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What if Sweden had Imposed a Lockdown?

A Synthetic Control Study on the Effects of the Swedish Covid-19 Response
on Gender-Specific Labor Market Outcomes

by

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Abstract

The Covid-19 pandemic triggered a global recession that has had large negative effects on both men and women in the Swedish labor market. We examine how the Swedish strategy of not imposing a lockdown has affected gender-specific labor market outcomes: relative female employment rate and weekly hours worked. To begin with, we study the development of these outcomes in Sweden. Looking at relative female employment we find evidence that women initially were hit harder by the pandemic than men, although this effect was transitory. On the contrary, looking at weekly hours worked, men initially seem to have been harder hit by the pandemic than women. Furthermore, to estimate the causal effect of the Swedish strategy we use the synthetic control method. Using this method we create a counterfactual scenario where Sweden imposes a lockdown and compare these synthetic outcomes with actual Swedish outcomes. We find that women would have been relatively benefited by a lockdown considering the employment rate, while not imposing a lockdown has been favorable for women when looking at relative weekly hours worked. These results suggest that women would meet the increased child care need related to a lockdown by decreasing their hours worked, but not by leaving the labor force. Moreover, our results indicate that the initial relative female employment drop in the pandemic recession was driven by a decreased relative female labor demand and that the Swedish furlough program might have been relatively disadvantageous for women.

Key words: Covid-19, Gender equality, Labor market, Sweden, Synthetic control method

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Contents

1	Introduction	6
1.1	Theory	8
1.2	Previous research	10
1.2.1	Existence and persistence of a shecession	10
1.2.2	Mechanisms behind the labor market outcomes	11
1.2.3	Labor market implications of lockdowns	12
1.2.4	Contribution of our study	13
2	Covid-19 strategies in Sweden and OECD countries	13
2.1	Containment measures	13
2.2	School closure	14
2.3	Economic measures	15
3	The synthetic control method	15
3.1	The structure of the model	16
3.2	Implementation of the model	18
3.3	Motivation to choosing the model	19
4	Data	20
4.1	Outcome variables	20
4.2	Predictor variables	21
4.3	Treatment variable	22
4.4	The donor pool	22
5	Results	23
5.1	Descriptive results	23
5.1.1	Employment and hours worked during the pandemic	23
5.1.2	The spread of the Covid-19 virus	25
5.2	Synthetic results	27
5.2.1	Employment rate	27
5.2.2	Weekly hours worked	31
5.3	Analysis and comparison to previous research	34
6	Inference	36
6.1	Placebo tests	36
6.1.1	In-time placebo	36
6.1.2	In-space placebo	38

6.2	Robustness tests	39
6.2.1	Leave-one-out	39
7	Discussion	40
8	References	44

List of Figures

1	Employment rate in Sweden	24
2	Worked hours in Sweden	24
3	Employment ratio in Sweden	25
4	Worked hours ratio in Sweden	25
5	Confirmed cases of Covid-19 in Sweden and OECD	27
6	Confirmed deaths due to Covid-19 in Sweden and OECD	27
7	Trends in employment ratio: Sweden versus OECD Sample	30
8	Trends in employment ratio: Sweden versus Synthetic Sweden	30
9	Employment ratio gap between Sweden and Synthetic Sweden	31
10	Trends in worked hours ratio: Sweden versus OECD Sample	33
11	Trends in worked hours ratio: Sweden versus Synthetic Sweden	33
12	Worked hours ratio gap between Sweden and Synthetic Sweden	34
13	Placebo treatment 2015Q1 Trends in employment ratio: Sweden versus Synthetic Sweden	37
14	Placebo treatment 2015Q1 Trends in worked hours ratio: Sweden versus Synthetic Sweden	37
15	Employment ratio gap in Sweden and placebo gaps in the control countries .	39
16	Worked hours ratio gap in Sweden and placebo gaps in the control countries	39
17	Leave-one-out distribution of the Synthetic control for Sweden for employment ratio	40
18	Leave-one-out distribution of the Synthetic control for Sweden for worked hours ratio	40

List of Tables

1	Synthetic control weights for employment ratio	28
2	Predictor balance for employment ratio	28
3	Synthetic control weights for worked hours ratio	31
4	Predictor balance for worked hours ratio	32

1 Introduction

The Covid-19 pandemic has caused a rapid economic downturn and led to an increased unemployment rate in Sweden as well as in other countries. Alon et al. (2021) show that in the labor market women have been harder hit by the pandemic than men in most countries: female employment has declined in relation to male employment and women have also decreased their hours worked more than men. They state that these labor market effects are in contrast to those in a regular recession, where men often experience larger negative effects in the labor market than women. The authors argue that the reason for this difference is that while a regular recession hits male-dominated sectors, such as the manufacturing industry, the pandemic recession has been a hard hit towards female-dominated sectors, for instance the service sector. In addition, containment measures such as school closures have increased the need for child care within the household, which has accentuated the choice between child care and work for women (Alon et al., 2021).

While other countries have experienced complete lockdowns and school closures, the Swedish government has instead implemented recommendations for social distancing and kept schools open to a higher extent (Born et al., 2021; Hale et al., 2020). It is, therefore, possible that the effects of the pandemic recession on the Swedish labor market differ from other countries.

The aim of this paper is to evaluate how the decision to keep the Swedish society open to a higher degree than other countries has affected the gender-specific labor market outcomes in Sweden. In order to evaluate this, we analyze changes in the gender-specific labor market outcomes in the short-run and answer the following research question: would relative female employment and weekly hours worked have been affected differently in the short-run if Sweden had implemented a lockdown?

In order to answer our research question we begin by descriptively establishing how the Swedish relative female employment and weekly hours worked have been affected by the pandemic. Thereafter, to evaluate the gender-specific labor market impacts of Sweden's choice of containment measures, we use a synthetic control method. Using quarterly data from the first quarter of 2005 until the fourth quarter of 2020 (2005Q1-2020Q4) we create a synthetic Sweden. This synthetic Sweden is a weighted average of 24 OECD countries similar to Sweden in terms of a number of predictor variables, but having implemented more strict containment measures. These predictor variables include the economic indicators GDP per capita and unemployment rate; variables that could affect the spread of the Covid-19 virus such as population and share of the population that lives in urban areas; share of GDP that the government spends on family benefits, used as an indicator of to which degree public child

care are offered and how accessible the labor market is for women. This synthetic Sweden is an estimate of the unobserved counterfactual for Sweden, a Sweden with lockdown. Comparing relative employment rates and weekly hours worked for men and women in Sweden with those of men and women in synthetic Sweden, we investigate how the Swedish approach to the pandemic has affected gender-specific labor market outcomes.

Observing the labor market trajectories of men and women over time reveals that women were hit harder than men by the pandemic during the second quarter of 2020 when looking at employment. However, this relative decline seems to have been transitory and passed already in the following quarter. In contrast, men decreased their weekly hours worked more than women during the second quarter of 2020, but also this relative decline seems to disappear in the next quarter.

Furthermore, we investigate the effects of Sweden not imposing a lockdown on female relative employment and weekly hours worked. Our results from the synthetic control analysis show that the relative female employment rate was negatively affected by Sweden not implementing lockdown, while relative female weekly hours worked were affected positively. These effects suggest that if Sweden had imposed a lockdown, this would have had a negative effect on female labor supply at the intensive margin, but not at the extensive margin. An increase at the intensive margin refers to an increase in hours worked, while an increase at the extensive margin implies going into employment. Furthermore, the negative effect on relative female employment of not imposing a lockdown indicates that relative female labor demand would have been positively affected by a lockdown.

The rest of the paper is organized as follows. To begin with, we develop a theoretical framework in order to provide a theoretical base for the development of the gender-specific labor market outcomes during the pandemic recession. In the following section, we present previous research both on how the pandemic recession has affected men and women differently in the labor market and on how a lockdown affects labor market outcomes. Chapter 2 describes the government responses towards the Covid-19 pandemic in Sweden and the rest of the OECD. In the following chapter, we explain the econometric framework for the synthetic control method. Chapter 4 presents the outcome, predictor and treatment variables, as well as how the possible control countries have been selected. In the next chapter, we describe and analyze the results for the gender-specific labor market effects of Sweden not imposing lockdown. In chapter 6, we perform a series of placebo and robustness tests as a model of inference. Lastly, chapter 7 contains a discussion of the results.

1.1 Theory

In contrast to male employment, Albanesi and Sahin (2018) show that female employment is countercyclical. Firstly, women are often employed in industries and occupations that are less cycle volatile than industries and occupations with high male employment. Consequently, male unemployment tends to increase more than female unemployment in a regular recession due to a relative decline in male labor demand (Albanesi & Sahin, 2018). Secondly, Doepke and Tertilt (2016) argue that women often are seen as a secondary family provider who will increase their labor supply when the employment of their husbands either is at risk or is lost. The increased labor supply can be seen both at the extensive and the intensive margin. Women’s employment can thus be seen as a within-family insurance (Doepke & Tertilt, 2016). Recent recessions have, due to this relative negative impact on male employment, been called “mancessions” (Alon et al., 2021).

Alon et al. (2020) argue that the pandemic recession will result in different gender labor market outcomes than a regular recession. Already during the first months of the Covid-19 pandemic they predicted that the measures taken by governments in order to hamper the spread of the virus would have different effects on men and women in the labor market. They anticipated that social distancing measures would have a relatively larger negative effect on female labor outcomes, giving rise to the expression “shecession”. First, they predicted that the pandemic recession would have a large negative effect on industries and occupations with a high proportion of female employment, for example the service sector. Thus, they argued that the pandemic recession would lead to a relative decline in female labor demand. Second, they anticipated that the closing of schools and daycare facilities would increase the need for child care within the household. The authors also stated that this additional child care need would be reinforced by the social distancing measures making alternative child care, such as letting grandparents or neighbors take care of the children, less accessible. Alon et al. (2020) argued that women would take the majority of the responsibility for the additional child care, resulting in a relative decrease in female labor supply both at the extensive and the intensive margin.

The assumption made in Alon et al. (2020) that women would decrease their labor supply due to an additional child care need, can be explained by economic incentives. Thinking of the household as an economic entity producing labor market goods and household commodities, when the need for child care within the household is increasing, the value of an hour of household production increases. Given that the household wishes to maximize their total utility, the parent with a lower wage rate will decrease their labor supply on the market in order to be able to allocate more time on household work. The choice of letting the parent with the lower wage rate decrease their labor supply minimizes the opportunity cost for child

care and incentivizes specialization in household production for this parent (Borjas, 2020). It is reasonable to believe that in Sweden mothers in general have a lower wage rate than fathers. The reason for this is firstly the gender wage gap. The Swedish National Mediation Office (2020) reports a gender wage gap of 9.9 percent in Sweden for 2019. Secondly, Kleven et al. (2019) document a child penalty for mothers in Sweden. They show that pre-parenthood the female and male earnings evolve in a similar way, controlling for life cycle and time trends. However, post-parenthood they find that earnings for women and men diverge and they estimate a long-run penalty of around 25 percent for mothers, while they do not find a long-run penalty for men. This penalty can arise from a negative impact on the wage rate or a drop in labor supply, either at the extensive or intensive margin (Kleven et al., 2019). Lower relative female wages in combination with the child penalty for mothers, showing that having children increases income differences between men and women, indicates that in many households the opportunity cost for taking care of the children when schools or child care centers close is lower for the woman than for the man. In addition to a lower opportunity cost, the child penalty for mothers also results in women having a weaker connection to the labor market, due to an already decreased labor supply, which could also increase the probability of women taking the child care responsibility (Stanfors, 2007).

