if men

tabulate-panel educa if women

generate oslo = 0

replace oslo = 1 if BEFOLKNING_KOMMNR_FAKTISK == '0301'

summarize-panel oslo if men

tabulate-panel oslo if men

tabulate-panel oslo if women

summarize-panel oslo if women

summarize-panel age if men

summarize-panel age if women

rename INNTEKT_WLONN wage

generate wages = wage / 1000

drop if sysmiss(wages)

summarize-panel wages
```

summarize-panel wages if men

summarize-panel wages if women

summarize-panel age if women

tabulate-panel oslo if men

summarize-panel women

summarize-panel men

generate married_partner = 0

replace married_partner = 1 if SIVSTANDFDT_SIVSTAND == '1' & '6'

generate children = 0

replace children = 1 if BEFOLKNING_FORELDREKODE == '1' & '2'

summarize-panel children

regress-panel wages i.women i.y2020 i.women#i.y2020 i.educa i.children i.oslo i.married_partner i.children#i.women i.married_partner#i.women i.women#i.y2020#i.children c.age, re

The microdata.no codes for working hours panel data 2019-2020

require no.ssb.fdb:15 as db

create-dataset reg

import db/BEFOLKNING_FOEDSELS_AAR_MND

import db/BEFOLKNING_KJOENN

generate alder = 2020-int(BEFOLKNING_FOEDSELS_AAR_MND/100)

keep if alder > 20 & alder <67

import db/BEFOLKNING_STATUSKODE 2021-01-01 as bosatstatus

```
keep if bosatstatus =='1'

sample 0.05 54321

clone-units reg paneldata

use paneldata

import-panel db/SIVSTANDFDT_SIVSTAND db/BEFOLKNING_KJOENN
db/ARBLONN_PERS_SUM_ARBEIDSTID db/BOSATTEFDT_BOSTED
db/BEFOLKNING_FOEDSELS_AAR_MND db/NUDB_BU 2019-04-16 2020-04-16

generate age = 2020 - int(BEFOLKNING_FOEDSELS_AAR_MND/100)

drop if sysmiss(age)

generate y2020 = 0

replace y2020 = 1 if year(date@panel) == 2020

generate women = 0

replace women = 1 if BEFOLKNING_KJOENN == '2'

rename ARBLONN_PERS_SUM_ARBEIDSTID workinghours

rename NUDB_BU education

destring education

generate educ = 1

replace educ = 2 if education < 600000

replace educ = 3 if education > 600000

replace educ=4 if education > 700000

define-labels ed '2' low_edu '3' bachelor '4' master_phd

generate educa = substr(educ, 1, 2)
```

```
assign-labels educa ed

destring educa

generate married_partner = 0

replace married_partner = 1 if SIVSTANDFDT_SIVSTAND == '1' & '6'

generate men = 0

replace men = 1 if BEFOLKNING_KJOENN =='1'

drop if sysmiss(workinghours)

generate oslo = 0

replace oslo = 1 if BOSATTEFDT_BOSTED =='0301'

tabulate-panel educa if men

tabulate-panel educa if women

summarize-panel workinghours if women

summarize-panel workinghours if men

regress-panel workinghours i.women i.y2020 i.women#i.y2020 i.oslo i.educa
i.married_partner i.married_partner#i.women c.age, re
```

The wage codes paneldata set 2018-2019

```
require no.ssb.fdb:15 as db

create-dataset reg

import db/BEFOLKNING_FOEDSELS_AAR_MND

import db/BEFOLKNING_KJOENN
```

```
generate alder = 2020-int(BEFOLKNING_FOEDSELS_AAR_MND/100)

keep if alder > 20 & alder <67

import db/BEFOLKNING_STATUSKODE 2021-01-01 as bosatstatus

keep if bosatstatus =='1'

sample 0.05 54321

clone-units reg paneldata

use paneldata

import-panel db/INNTEKT_WLONN db/BEFOLKNING_KJOENN
db/BEFOLKNING_KOMMNR_FAKTISK db/BEFOLKNING_FORELDREKODE
db/NUDB_BU db/BEFOLKNING_FOEDSELS_AAR_MND
db/SIVSTANDFDT_SIVSTAND 2018-01-01 2019-01-01

generate women = 0

replace women = 1 if BEFOLKNING_KJOENN == '2'

generate y2019 = 0

replace y2019 = 1 if year(date@panel) == 2019

rename NUDB_BU education

destring education

generate educ = 1

replace educ = 2 if education < 600000

replace educ = 3 if education > 600000

replace educ = 4 if education > 700000

define-labels ed '2' low_education '3' bachelor '4' master_phd

generate educa = substr(educ, 1, 2)
```

assign-labels educa ed

destring educa

tabulate-panel educa

generate married_partner = 0

replace married_partner = 1 if SIVSTANDFDT_SIVSTAND == '1' & '6'

generate age = 2019- int(BEFOLKNING_FOEDSELS_AAR_MND /100)

rename INNTEKT_WLONN wage

drop if sysmiss(wage)

generate wages = wage / 1000

generate oslo = 0

replace oslo = 1 if BEFOLKNING_KOMMNR_FAKTISK == '0301'

generate children = 0

replace children = 1 if BEFOLKNING_FORELDREKODE == '1' & '2'

regress-panel wages i.women i.y2019 i.women#i.y2019 i.educa i.children i.oslo i.married_partner i.children#i.women i.married_partner #i.women c.age i.women#i.y2019#i.children, re

working hours codes 2018-2019

require no.ssb.fdb:15 as db

create-dataset reg

import db/BEFOLKNING_FOEDSELS_AAR_MND

```
import db/BEFOLKNING_KJOENN

generate alder = 2020-int(BEFOLKNING_FOEDSELS_AAR_MND/100)

keep if alder > 20 & alder <67

import db/BEFOLKNING_STATUSKODE 2021-01-01 as bosatstatus

keep if bosatstatus =='1'

sample 0.05 54321

clone-units reg paneldata

use paneldata

import-panel db/SIVSTANDFDT_SIVSTAND db/BEFOLKNING_KJOENN
db/ARBLONN_PERS_SUM_ARBEIDSTID db/BOSATTEFDT_BOSTED
db/BEFOLKNING_FOEDSELS_AAR_MND db/NUDB_BU 2018-04-16 2019-04-16

generate age= 2019-int(BEFOLKNING_FOEDSELS_AAR_MND /100)

generate y2019 = 0

replace y2019 = 1 if year(date@panel)==2019

generate women = 0

replace women = 1 if BEFOLKNING_KJOENN =='2'

rename ARBLONN_PERS_SUM_ARBEIDSTID workinghours

rename NUDB_BU education

destring education

generate educ = 1

replace educ = 2 if education < 600000

replace educ = 3 if education > 600000
```

```
replace educ = 4 if education > 700000

define-labels ed '2' low_education '3' bachelor '4' master_phd

generate educa = substr(educ, 1, 2)

assign-labels educa ed

destring educa

tabulate-panel educa

drop if sysmiss(educa)

generate married_partner = 0

replace married_partner = 1 if SIVSTANDFDT_SIVSTAND == '1' & '6'

drop if sysmiss(workinghours)

generate oslo = 0

replace oslo = 1 if BOSATTEFDT_BOSTED == '0301'

drop if sysmiss(oslo)

regress-panel workinghours i.women i.y2019 i.women#i.y2019 i.educa i.married_partner
i.oslo i.women#i.married_partner c.age, re
```