These economic incentives for mothers to decrease their labor supply can also be reinforced by traditional gender norms, where women are expected to allocate more time taking care of children (Stanfors, 2007). The fact that mothers in Sweden use the parental leave to a larger extent than fathers (Försäkringskassan, 2020; Kleven et al., 2019; Stanfors, 2007) and that women in Sweden are more likely than men to work part-time (Stanfors, 2007; Swedish National Mediation Office, 2020), can be seen as indications of female specialization in household production and male specialization in producing market goods. Traditional gender norms therefore result in women being more productive than men regarding household production and the choice of women decreasing their labor supply in order to allocate more time on household production when additional child care is needed is therefore economically efficient (Borjas, 2020). Taken together the economic incentives, reinforced by traditional gender norms, suggest that the increasing need of within-family child care when schools and child care centers close, would have a relatively larger negative effect on women's labor supply than men's, both at the extensive and the intensive margin.

1.2 Previous research

1.2.1 Existence and persistence of a shecession

Alon et al. (2021) show that in most countries the pandemic recession has resulted in a more severe decline in employment for women than for men, in contrast to regular recessions. Using aggregate data for 28 advanced economies, the authors find that women's employment declined more than men's in 18 of 28 countries between the fourth quarter of 2019 and the second quarter of 2020. They observe however a heterogeneity between countries regarding the degree of the relative decline. This heterogeneity highlights the importance of institutions and policies for the effect of the pandemic recession on the gender-specific labor market outcomes. Sweden is among the countries experiencing a relative decline in female employment during the period studied, implying the existence of a shecession when looking at employment. Bluedorn et al. (2021) study the occurrence and persistence of a shecession due to the Covid-19 pandemic. Estimating the absolute gender gap changes, the authors find that more than half of the countries in their sample of 30 advanced countries and eight emerging countries experienced a shecession in the second quarter of 2020. Sweden shows a gap in employment rate changes between men and women of about one percent, the fourth largest value in the sample. This early absolute gender employment gap in Sweden is also confirmed by Galasso and Foucault (2020). Using real-time survey data collected in April 2020, they show that more women than men had stopped working during the first months of the pandemic. In their sample 15 percent of the women had stopped working, compared to seven percent of the men. This tendency was seen also in Poland, Austria, Canada, Germany and Italy. Looking at the relative gender gap change in employment rate, Bluedorn et al. (2021) also find evidence for a shecession in the second quarter of 2020 in two-thirds, including Sweden, of their sample.

Having confirmed the existence of a general shecession during the second quarter of the pandemic recession, in line with Alon et al. (2021), Bluedorn et al. (2021) continues by examining the persistence of the shecession. For the median country in their sample the shecession had passed already in the third quarter of 2020. This transitory characteristic of the shecession is found when looking at the absolute and relative gender gap in employment rate changes and is valid for Sweden in both cases. Looking at the absolute gender gap employment changes, they find evidence for a shecession in 52 percent of the countries in their sample in the second quarter, while only 32 percent of the countries faced a shecession in the third quarter. When only considering the advanced economies in the sample, the fraction falls from 53 to 30 percent. Considering changes in the relative gender gap, the share of countries experiencing a shecession falls from 68 to 45 percent between the second and the third quarter, and from 63 to 37 percent among the advanced economies.

Examining relative female hours worked, Alon et al. (2021) find an even larger general decline than when looking at relative female employment. The number of female hours worked fell in relation to men's in 19 of 28 countries between the fourth quarter of 2019 and the second quarter of 2020. This result signals the existence of a general shecession also when looking at hours worked. However, the authors do not find evidence for a shecession in Sweden during this period considering hours worked. During this period female relative hours worked increased in Sweden. In line with the results for Sweden in Alon et al. (2021), but in contrast to their general conclusion, Bluedorn et al. (2021) find that relative female working hours increased. This means that for those still employed, men decreased their hours worked more than women. The results in Bluedorn et al. (2021) therefore indicate that the shecession only occurred at the extensive margin and not at the intensive margin.

1.2.2 Mechanisms behind the labor market outcomes

Confirming the theory presented by Alon et al. (2020), Alon et al. (2021) point out two reasons for the general relative decline they observe in female employment and hours worked. Firstly, relative female labor demand has declined. In contrast to a regular recession, industries with high female employment were on average hit harder by the pandemic recession than industries with high male employment. However, they find large differences across countries in the sample. This heterogeneity can be a result of differences between countries regarding the composition of industries or the degree to which industries were affected by the pandemic recession. Secondly, relative female labor supply has declined. The authors point to the increased need for child care within the household, following closures of schools and daycare facilities, as an explanation for the relative decline in female labor supply. They state however that the effect on female labor supply will differ across countries, due to differences in mothers' initial labor supply and to which extent schools and daycare facilities have been closed due to the pandemic. To strengthen this argument, the authors underline the fact that Sweden only has experienced school closures to a limited degree and is one of the few countries that has seen a relative increase in female hours worked, indicating that relative female labor supply in Sweden has not decreased on the intensive margin. The authors also show that in countries where the female labor supply was high, the relative female decrease in hours worked was smaller, while the fall in relative employment was larger than in countries with a low female labor supply.

Bluedorn et al. (2021) show that the relative drop in female employment during the beginning of the pandemic recession is driven by a relative decline in labor force participation rather than by a relative increase in unemployment. They find that in general, sectors with a high share of female employment seem to have been affected more

negatively regarding employment rates than sectors with a high share of male employment. However, they conclude that in eight of nine countries experiencing a recession, including Sweden, the relative female employment decline is driven by changes in gender shares within sectors rather than female-dominated sectors being hit harder by the pandemic recession. The authors thereby attribute the recession found when looking at employment to a decreased relative female labor supply rather than a decreased relative female labor demand. Evaluating the effects of the Covid-19 pandemic on gender-specific labor market outcomes in Sweden using monthly unemployment data from January 2019 to July 2020, Campa et al. (2021) concludes that even though employment has declined more in female-dominated sectors, the risk for job loss has increased more among men in these sectors. Consequently, they find no evidence for a positive relationship between the share of female employment in a sector and the change in job loss probability at the sector level. Campa et al. (2021) thereby confirm the findings in Bluedorn et al. (2021) that relative female labor demand has not been a driving force in the recession.

Also Fabrizio et al. (2021) point to the importance of a decreasing relative female labor supply at the extensive margin for the relative employment drop. Using monthly Current Population Survey (CPS) data and controlling for industry, occupation and education level the authors show that in the United States women with young children are the hardest hit workers in the pandemic recession. During the first nine months of the pandemic, women with children under 12 years were three percentage points less likely than men with similar characteristics to be employed, while women without children under 12 years were one percentage point less probable to be employed in comparison to a man with similar characteristics. The authors estimate that 45 percent of the increase in the employment gender gap during the pandemic recession can be explained by the increased need for child care within the household. These findings are supported by Albanesi and Kim (2021), attributing the gender employment gap in the United States not only to a drop in female labor demand due to female overrepresentation in service occupations but also to a drop in female labor supply at the extensive margin when mothers leave the labor force due to increased child care needs.

1.2.3 Labor market implications of lockdowns

Using a difference-in-difference approach, Juranek et al. (2020) study the effects of non-pharmaceutical interventions, implemented to hamper the spread of the Covid-19 virus, on the labor market in the Nordic countries. These countries experienced a similar spread of the virus at the beginning of the pandemic, but differed substantially in the implementation of interventions to limit the spread of the Covid-19 virus. Norway, Denmark and Finland rapidly introduced strict containment measures, while Sweden instead used less strict restrictions.

Using weekly data on unemployment and furlough spells in the 56 regions in the Nordic countries, the authors compare the labor market outcomes in Sweden and its neighbors during the first ten weeks after the implementation of the first strict containment measures in March. The results show that the pandemic had a large negative impact on the labor markets in all countries. However, the negative effect on the Swedish labor market is slightly smaller than in the other Nordic countries. The total number of new unemployment and furlough spells is significantly lower in Sweden up to week 21. In addition, the downturn in the Swedish labor market lags two to three weeks behind its neighbors. This result suggests that in the short run strict containment measures are costly looking at labor market outcomes and highlights the importance of containment strategies for labor market outcomes.

1.2.4 Contribution of our study

Our study is a contribution to the emerging literature evaluating the effects of the Covid-19 pandemic on men and women in the labor market. Analyzing the effects on gender-specific labor market outcomes of not imposing lockdown in Sweden contributes with an insight on how different containment policies can have diverse effects on the labor market for men and women. Such knowledge could be important for policymaking, both considering containment measures and economic measures. This perspective complements previous research on the effect of the pandemic recession on gender-specific labor market outcomes. Furthermore, our study complements the study by Juranek et al. (2020) by adding a gender perspective in analyzing the effects on labor market outcomes of Sweden not imposing lockdown. Moreover, our study extends the analysis of the effect on labor market outcomes until the end of 2020, adding to the existing literature where a large part of the studies investigates the initial effects of the pandemic recession on the labor market.

2 Covid-19 strategies in Sweden and OECD countries

2.1 Containment measures

Hale et al. (2021) explain how governments have implemented different measures and interventions trying to impede the virus spread as much as possible. The governments' responses differ widely when it comes to which kind of restrictions that were implemented, their stringency level and when in time these measures were adopted. The responses do not only vary between countries, but also within countries. For example, some regions closed primary schools completely, while in other areas schools remained open but only for children of essential workers. This spread of different responses caused a debate over the effectiveness of measures, on what level and how quickly the responses should be

implemented (Hale et al., 2021).

According to Born et al. (2021) Sweden deviates from the rest of Europe, not having its government impose a lockdown in the spring of 2020, despite having a similar spread of the Covid-19 virus. Sweden has instead kept stores and restaurants open, relying on people to follow recommendations. The Swedish authorities advised, not ordered, people to adapt and adjust their behavior to the pandemic. For example, citizens were told to avoid unnecessary traveling and social events, and keep social distance. A change in behavior is confirmed by Juraneck et al. (2020) that uses Google's COVID-19 Community Mobility Reports to examine mobility patterns for the Nordic countries. They find that there is an increase in the time stayed at home in Sweden, while less time is spent at the workplaces, transit stations and shops. This indicates that although the Swedish government did not introduce a lockdown, the Swedish inhabitants followed the recommendations and changed their behavior to a certain degree, acting as if it would have been a lockdown. However, even if a decline in mobility is distinguishable in Sweden, it is not as large as in its Nordic neighbours that imposed stricter measures.

2.2 School closure

A common measure to prevent the spread of the virus and keep social distance, is closing schools and universities. Among the OECD members, all countries except Sweden and Finland have closed schools at all levels at some point in time during 2020 (Hale et al., 2020). Sweden has instead kept preschools and primary schools open during the pandemic, while closing education on higher levels. The Public Health Agency of Sweden (2020) motivates this decision by the risk that the negative effects on society of closing schools for young children would be larger than the positive effects obtained by school closures. The increased need for child care risks decreasing labor supply of essential workers in the healthcare industry and puts vulnerable groups, for example grandparents, at a higher risk (Public Health Agency of Sweden, 2020). These risks are recognized by the European Centre for Disease Prevention and Control (2020), arguing that negative effects regarding mental health, educational as well as economic impact on society outweighs the benefits of school closings. However, they also recognize that transmission of Covid-19 can take place within schools and clusters have been reported in preschools, primary schools and secondary schools.

2.3 Economic measures

Governments have responded to the pandemic recession with various economic measures, trying to reduce negative economic effects. However, there are also similarities across countries. Juranek et al. (2020) explains that the Nordic countries established similar programs to keep the effects of the Covid-19 virus on the economy and labor market moderate. In March, Sweden and Denmark presented a furlough program that guarantees workers between 75 and 90 percent of their salary despite not having work tasks to do. Finland and Norway made their existing furlough programs more generous. According to the Swedish National Mediation Office (2021), total employment has declined 1.3 percent during 2020. They state that there is a risk that without the Swedish furlough program, employment would have decreased even more. However, women and men seem to have been affected differently by the program. In total, the decline in female employment was more severe than that in male employment between March and December 2020 compared to the previous year. Some of this difference could be attributed to the design of the furlough program. In Sweden, furlough is not accessible for those with temporary employment and this sort of employment is relatively more common among women than among men in the private sector, where furlough support has been implemented. In addition, industries where temporary employment is common have been particularly negatively affected by the pandemic, resulting in a relatively larger decrease in female employment than male employment.

3 The synthetic control method

Comparative case studies are often used to evaluate the effects of interventions that take place at an aggregate level and affect aggregate units. To capture the causal effect of an intervention we need to compare the outcomes of a treated unit to what the outcomes would have been if the unit had not been treated, i.e. the counterfactual. A unit can only be treated or untreated and the counterfactual is therefore by definition unobserved. Since we only observe one of the outcomes we need a control unit to estimate the counterfactual. The goal is to choose a control unit that is as close to the true counterfactual as possible (Abadie and Gardeazabal, 2003; Abadie et al., 2010). In our application "units" refer to countries, while the "intervention" or "treatment" describes having less strict containment measures. We refer to this as not imposing a lockdown.

Using the synthetic control method we use Sweden as the treated unit and create a synthetic Sweden with lockdown. This synthetic control unit is created as a weighted average of a few OECD countries, which are chosen to construct a control unit that is as close to Sweden as

possible regarding the outcome variable in the pretreatment period. This method allows us to more credibly estimate the counterfactual for Sweden, i.e. how the labor market outcomes for Swedish women and men would have progressed if Sweden had imposed lockdown in response to the Covid-19 pandemic. Doing this, we are able to evaluate the effect of the treatment by comparing the outcome variables after treatment in the actual Sweden and the synthetic Sweden (Abadie and Gardeazabal, 2003; Abadie et al., 2010). In this study we estimate the effects for the ratio between men and women for two different outcomes: employment rate and weekly hours worked.

3.1 The structure of the model

Following Abadie and Gardeazabal (2003) and Abadie et al. (2010, 2015), suppose we have $J + 1$ countries, indexed by j , for $t = 1, \dots, T$ time periods in a balanced sample, meaning that all units are observed in the same time periods. The first country, $j = 1$, is exposed to an intervention, while countries $j = 2$ to $j = J + 1$ compose a donor pool. The donor pool is a source of potential comparison units, used to approximate the counterfactual to the unit of interest. It is thus important that the donor pool consists of units that are similar to the treated unit and were not subject to structural shocks to the outcome variable during the sample period of the study. In our application, the treatment is not imposing lockdown. The treated unit is Sweden and the donor pool consists of 24 OECD countries having imposed stricter containment measures than Sweden. Let then T_0 be a positive number of pretreatment periods (in our study: 2005Q1-2019Q4) and T_1 a positive number of posttreatment periods (in our study: 2020Q1-Q4). We further assume that $T = T_0 + T_1$, $1 \leq T_0 < T$ and that the treatment happens at $T_0 + 1 < T$. In this study, the treatment takes place in the first quarter of 2020. The treatment is only supposed to affect the treated unit and not the remaining J countries, that is we assume that there is no interference between units (Abadie et al., 2010, 2015; Andersson, 2019.).

Let Y_{jt}^l be the outcome that would be observed for country j at time t if the country was exposed to the treatment in periods $T_0 + 1$ to T , for countries $j = 1, \dots, J + 1$ and periods $t = 1, \dots, T$. This is the outcome observed for the treated unit. Let Y_{jt}^N be the outcome that would have been observed for country j at time t in the absence of treatment. Assuming that the treatment have no effect on the outcome before 2020Q1, the outcome in country j is the same in the pretreatment period irrespective of the country being treated or not (Abadie et al., 2010).

Abadie et al. (2010) further explain that $\alpha_{jt} = Y_{jt}^l - Y_{jt}^N$ is the causal effect of the treatment for country j at time t . D_{jt} is a dummy that have the value one if country j is exposed to treatment and zero if not. This dummy variable will therefore only equal one if $j = 1$ and

$t > T_0$. The observed outcome for country j at time t is therefore:

$$Y_{jt} = Y_{jt}^N + \alpha_{jt}D_{jt} \quad (1)$$

The goal is to evaluate the causal effect of the treatment on the outcome variable for the treated unit in the posttreatment period ($t > T_0$): $\alpha_1 = (\alpha_{1T_0+1}, \dots, \alpha_{1T})$.

$$\alpha_{1t} = Y_{1t}^l - Y_{1t}^N = Y_{1t} - Y_{1t}^N \quad (2)$$

Since Y_{1t}^l is already observed ($Y_{1t}^l = Y_{1t}$), we estimate the counterfactual outcome Y_{jt}^N in order to estimate α_{1t} . Y_{jt}^N is given by

$$Y_{jt}^N = \delta_t + \theta_t Z_j + \lambda_t \mu_j + \epsilon_{jt} \quad (3)$$

where δ_t is an unknown constant factor across countries; Z_j a vector of observed covariates that are not affected by the lockdown; λ_t is a vector of unobserved covariates common across countries; θ_t and μ_j are vectors of unknown parameters; and ϵ_{jt} is an error term consisting of unobserved temporary shocks for country j . The error term is zero on average (Abadie et al., 2010).

We then examine a vector consisting of weights for the J untreated units: $W = (w_2, \dots, w_{J+1})'$ where $w_j \geq 0$ and the weights sum up to one. These weights express the importance attributed to each untreated unit in the synthetic control unit. The value for the outcome variable in the synthetic control unit can be described by:

$$\sum_{j=2}^{J+1} w_j Y_{jt} = \delta_t + \theta_t \sum_{j=2}^{J+1} w_j Z_j + \lambda_t \sum_{j=2}^{J+1} w_j \mu_j + \sum_{j=2}^{J+1} w_j \epsilon_{jt} \quad (4)$$

We then assume that there exists weights $(w_2^*, \dots, w_{J+1}^*)$ such that for each time period in the pretreatment period ($T = 1, \dots, T_0$) the value of the outcome variable in the synthetic control unit equals the value of the outcome variable for the treated unit ($j = 1$) and the weighted value of the observed covariates equals the value of these observed covariates for the treated unit. This can be expressed as following:

$$\sum_{j=2}^{J+1} w_j^* Y_{j1} = Y_{11}, \quad \sum_{j=2}^{J+1} w_j^* Y_{j2} = Y_{12}, \quad \dots, \quad \sum_{j=2}^{J+1} w_j^* Y_{jT_0} = Y_{1T_0} \quad (5)$$

$$\text{and} \quad \sum_{j=2}^{J+1} w_j^* Z_j = Z_1 \quad (6)$$

Using these weights we create a synthetic control unit as an estimator of Y_{1t}^N , such that we can estimate the treatment effect in the posttreatment period ($t = T_0 + 1, \dots, T$):

$$\hat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \quad (7)$$

The synthetic control unit will be an unbiased estimator of Y_{1t}^N only if the following holds:

$$\sum_{j=2}^{J+1} w_j^* Z_j = Z_1 \quad \text{and} \quad \sum_{j=2}^{J+1} w_j^* \mu_j = \mu_1 \quad (8)$$

μ_1, \dots, μ_{J+1} are not observed and can therefore not be taken into account when choosing the synthetic control. However, according to Abadie et al. (2010) equation (3) indicates that a synthetic control can fit Z_1 and pretreatment outcomes Y_{11}, \dots, Y_{1T_0} only if it fits both Z_1 and μ_1 . This implies that these equations hold approximately and we can thereby estimate the treatment effect as in equation (7).

3.2 Implementation of the model

Selecting a synthetic control is done by determining a value for W . We assign weights to the control countries so that the synthetic control best corresponds to the treated unit in terms of a few chosen determinants. Let X_1 denote a vector of pretreatment characteristics for the treated unit, including both the observed covariates in Z_j and values for the outcome variable in the pretreatment period. X_0 denotes a matrix containing the same variables for the untreated units. These pretreatment characteristics are the prediction variables. We select a value for W that matches the characteristics in X_0 as precise as possible to the values in X_1 .

The vector $X_1 - X_0W$ describes the difference between the pretreatment characteristics of the treated unit and a synthetic control. When choosing W we strive to minimize this difference, i.e. $\|X_1 - X_0W\|$ subject to $0 \leq w_j \leq 1$ for $j = 2, \dots, J+1$ and $w_2 + \dots + w_{J+1} = 1$. W^* denotes the optimal synthetic control. This difference can be measured by $\|X_1 - X_0W\|V$, where V is a matrix assigning weights to the pretreatment characteristics based on their importance in the prediction of the outcome variable. To select V we use a data-driven approach that minimizes the mean squared prediction error (MSPE) for the pretreatment period (Abadie and Gardeazabal, 2003; Abadie et al., 2010, 2015; Andersson, 2019).

3.3 Motivation to choosing the model

The synthetic control method has several advantages in comparative case studies and builds on the idea that combining units can result in an improved control unit compared to only using a single unit as control. The method also has advantages in comparison to the difference-in-difference approach often used in these types of studies (Abadie et al., 2010). The difference-in-difference method builds upon the parallel trends assumption, meaning that the treated unit and the control unit need to have common underlying trends in the outcome variable in the pretreatment period, indicating that the trend would stay the same in both units if the treatment had not taken place. Differences between the countries are then controlled for using fixed effects and the treatment effect is estimated by the deviation from the trend after the treatment (Angrist and Pischke, 2009). Unobserved characteristics can thereby be accounted for in the difference-in-difference approach as long as they are constant over time, indicating that λ_t in equation (3) is constant. The synthetic control method relaxes the parallel trends assumption by allowing unobserved covariates to vary over time (Abadie et al., 2010). This is favorable since the parallel trends assumption is difficult to ensure and cannot be tested (Andersson, 2019). The possibility to construct a control unit as a weighted average of several possible control units in combination with allowing unobserved country specific effects to vary over time, makes the synthetic control method suitable for evaluating the effect of Sweden not imposing lockdown on Swedish labor market outcomes for men and women.

Furthermore, the synthetic control method holds advantages to regression analysis techniques. The weighted average of possible control units creates transparency. First, it displays similarities and differences between the treated unit and the synthetic control unit. Second, it becomes clear how each possible control unit contributes to the synthetic control unit created. This approach also prevents extrapolation biases since it, in contrast to regression methods, limits the weights given to possible control units to lie between zero and one. The use of interpolation, instead of extrapolation, provides a more concentrated analysis of the relationship between the unit of interest and the control units. There is however a risk for interpolation bias, in particular if the donor pool includes units that differ substantially from the treated unit. In order to reduce the risk for bias one can therefore restrict the donor pool to units that have similar characteristics to the unit of interest (Abadie et al., 2010, 2015).

4 Data

We use quarterly data for Sweden and the donor pool, consisting of 24 OECD countries, over the years 2005-2020 to obtain as many observations as possible. 2005 is the earliest year data is available for most countries in the initial sample of possible control countries, including all OECD countries. Using this period gives us 60 observations for each country and variable pretreatment, which is sufficient to construct a feasible counterfactual. 2020 is our posttreatment period, where we have four periods of observations.

4.1 Outcome variables

Our analysis involves two different ratios as outcome variables that reflect outcomes in the labor market. The purpose of using a ratio instead of absolute values is to see how women are affected in relation to men and thereby cancel out effects due to differences in absolute values between men and women across countries (Bluedorn et al., 2021). We have seasonally adjusted both outcome variables by quarter to remove seasonal influences. The first outcome variable is an employment ratio between women and men:

$$\textit{Employment ratio} = \textit{Female employment rate} / \textit{male employment rate}$$

Using this as an outcome variable allows us to analyze the relative effect on employment, in line with the findings in Alon et al. (2020, 2021), Bluedorn et al. (2021) and Galasso and Foucault (2020). The employment ratio captures relative changes both due to individuals leaving the labor force, for example in order to meet the additional need for child care, and going from employment to unemployment. It therefore captures both gender-specific labor demand and labor supply at the extensive margin. To construct this variable we use data for “Employment rate” as a percentage of the total working age population by sex (OECD, 2021a).

Our second outcome variable is a ratio between women and men for mean weekly hours worked:

$$\textit{Hours worked ratio} = \textit{Female mean weekly hours worked} / \textit{male mean weekly hours worked}$$

This allows us, in accordance with Alon et al. (2021, 2020), to investigate changes in labor supply at the intensive margin. It is plausible that people decrease hours worked due to for example an increased need for child care within the household. The data used for hours worked is “Mean weekly hours actually worked per employed person by sex and economic activity - Quarterly”, where we selected “Aggregate: Total” for economic activity (ILO, 2021).

For some countries only annual data were available for employment rate or weekly hours worked during a few years period. Since the Stata command used for the synthetic control method is sensitive to missing values, we used averages over years to fill the gaps in the data set. However, this should not be a problem since the method uses averages over a longer period of time to create the synthetic control unit.

4.2 Predictor variables

Our model consists of a variety of economic and demographic predictor variables at country level, that either have a potential effect on our outcome variables or correlates with the Covid-19 virus spread. These predictor variables are used to create a control unit as similar to Sweden as possible. As economic indicators we include the logarithm of real GDP per capita, which is seasonally adjusted and measured in current prices U.S. dollars, and the total unemployment rate. The data for GDP per capita and the unemployment rate is collected from OECD (2021b, 2021c).

Regarding the demographic variables we include variables for population size and the share of the population living in urban areas, as a measure of population density. This is done in line with Born et al., (2021), since these variables can affect the spread of the Covid-19 virus and we aim to create a counterfactual with similar conditions for the advancement of the virus. The data for population size and the share of urban population is collected from the World Bank (2021a, 2021b). In addition, we have a variable for public spending on family benefits as a share of GDP. Family benefits include financial support directed exclusively to families and children, such as cash transfers to families with children, public child care support and public income support for parental leave. This variable is used as a proxy for how accessible the labor market is for women and the availability of child care outside the household. The data for public spending on family benefits is collected from OECD (2021d). For the variables population size, share of urban population and public spending on family benefits only annual data were available. In these cases, the value for a given year is used for all quarters during that specific year. Similar as for the outcome variables this is not a problem since the synthetic control method uses averages over a longer period of time.

The predictor variables are averaged for the period 2010Q1-2019Q4, to hamper the possible effects of our economic indicators reacting to the financial crisis in 2008 in various ways across countries. Restricting the averages to this period thereby minimize interpolation bias. The predictor variables are also augmented by including the value for the outcome variable for three lagged periods (2005Q4, 2014Q4, 2019Q4).

4.3 Treatment variable

Our treatment is to not impose lockdown and instead use less strict containment measures. In order to decide which countries are treated and untreated we use the “Stringency Index” provided by the “Oxford COVID-19 Government Response Tracker”. This is a global database for government responses to the Covid-19 pandemic. The data is gathered as from January 1st 2020 from public sources and consists of several measures. The Stringency Index is a weighted measure of the following containment measures: school and workplace closing, canceling of public events, restrictions on gathering, closing public transport, stay-at-home requirements, restrictions on internal movement and international travel controls. In addition, it also includes a “health measure” of public information campaigns. The index is an ordinal scale from 0 to 100, where 0 is no response and 100 is full response (Hale et al., 2020). We use the countries’ maximum values for 2020 of the Stringency Index in order to decide which countries are treated and untreated. The reason for not using the mean value is that countries imposing strict measures during a short period of time, minimizing the spread of the Covid-19 virus, risks having a lower mean value than Sweden that imposed less strict measures during a longer period of time. Sweden has a 2020 maximum value of 69.44 in the index, meaning that countries having a higher maximum value during 2020 than that are considered untreated units.

4.4 The donor pool

When selecting our donor pool, we strive to have a high level of homogeneity between Sweden and control countries in order to avoid interpolation bias. In line with Andersson (2019), we initially start with all OECD countries, excluding Sweden. First, we omit all countries that have lower or the same maximal value on the Stringency Index during 2020 as Sweden, since those countries are considered treated. Therefore Finland, Iceland, Japan and Korea are dropped from the sample of possible control units. In a second step, we exclude Colombia, Chile, Israel and Turkey due to lack of data. The exclusion of these countries is also reasonable since they differ substantially from Sweden concerning economic or structural characteristics and therefore are unlikely to be given a positive weight in synthetic Sweden. In line with this reasoning, we also exclude Mexico. Australia and New Zealand both lack data for average weekly hours worked and are therefore also excluded. Even though these countries could be similar to Sweden in terms of economic indicators, they differ from Sweden regarding geographic characteristics. Since their location under the equator results in having different seasons from Sweden, they could differ in conditions for the spread of the Covid-19 virus, which validates their exclusion from the donor pool. Similar to Born et al. (2021) we also rule out Luxembourg since they have a population of less than one million citizens,

indicating an important difference to Sweden in the possibility of controlling the spread of the virus. Finally, we end up with 24 OECD countries in our donor pool: Austria, Belgium, Canada, Czechia, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Switzerland, United Kingdom and United States.

5 Results

5.1 Descriptive results

5.1.1 Employment and hours worked during the pandemic

The absolute values for the labor market outcomes in Sweden demonstrate that both men and women have experienced large negative effects of the pandemic recession. These results are vital for the coming analysis of the ratios of labor market outcomes, since in order to draw conclusions it is necessary to know in which direction employment and hours worked have changed for men and women. Figure 1 shows that both female and male employment decreased drastically between the last quarter of 2019 and the second quarter of 2020. This decline is an abrupt deviation from the upgoing trend in employment rate for both sexes. A corresponding drop is only seen during the international financial crisis in 2008. Figure 2 plots the average weekly hours worked for men and women. This trend oscillates, due to a variation in weekly hours worked during the year. The variation in the values make it more difficult to see the changes in hours worked during the pandemic. However, looking closely at Figure 2, it shows that the male weekly hours worked decreased more during the first and second quarter of 2020 than it has done during recent years. The trend recovers to some extent during the third quarter of 2020, but stays at a lower level than during the second half of 2019. Regarding female weekly hours worked, the drop is not as large as that for men and does not differ from declines shown during previous years. However, even though female hours worked increases during the third quarter of 2020, unlike previous years the trend does not quickly return to its initial level, indicating that women also have been negatively affected by the pandemic regarding weekly hours worked. The oscillating trends for weekly hours worked shows the importance of seasonally adjusting the measures, in order to avoid seasonal variation.

Figure 1: Employment rate in Sweden

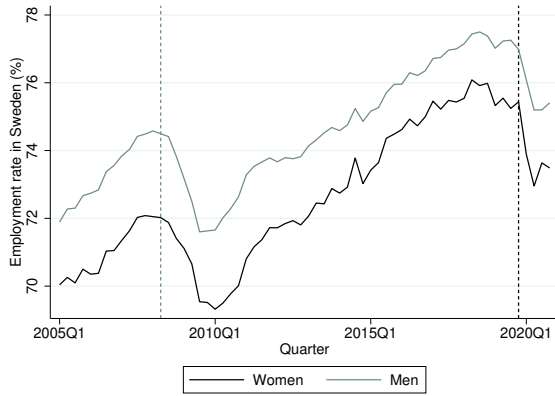
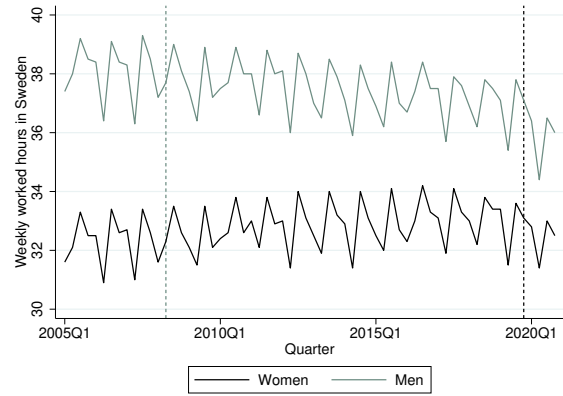


Figure 2: Worked hours in Sweden



Note: The grey dotted vertical line marks the last period before the financial crisis in 2008, while the black dotted vertical line marks the last period before the treatment.

Looking at the absolute values, it is difficult to determine the effects of the pandemic recession on female labor market outcomes in relation to male labor market outcomes. Therefore, Figure 3 and 4 presents a seasonally adjusted ratio between women and men for employment and weekly hours worked in Sweden. Figure 3 shows a rapid decrease in female relative employment rate during the first two quarters of the pandemic recession. Given the absolute decline in female and male employment shown in Figure 1, this indicates that female employment decreased more than male employment during the first two quarters of the pandemic. These findings give evidence for a shecession looking at employment rates. After the second quarter of the pandemic recession relative female employment starts to increase. The ratio experiences a decline again in the fourth quarter of 2020, but the drop is not as large as during the first two quarters of the pandemic. Consequently, the shecession in Sweden was transitory and only lasted for two quarters. Looking at the trend for the employment ratio during the financial recession, we instead see a rapid increase. Together with the drop in employment for both men and women seen in Figure 1, this peak shows that during the financial crisis male employment declined more rapidly than female employment in Sweden. In contrast to during the pandemic recession, Sweden thus experienced a mancession during the financial crisis in 2008. These contrasting results imply that the pandemic recession has different features than a regular recession.

Figure 4 shows an increase in the ratio of hours worked during the first two quarters of the pandemic. Combining these results with the drop in weekly hours worked seen in Figure 2, the increased worked hours ratio reveals that in Sweden men decreased their hours worked more than women during the start of the pandemic. In the following quarters, the ratio declines, but is still higher than its initial level at the end of 2020. This suggests that initially, men were relatively harder hit by the pandemic recession than women looking at

hours worked. Consequently, we do not find evidence for a shecession considering weekly hours worked. Looking at the financial crisis in 2008, the ratio for hours worked did not deviate from the trend. Therefore men seem to have been harder hit in relation to women during the pandemic recession than during the financial crisis in 2008, at least initially.

In conclusion, Sweden seems to have experienced a transitory shecession during the first two quarters of the pandemic looking at employment rates. However, when considering hours worked, men seem to initially have decreased their hours worked more than women, giving no evidence for a shecession.

Figure 3: Employment ratio in Sweden

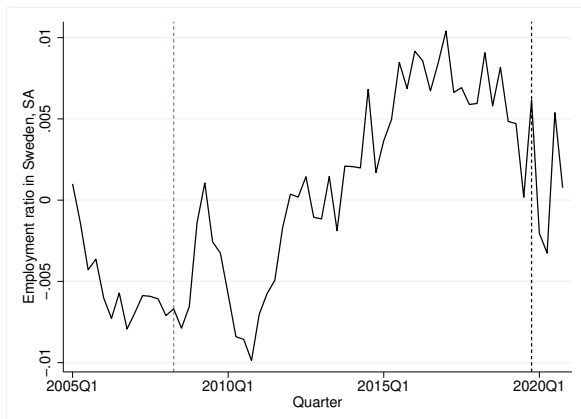
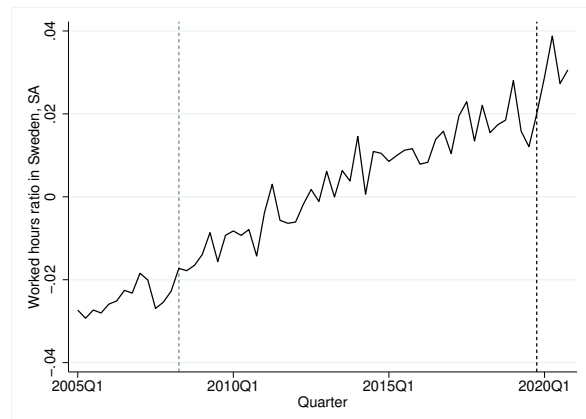


Figure 4: Worked hours ratio in Sweden



Note: The grey dotted vertical line marks the last period before the financial crisis in 2008, while the black dotted vertical line marks the last period before the treatment. The ratios are seasonally adjusted, meaning that the figures show the deviation from the quarterly trend.

5.1.2 The spread of the Covid-19 virus

Comparing the number of confirmed cases in Sweden due to Covid-19 with an average of the countries in our donor pool, having imposed lockdown, can give a wider understanding of the virus spread and the effectiveness of the strategies adopted by the countries. In order to be able to analyze the treatment effect on the labor market outcomes, it is important to ensure that Sweden and the possible control countries have been similarly hit by the pandemic and that the decision not to impose lockdown did not depend on a lower degree of the spread of the Covid-19 virus. To compare the spread of the virus in Sweden and the OECD sample, it is also relevant to complement the confirmed cases with the number of deceased, since countries might have differed in their strategy of testing for infection of Covid-19.

Figure 5 illustrates the cumulative number of confirmed cases of Covid-19 per 100 000 persons during 2020 in Sweden and an average of the OECD sample. The trends are quite similar, showing that the amount started to increase steadily in April, but took a more rapid pace in October. Although there are similar patterns, Sweden's trend is above the rest of the OECD

sample for the period April to October, indicating that Sweden experienced a similar virus spread, or even a bit more expansive, compared to its peers that imposed lockdown.

In Figure 6 the cumulative number of deaths due to Covid-19 per 100 000 persons during 2020 is displayed. Similar to the number of confirmed cases, an increase in the number of deaths can be seen in April for both Sweden and the OECD sample. However, in Sweden, the increase is significantly more rapid during the spring compared to the rest of the OECD sample, indicating that during this period Sweden experienced a substantially larger spread of the Covid-19 virus than the average OECD country. Both Sweden and the OECD sample experience more constant levels during the summer, although Sweden's trend is above the OECD sample due to the high levels in the spring. In October, the number of deceased start to increase again in both Sweden and the OECD sample. This time the OECD sample has a steeper trend than Sweden, implying a larger virus spread in the OECD sample than in Sweden. Consequently, Sweden and the OECD sample reach the same level of deaths at the end of 2020.

From these figures it is reasonable to believe that Sweden was in a similar, or even a worse, situation concerning the virus spread than the average country in the donor pool. Sweden's slightly higher numbers of confirmed cases and substantially higher number of deaths during the spring, implies that the situation was more critical in Sweden than in the average of countries having imposed lockdown. This difference indicates that the strategy in Sweden of not imposing lockdown was not due to a less severe virus spread. Moreover, the figures imply that Sweden might have been able to decrease the spread and mortality of Covid-19 with a different strategy. On the other hand, at the end of 2020 the OECD sample experiences a similar level of confirmed cases and number of deceased as Sweden. In respect to this similar cumulative numbers, over a longer period of time lockdown might not limit the virus spread more than not introducing a lockdown. Doing this comparison between Sweden and the average country in the donor pool it is however important to consider that countries are heterogeneous, having different demographic, geographic and economic characteristics that can affect the number of cases and deaths. Also, countries may differ in how they present statistics which could possibly affect the results.

Figure 5: Confirmed cases of Covid-19 in Sweden and OECD

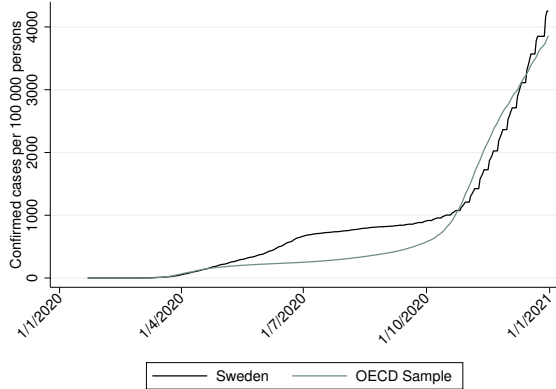
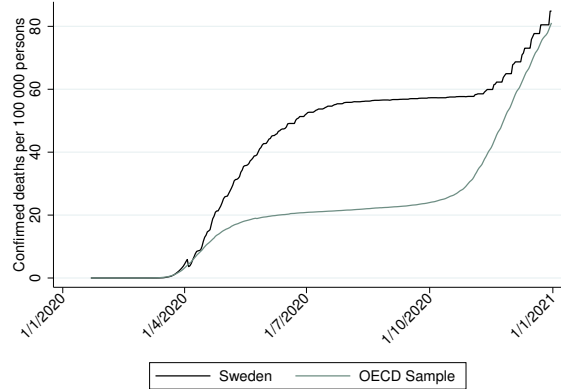


Figure 6: Confirmed deaths due to Covid-19 in Sweden and OECD



Note: The OECD sample is an average of the 24 countries in our donor pool. The figures report the cumulative number.

5.2 Synthetic results

5.2.1 Employment rate

In order to estimate the causal effect of Sweden not imposing lockdown, we create a synthetic Sweden by choosing the weights for the countries in the donor pool that creates the best match for the employment ratio in the synthetic control and the actual Sweden in the pretreatment period. The weights are chosen using the techniques described in the methodological section.

Table 1 shows the optimal synthetic control, W^* , presenting the weight assigned to each country in the donor pool. The synthetic Sweden is a weighted average of Poland, Denmark, Slovenia and the United States, where Poland is given the largest weight and the United States the smallest weight. All other countries in the donor pool are given zero weight and the weights sum to one. However, in the table the values are rounded off to three decimals, resulting in them summing up to 0.999. Unexpectedly, Poland receives a large weight in the synthetic control. Since Poland and Sweden differ in economic characteristics, this could potentially be negative for the credibility of the synthetic control. Also, Slovenia and the United States are rather unpredictable choices. The weights given to these two countries are however small and their contribution to the synthetic control is therefore not as important. The fact that Denmark is given a large weight strengthens the results since it is similar to Sweden both in its economic and geographic characteristics.

Table 1: Synthetic control weights for employment ratio

Country	Synthetic Control Weight	Country	Synthetic Control Weight
Austria	0	Latvia	0
Belgium	0	Lithuania	0
Canada	0	Netherlands	0
Czechia	0	Norway	0
Denmark	0.250	Poland	0.578
Estonia	0	Portugal	0
France	0	Slovakia	0
Germany	0	Slovenia	0.100
Greece	0	Spain	0
Hungary	0	Switzerland	0
Ireland	0	United Kingdom	0
Italy	0	United States	0.071

Table 2 shows the predictor balance, i.e. the average of the predictor variables and the lagged values for the employment ratio for the pretreatment period for Sweden and the synthetic Sweden. The population-weighted average of the countries in the donor pool is also included as a comparison. The averages for synthetic Sweden follow the values for Sweden rather closely. The average for Sweden is closer to synthetic Sweden than the OECD sample regarding the population variable, the unemployment rate, the variable for the urban population share, the family benefits variable and all three lagged values for the employment ratio (for the periods 2005Q4, 2014Q4 and 2019Q4). The average for the OECD sample is however closer to Sweden when looking at the average for GDP per capita. Altogether, the averages for the synthetic Sweden correspond better to the averages of the actual Sweden, suggesting that the synthetic control better predicts the trajectory of the Swedish employment ratio than the OECD sample and therefore provides a better estimate of the counterfactual for Sweden.

Table 2: Predictor balance for employment ratio

	Sweden	Synthetic Sweden	OECD Sample
GDP per capita (log)	10.79	10.40	10.73
Population (log)	16.10	16.82	18.27
Unemployment rate	7.44	7.16	7.87
Urban population share	73.71	72.88	84.12
Family benefits (% of GDP)	1.68	1.88	2.00
Employment ratio (2005)	-0.003	-0.009	-0.034
Employment ratio (2014)	0.002	0.002	0.005
Employment ratio (2019)	0.006	0.006	0.019

Note: The predictor variables, except the lagged values for the employment ratio, are all averaged for the 2010Q1-2019Q4 period. The OECD sample is a population-weighted average for the 24 countries in our donor pool.

Figure 7 shows that Sweden and the OECD sample experienced different paths in the employment ratio before the pandemic recession. Accordingly, the OECD sample does not represent a good control unit in order to evaluate the effect of not imposing lockdown in Sweden. Figure 8 plots the employment ratio for Sweden and the synthetic control during the pretreatment period. Comparing Figure 7 and 8, it is evident that the synthetic Sweden fits the trend for Sweden better than the population-weighted average for the OECD countries. This conclusion confirms the results of the predictor balance and suggests that creating a synthetic control improves the estimate of the counterfactual.

Figure 8 displays however that the trajectory for the synthetic Sweden does not follow the trend for Sweden perfectly. The employment ratio differs especially before 2010, which could partly be due to the countries in the donor pool experiencing different changes in the employment ratio during the financial crisis in 2008. Looking at Figure 7, the average for the countries in the donor pool is smaller than the values for Sweden during the period 2005Q1-2009Q2 and larger than the values for Sweden during the period 2009Q2-2011Q4. These are the periods where the synthetic Sweden differs the most from the Swedish trajectory, even though this trend still stays closer to the trend in the actual Sweden than does the OECD sample trend. The large deviation from the Swedish trend for the OECD sample average can be an explanation for the deviations from the Swedish trend for the synthetic control unit. The reason for this is that the values for a large part of the OECD countries are substantially lower than in Sweden during the period 2005Q1-2009Q2 and substantially larger during the period 2009Q2-2011Q4. Since the synthetic control is created using interpolation, and not allowing for extrapolation, this is likely to affect the value for the synthetic Sweden, building on existing values in the donor pool.

Figure 8 shows that the employment ratio differs in Sweden and the synthetic Sweden in the posttreatment period. Both Sweden and synthetic Sweden experience a drop in the employment ratio in the second quarter. This indicates that female employment declined more than male employment during that quarter, which confirms the descriptive findings of a pandemic recession in section 5.1.1. This drop is in line with Alon et al. (2021) and Bluedorn et al. (2021) finding evidence for a recession in the second quarter of 2020, in Sweden as well as in other OECD countries. Figure 8 displays that this decline is larger in Sweden and starts already in the first quarter of 2020, in contrast to synthetic Sweden where it starts in the second quarter of 2020. However, looking at the third quarter, the employment ratio increases in both Sweden and synthetic Sweden, although the increase is larger in synthetic Sweden. Given the slight increase in employment seen in Figure 1, this indicates that female employment increased more than male employment during this period. Figure 8 demonstrates that in the fourth quarter of 2020 the employment ratio in Sweden

and synthetic Sweden goes in different directions. While the ratio declines in Sweden, it increases in synthetic Sweden. This suggests that regarding employment rates, women were hit harder in relation to men in Sweden than in synthetic Sweden. Thus, our results show that the Swedish approach of not imposing a full lockdown had a negative effect on women’s employment, relative to men’s.

Figure 7: Trends in employment ratio: Sweden versus OECD Sample

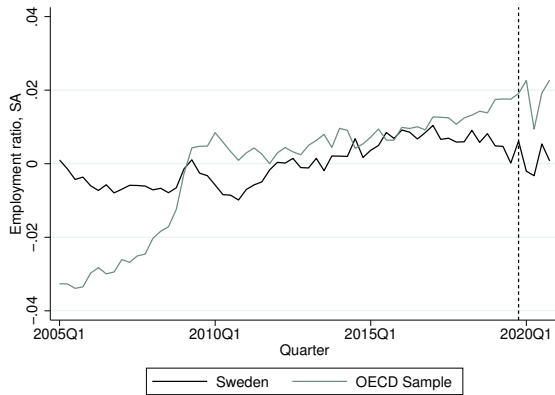
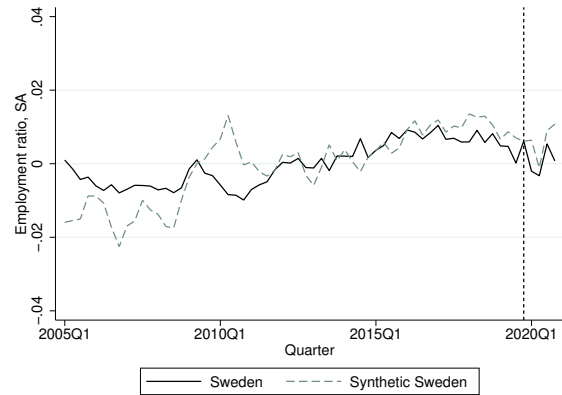


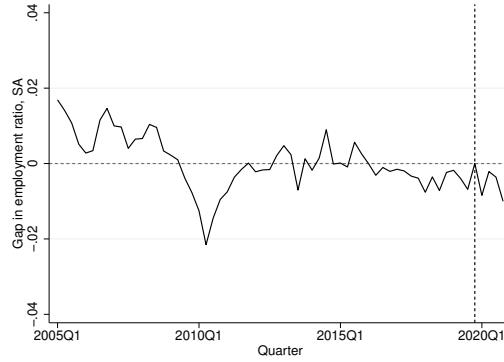
Figure 8: Trends in employment ratio: Sweden versus Synthetic Sweden



Note: The OECD sample is a population-weighted average of the 24 countries in our donor pool. The ratios are seasonally adjusted, meaning that the figures show the deviation from the quarterly trend. The dotted vertical line marks the last period before the treatment.

Figure 9 displays the negative treatment effect, expressed as the difference between the employment ratio in Sweden and synthetic Sweden in the posttreatment period. This figure shows a negative treatment effect, being marginal in the second quarter of 2020, but growing in the third and fourth quarter of 2020. These results suggest that looking at employment rates, women in Sweden were hit harder in relation to men than they would have been if Sweden had imposed lockdown. However, the results have to be interpreted with caution. First, the changes in the gap in the posttreatment period are small. Second, as Figure 9 displays, the gap between the ratios in Sweden and synthetic Sweden is deviating from zero already during the pretreatment period. The largest differences can be seen in the first part of the pretreatment period, while the ratios for Sweden and the control unit follow each other more closely during the years before the treatment, giving more credibility to the estimated treatment effect.

Figure 9: Employment ratio gap between Sweden and Synthetic Sweden



Note: The gap in the employment ratio is the difference between the employment ratio in Sweden and the employment ratio in synthetic Sweden. The dotted vertical line marks the last period before the treatment.

5.2.2 Weekly hours worked

To further investigate gender-specific labor market outcomes, we create a second synthetic Sweden using the same method as in the previous section and the weekly hours worked ratio as the outcome variable. The weights given to each possible control country in the donor pool in the optimal synthetic control, W^* , can be seen in Table 3. Our synthetic Sweden is constructed as a weighted average of Switzerland, Netherlands, Portugal and Latvia, enumerated in decreasing order of importance. The remaining countries in the donor pool receive zero weight in the synthetic Sweden. While Switzerland and the Netherlands are countries expected to be chosen as control countries, due to their similarities in economic characteristics, Portugal and Latvia are more unexpected to be a part of the synthetic control unit. Since Switzerland and the Netherlands receive the largest weights, and therefore are of more importance in the synthetic control, the results still seem reasonable.

Table 3: Synthetic control weights for worked hours ratio

Country	Synthetic Control Weight	Country	Synthetic Control Weight
Austria	0	Latvia	0.127
Belgium	0	Lithuania	0
Canada	0	Netherlands	0.312
Czechia	0	Norway	0
Denmark	0	Poland	0
Estonia	0	Portugal	0.247
France	0	Slovakia	0
Germany	0	Slovenia	0
Greece	0	Spain	0
Hungary	0	Switzerland	0.314
Ireland	0	United Kingdom	0
Italy	0	United States	0

Table 4 shows the predictor balance when looking at hours worked and includes a population-weighted average of the donor pool in addition to the averages for Sweden and synthetic Sweden. Regarding the average for the population variable, the total unemployment rate, the variable for the prevalence of family benefits and the share of urban population, the synthetic Sweden provides pretreatment averages closer to the Swedish averages than what the OECD sample does. Also when looking at the lagged values of worked hours (for the periods 2005Q4, 2014Q4 and 2019Q4) the synthetic Sweden provides better predictions than the OECD sample. Concerning the GDP per capita variable, the OECD sample has a closer match to Sweden than the synthetic control unit. However, the OECD sample only provides an average slightly closer to the Swedish average for this variable (the OECD sample value differs 0.06 log points from the value for Sweden, while synthetic Sweden differs 0.1 log points). Altogether, the predictor balance implies that the synthetic Sweden is a more appropriate estimate of the counterfactual Sweden than the OECD sample.

Table 4: Predictor balance for worked hours ratio

	Sweden	Synthetic Sweden	OECD Sample
GDP per capita (log)	10.79	10.69	10.73
Population (log)	16.10	16.03	18.27
Unemployment rate	7.44	7.67	7.87
Urban population share	73.71	71.83	84.12
Family benefits (% of GDP)	1.68	1.68	2.00
Worked hours ratio (2005)	-0.028	-0.028	-0.017
Worked hours ratio (2014)	0.010	0.009	-0.001
Worked hours ratio (2019)	0.020	0.023	0.016

Note: The predictor variables, except the lagged values for the worked hours ratio, are all averaged for the 2010Q1-2019Q4 period. The OECD sample is a population-weighted average for the 24 countries in our donor pool.

Figure 10 displays the trends in Sweden and the OECD sample for the worked hours ratio. The figure reveals that the trends differed considerably during the pretreatment period, indicating that a better control unit would be needed in order to estimate the causal treatment effect. Figure 11 instead plots the trends for the worked hours ratio in Sweden and the synthetic Sweden, showing that the synthetic Sweden closely follows the trajectory of Sweden before treatment. Comparing Figure 10 and 11, it is reasonable to say that the synthetic Sweden provides a more appropriate comparison to Sweden than the average of our OECD sample, which is consistent with the predictor balance in Table 4.

Furthermore, Figure 11 shows that the trends for Sweden and synthetic Sweden parts in the posttreatment period. Men decreased their hours worked more than women in both Sweden and synthetic Sweden. These results confirm the descriptive results in section 5.1.1 and are in line with the findings for Sweden in Alon et al. (2021) and the general result in Bluedorn

et al. (2021), finding no evidence for a shecession when looking at hours worked. The trend for synthetic Sweden stays under the trend for Sweden during the posttreatment period, signaling that in terms of hours worked women would have been hit harder in relation to men if Sweden had implemented a lockdown. The trend for Sweden is particularly higher than the trend for synthetic Sweden during the second quarter of 2020. The gap between the trends closes during the third quarter but seems to reappear again in the fourth quarter, although smaller than before. The results imply a positive effect for women in relation to men of Sweden not imposing lockdown.

Figure 10: Trends in worked hours ratio: Sweden versus OECD Sample

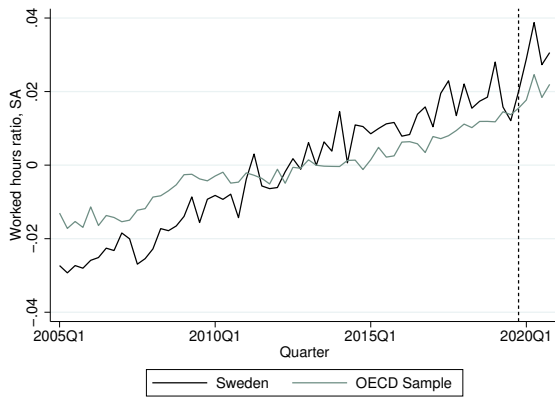
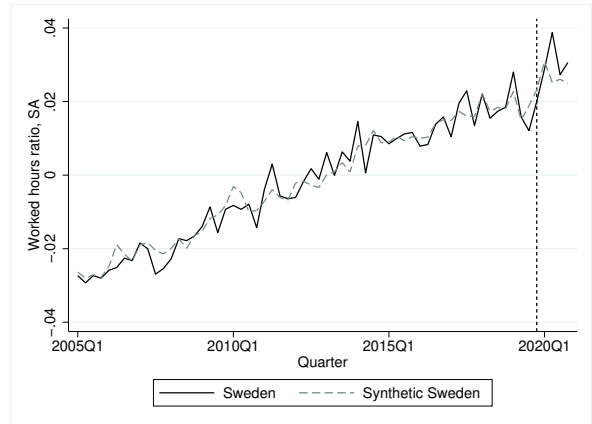


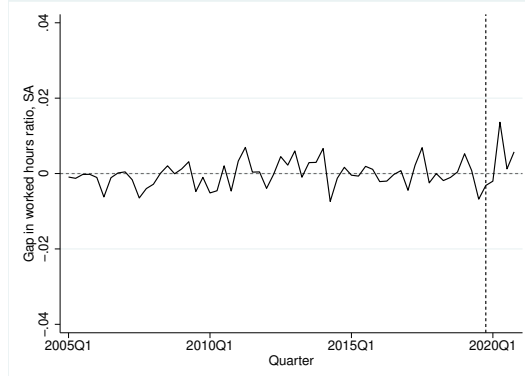
Figure 11: Trends in worked hours ratio: Sweden versus Synthetic Sweden



Note: The OECD sample is a population-weighted average of the 24 countries in our donor pool. The ratios are seasonally adjusted, meaning that the figures show the deviation from the quarterly trend. The dotted vertical line marks the last period before the treatment.

We plot the positive treatment effect on women in relation to men of not imposing lockdown in Figure 12. Once again, the treatment effect is the difference between the outcome variable in Sweden and the synthetic Sweden in the posttreatment period. Before treatment the difference varies around zero. Although the gap deviates slightly from zero in the pretreatment period, the largest deviation is seen in the posttreatment period during the second quarter of 2020. This increased gap after treatment reveals the positive effect on female relative hours worked of Sweden not imposing lockdown. Nonetheless, it is important to take into consideration when commenting on the results that the positive treatment effect is small. Moreover, even though the synthetic Sweden provides a more accurate counterfactual than the OECD sample it is still not an optimal match, as indicated by the gap deviating from zero in the pretreatment period, and the result should therefore be interpreted with caution. The synthetic Sweden created for the weekly hours worked ratio is however a better match to Sweden than the synthetic Sweden created for the employment ratio.

Figure 12: Worked hours ratio gap between Sweden and Synthetic Sweden



Note: The gap in the worked hours ratio is the difference between the worked hours ratio in Sweden and the worked hours ratio in synthetic Sweden. The dotted vertical line marks the last period before the treatment.

5.3 Analysis and comparison to previous research

Our results show that Sweden experienced a shecession during the second quarter of 2020 when looking at the employment rate. These descriptive results seen in Figure 3 confirm the theory of female employment being more cyclical during the pandemic recession than during a regular recession. These findings point to the importance of the particular characteristics of the pandemic recession for Swedish labor market outcomes, bringing attention to the relevance of policy chosen to reduce the negative economic and health consequences caused by the Covid-19 virus. One reason for the shecession could be a decrease in relative female labor demand, as a result of female-dominated sectors being hit harder by the pandemic than male-dominated industries. Another possible reason is that relative female labor supply decreases at the extensive margin, due to economic incentives or traditional gender norms, when the need for additional child care within the household increases. Our findings of a shecession looking at employment are in line with those of Alon et al. (2021) and Bluedorn et al. (2021). Following the findings of the latter, the shecession in Sweden seems to be temporary.

Looking at worked hours, our results are again in line with Bluedorn et al. (2021), finding no evidence for a shecession. This result also corresponds to what Alon et al. (2021) find for Sweden. A possible reason for this is that not imposing lockdown, and thereby avoiding school closure, has kept down the additional need for child care within the household. Consequently, the value of household production has not increased as much as if Sweden had imposed a lockdown, dampening the incentives for the parent with lower wage rate to decrease their labor supply at the intensive margin.

Having analyzed the descriptive results we now turn to the synthetic results, evaluating the effect on gender-specific labor market outcomes of the Swedish strategy to not implement

a lockdown. Integrating a gender perspective in the analysis of the effects of a lockdown on the labor market, complementing the results of Juranek et al. (2020) that show that lockdowns are costly for employment rates in the short-run, gives important insights on how female and male employment rates would have been affected differently by a lockdown. Our synthetic control results suggest that the relative decline in female employment would have been less severe if Sweden had imposed a lockdown. This is in contrast to theory suggesting that a lockdown would affect both relative female labor demand and relative female labor supply at the extensive margin more negatively than keeping the society open to a larger extent. Following theory, female-dominated sectors would be even harder hit if Sweden had closed down the society completely. Furthermore, the need for additional child care would increase substantially if schools and daycare centers closed down, affecting female labor supply negatively at the extensive margin in line with what Fabrizio et al. (2021) and Albenesi and Kim (2021) found for the United States. The opposing results found in this paper could potentially be explained by the uneven furlough distribution between men and women. The Swedish strategy to not impose lockdown, keeping the society open, and offering a possibility of furlough has not been beneficial for women. Since women in the private sector more often than men have temporary employment, and thereby cannot be covered by this support, they could have a relatively higher risk of losing their job. It is thus possible that a lockdown, where restaurants and stores had closed and were offered compensation by the government, potentially could have benefited women and reduced the decline in relative female employment. It is however also possible that the positive effect on relative female employment of a lockdown is due to women increasing their labor supply at the extensive margin as a within-family insurance when their husbands get unemployed, in line with the theory of women being seen as the secondary family provider.

Continuing the analysis by looking at differences in female relative weekly hours worked between Sweden and synthetic Sweden, suggests that the female relative hours worked would have been lower if Sweden had imposed a lockdown. This follows the theory that women take a larger child care responsibility than men, due to economic incentives and traditional gender norms when schools and daycare centers close. Consequently, the Swedish strategy of not imposing lockdown has been relatively beneficial for women looking at hours worked.

The synthetic results suggest that the negative effects on the female labor supply of a lockdown in Sweden would appear at the intensive margin (i.e. hours worked) and not at the extensive margin (i.e. employment). This could potentially be explained by the widespread use among women, especially mothers, of the possibility to work part-time. This indicates that when the value of household production increases due to an additional need for child care within the household, women are more likely to decrease hours worked

than leaving the labor force in order to meet this increased need for household production.

Adding the synthetic results to the descriptive results, which found evidence for a shecession when looking at employment rates but not when considering weekly hours worked, one could argue that the relative decline in female employment during the pandemic recession has been caused by a decrease in relative female labor demand. The synthetic results imply that women in Sweden respond to an increased demand for within-household child care by decreasing their labor supply at the intensive margin and not at the extensive margin. Therefore, it is possible that the decrease in relative female employment in Sweden is not driven by additional child care needs, but rather by a decrease in relative female labor demand due to female-dominated sectors being hit hard by the pandemic. This interpretation is however in contrast to Campa et al. (2021), finding no sign of a positive correlation between the share of female employment in a sector and the sector-level change in probability of job loss. These conflicting results demonstrate the need for further research in this area.

6 Inference

In line with Abadie et al. (2015), we use an alternative inference model in order to evaluate the credibility and robustness of our results. Using traditional statistical inference techniques is difficult in comparative case studies, due to the small and non-random sample (Abadie et al., 2015). We therefore perform three different falsification tests instead of using a traditional method. First, we perform an “in-time” placebo test, changing the treatment period. Second, we do an “in-space” placebo test, changing the treated unit. Third, we perform a “leave-one-out” robustness test, by iteratively leaving out one of the countries with positive weight in the synthetic control. The placebo studies build on the idea that the estimate of the treatment effect, attained by comparing the posttreatment outcome in the synthetic control with the posttreatment outcome in the treated unit, would be less credible if similar or larger effects were estimated in a period or for a unit where the treatment did not take place. The robustness test allows testing the sensitivity of the estimate by evaluating if it relies on a certain country contributing to the synthetic control unit (Abadie et al. 2015).

6.1 Placebo tests

6.1.1 In-time placebo

Following Abadie et al. (2015) we rerun the model, but now with 2015Q1 as the treatment period, five years before the actual treatment, conducting an in-time placebo test. Obtaining large treatment effects from this test would indicate that the estimated treatment effects

found in our synthetic results are not driven by the treatment of not imposing lockdown, but are rather a result of inadequate counterfactuals (Abadie et al., 2015).

Figure 13 displays the result for the in-time placebo test for the employment ratio. Before the placebo treatment the trends for Sweden and synthetic Sweden differ to some extent, but start to converge around 2011Q4. The placebo treatment in 2015Q1 gives no visible effect. We then perform a similar in-time placebo test for the weekly hours worked ratio. Figure 14 shows the results for this test. The trajectory of synthetic Sweden is close to that of Sweden in the period before the placebo treatment. Again, there is no significant effect of the placebo treatment in 2015Q1, instead the trends continue to show a similar progress.

The results for the in-time placebo test for both the employment rate and the weekly hours worked ratio, giving no indication of large placebo treatment effects, indicate that the treatment effects found in the synthetic results are driven by the actual treatment of not imposing lockdown. Consequently, the in-time placebo results give credibility to our main results.

Figure 13: Placebo treatment 2015Q1
Trends in employment ratio:
Sweden versus Synthetic Sweden

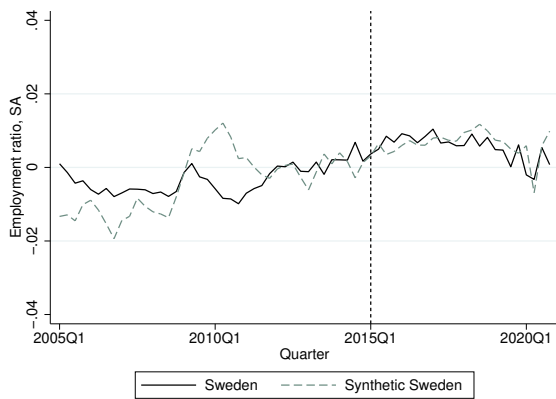
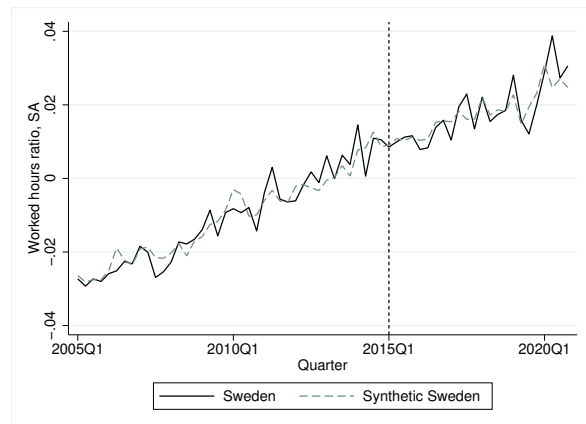


Figure 14: Placebo treatment 2015Q1
Trends in worked hours ratio:
Sweden versus Synthetic Sweden



Note: The dotted vertical line marks the placebo treatment period 2015Q1. The ratios are seasonally adjusted, meaning that the figures show the deviation from the quarterly trend.

6.1.2 In-space placebo

In accordance with Abadie et al. (2010, 2015) we do an in-space test, moving Sweden to the donor pool and iteratively letting each country in the donor pool act as the treated unit. Doing this, we evaluate the effect of a placebo treatment. Comparing the results for the placebo treatments with the actual treatment effect allows us to understand if the estimated effect for Sweden is exceptionally large. If the estimated placebo treatment effect for the countries in the donor pool are similar or larger than the actual treatment effect estimated for Sweden, this signals a lack of credibility for the main results (Abadie et al., 2010, 2015).

Figure 15 presents the gap in the employment ratio for Sweden and the estimated gap for the placebo synthetic control for every country in the donor pool. Figure 16 plots in the same way the gap in the worked hours ratio. Looking at the gap in both ratios in the posttreatment period shows that there are placebo treatments that result in similar or larger effects than does the actual effect in Sweden. These results question the credibility of the estimated treatment effect.

However, it is possible that these results spring from the fact that the possible control countries differ in their degree of being untreated. The treatment was defined as having a maximum value of the Stringency Index for 2020 that was lower or equal to the maximum value of Sweden. The untreated countries therefore all have a higher maximum value of the Stringency Index than Sweden, but their maximum values differ. There are thus countries among the possible control countries that have had more strict containment measures than others. This suggests that it can be difficult to do comparisons among the control countries. A country that has a maximum value close to the Swedish maximum value, will in a way be treated when creating a synthetic control, since the majority of the countries in the donor pool will have a higher maximum value than this country. This could be an explanation for the larger treatment effects obtained for some of the placebo treatments. In addition, the maximum values do not take into account how long these strict containment measures have lasted. Hence, some of the possible control countries might have had strict containment measures during a long period of time, while others have only had these measures for a short period, which can also imply that the countries have been treated to different degrees. Consequently, it can be difficult to rely on these in-space placebo tests and the in-time test might be better suited for this study.

Figure 15: Employment ratio gap in Sweden and placebo gaps in the control countries

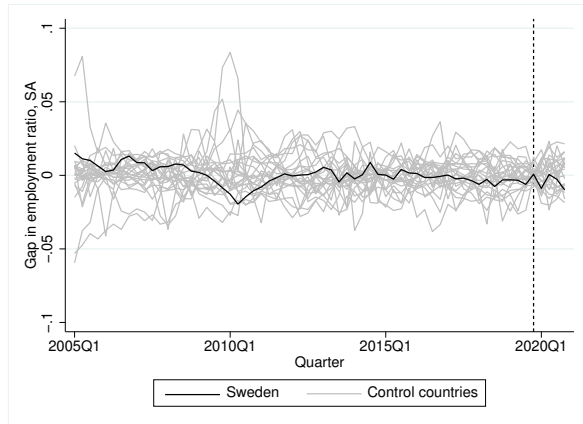
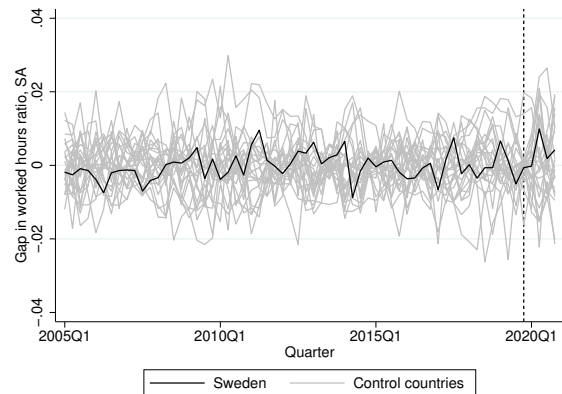


Figure 16: Worked hours ratio gap in Sweden and placebo gaps in the control countries



Note: The dotted vertical line marks the last period before the treatment.

6.2 Robustness tests

To test the robustness of our results, we test how sensible they are to changes in the weights assigned to the countries defining the synthetic control unit. This is done by iteratively excluding one of the countries given a positive weight in the donor pool when constructing the synthetic Sweden. Omitting countries given positive weight reduces the goodness of fit. On the other hand, it makes it possible to analyze if the results are based on a specific country in the donor pool (Abadie et al., 2015).

6.2.1 Leave-one-out

Figure 17 and 18 reports the results from the robustness test. The figures are similar to Figure 8 and 11, displaying the synthetic results for Sweden and synthetic Sweden, but adds the result for synthetic Sweden when the countries given positive weights in the main results are excluded one by one. Figure 17 shows the results for the employment ratio. The leave-one-out results follow the main synthetic control, implying that the main results are sufficiently robust. The country that seems to be most important for the main synthetic control is Denmark. Excluding Denmark gives the leave-one-out synthetic control that deviates the most from the actual synthetic control and results in a more severe decline in the first quarter of 2020. However, even when excluding Denmark, the results for the later quarters of 2020 follows the result of the main synthetic control. The other leave-one-out synthetic controls correspond well to the actual synthetic control. Although Denmark received a lower weight than Poland in the synthetic control unit, this indicates Denmark's importance for the results. Given that Denmark is similar to Sweden in its economic characteristics, and also is geographically close to Sweden, it is reasonable that this country is important for

the synthetic control unit. The fact that Denmark seems more important for the synthetic results than Poland, that is more different to Sweden in its characteristics, strengthens the credibility of the synthetic control. Taken together the synthetic control unit created for the employment ratio seems quite robust.

Figure 18 reveals that also the synthetic control for the worked hours ratio seems reasonably robust. The leave-one-out synthetic control that differs the most from the main synthetic control is when excluding Switzerland. This result is however not surprising, since Switzerland receives the highest weight of the chosen control countries and is close to Sweden in its economic characteristics. It should therefore reasonably be of importance to the synthetic results. Excluding Switzerland results in a synthetic control that follows the trend for the worked hours ratio of actual Sweden more closely. Nonetheless, also this leave-one-out synthetic control obtains values lower than the actual Sweden. This indicates that our main results would be supported also using such a synthetic control, even though it follows the trend for Sweden more closely than the main synthetic control. The other leave-one-out synthetic controls are similar to the main control unit created. Therefore, this test indicates that the main synthetic results for the weekly hours worked ratio are solid.

Figure 17: Leave-one-out distribution of the Synthetic control for Sweden for employment ratio

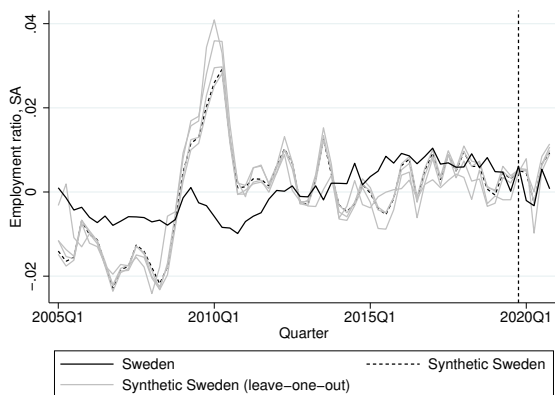
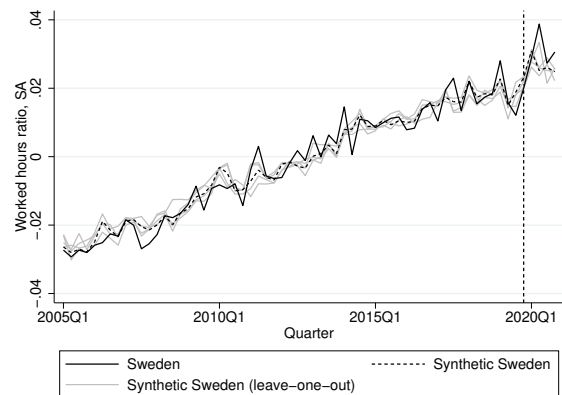


Figure 18: Leave-one-out distribution of the Synthetic control for Sweden for worked hours ratio



7 Discussion

In this paper, we investigate the effects of the Swedish strategy to not impose a lockdown in response to the Covid-19 pandemic on gender-specific labor market outcomes. This is done by firstly analyzing how the pandemic recession has affected women in relation to men regarding employment and weekly hours worked in Sweden. Thereafter, we use the synthetic control method to construct a synthetic Sweden, i.e. an estimate of a hypothetical Sweden

that did impose a lockdown. We create a synthetic Sweden for two different labor market outcomes: one as an estimated counterfactual for the female relative employment rate in Sweden and the other as an estimated counterfactual for the female relative weekly hours worked in Sweden. Comparing the labor market outcomes in these two synthetic Sweden with those of the actual Sweden, we estimate the effect of Sweden not imposing a lockdown on female relative employment rate and weekly hours worked.

Analyzing how Swedish relative female employment and weekly hours worked has been affected by the pandemic, our results find evidence for a shecession during the second quarter of the pandemic when looking at the relative employment rate. This means that female employment decreased more than male employment during this quarter. This can be due to a relative decline in female labor demand or a relative decline in female labor supply at the extensive margin. Nonetheless, this shecession seems to have been transitory and have passed already during the third quarter of 2020. Regarding the average weekly hours worked, we find no evidence for a shecession.

Evaluating the short-run effect of Sweden not imposing lockdown on relative female employment and weekly hours worked, we find that relative female employment would have been higher if Sweden had imposed lockdown while relative female weekly hours worked would have been lower. Hence, not imposing lockdown in Sweden has had a negative effect on female relative employment, but a positive effect on female relative weekly hours worked.

The synthetic results for the employment ratio indicate that relative female labor demand has declined more in Sweden than if a lockdown would have been imposed. This could be due to furlough support not being beneficial for women in relation to men or women increasing their labor supply at the extensive margin when their husbands get unemployed. Regarding relative female labor supply, we find no evidence that women would have decreased their labor supply at the extensive margin, due to an even larger increased child care need, if Sweden had imposed a lockdown. However, our results suggest that the relative female labor supply at the intensive margin would have been negatively affected by a lockdown. This result suggests that women in Sweden would meet the additional child care needs, coming with the closing of schools and daycare centers, by decreasing their hours worked and not by leaving the labor force. This effect might be due to women choosing to use the possibility of working part time in order to combine the responsibility for the family with employment. This analysis might indicate that the decrease in relative female employment rate in Sweden during the first two quarters of the pandemic was driven by a decrease in relative female labor demand, female-dominated sectors being hit harder than male-dominated sectors by the pandemic recession, and not by an increased child care need.

However, even though the absolute values for the labor market outcomes are known for Sweden, we do not observe the absolute values in synthetic Sweden. Since we look at the relative female employment and hours worked we can therefore only draw conclusions on how women are affected in relation to men and not on the direction of the absolute gender-specific effects. The increased relative female employment rate we estimate for Sweden if a lockdown would have taken place might therefore be a result of an additional decrease in employment for men rather than women being in a more advantageous position. Furthermore, the same reasoning can be applied to relative hours worked. The negative effect on relative female hours worked of a lockdown, might be caused by an increase in male hours worked and not a decrease in female hours worked. To be able to confirm the absolute effect further research is therefore needed.

Our results are policy relevant, examining possible labor market effects for women and men in Sweden that would be important to take into account when deciding on introducing a lockdown or not. Choosing to close down schools and other child care facilities in Sweden, comes with negative consequences for women due to the additional child care needs within the household. Our result suggests that women respond to such closures by decreasing their labor supply at the intensive margin, decreasing their hours worked. In addition, this study has found indications for the Swedish furlough program not being beneficial for women in relation to men. This highlights the need for an increased awareness of how women and men are favored differently by the economic policies implemented to reduce the negative economic consequences of the pandemic. It is important to underline that the estimated control unit shows how Swedish labor market outcomes would have responded to a lockdown, implying that external validity is low. The results and the policy implications can therefore not be extended to another country's labor market without adjustments. It can however give an indication of the gender-specific labor market effects that needs to be taken into account when designing policies concerning containment measures.

Given limitations to internal validity, our result should be interpreted with caution. To obtain more solid results, the trends for the gender-specific labor market outcomes for synthetic Sweden should follow the trend for Sweden more closely in the prepandemic period. In particular, the matching of the employment ratio can be questioned since the trend for synthetic Sweden deviates to some extent from the Swedish trajectory. There is thus a risk that the estimated treatment effect differs from the causal treatment effect. Furthermore, the estimated treatment effects for both the employment ratio and the worked hours ratio are small. This increases the risk of misleading results and that the causal treatment effect has a different direction than estimated. However, the in-time placebo test and the leave-one-out robustness test performed indicate valid synthetic results. Moreover, the pandemic is still

on-going and long-run effects are not yet apparent. Therefore, it is possible that the effect on gender-specific labor market outcomes will emerge in the years to come. This points to the importance of continuous evaluation in this area.

Another possible threat to the internal validity of the study is the heterogeneity in government responses across countries. Even though all countries in the donor pool are considered as untreated, having imposed lockdown, they differ in degree, timing and persistence of containment measures, as discussed in relation to the in-space placebo test. In addition, even though Sweden did not implement a lockdown, the government introduced strict recommendations that made Swedish citizens decrease their mobility patterns substantially. Therefore, it is possible that Sweden to some extent could be seen as untreated. Furthermore, the countries in the donor pool might differ in economic measures taken to hamper the effects of the pandemic on the economy and the labor market. These heterogeneities regarding degree of being untreated or treated and the differences in economic measures impose a risk of biased results.

Following up our study, research on absolute changes in labor market outcomes for men and women in case of a lockdown in Sweden would be needed in order to validate the conclusions about the reasons behind the changes in relative female employment and hours worked found in this paper. Moreover, the policy implication of our results advocate for the importance of continuing research on the effect of school closures on female labor supply. Furthermore, continued research is important to understand the potentially different effects of the furlough support on men and women and the reasons behind lockdown being beneficial for women regarding relative female employment. Decomposing the effects of a lockdown on relative female employment rate into changes in unemployment and labor force participation, would make it possible to detect whether the effect is caused by changes in relative female labor demand or relative female labor supply at the extensive margin. In addition, future research is needed regarding the gender-specific labor market outcomes in the medium and long run.

Finally, this study finds important evidence of women decreasing their labor supply at the intensive margin if a lockdown would have been imposed in Sweden, while female employment in relative terms would have benefited from a lockdown. These findings are relevant for policy makers to understand the gender-specific implications of closing down society and in designing economic measures to hamper the consequences of a lockdown. This paper creates a base for future research on how the pandemic recession has affected men and women in the labor market.

8 References

- Abadie, A. & Gardeazabal, J. (2003). The economic costs of conflict: a case study of the Basque country, *American Economic Review*, vol. 93, no.1, pp.113–132
- Abadie, A., Diamond, A., Hainmueller, J. (2010). Synthetic Control Methods for Comparative Case Studies: Estimation the Effect of California’s tobacco Control program, *Journal of the American Statistical Association*, vol.105, no. 490, pp.493-505
- Abadie, A., Diamond, A. and Hainmueller, J. (2015). Comparative politics and the synthetic control method, *American Journal of Political Science*, vol. 59, no.2, pp.495–510
- Andersson, J. J. (2019). Carbon taxes and CO 2 emissions: Sweden as a case study. *American Economic Journal: Economic Policy*, vol.11, no.4, pp.1-30
- Angrist, D. J., Pischke, J. (2009). Mostly harmless econometrics: an empiricist’s companion, Princeton and Oxford: Princeton University Press
- Albanesi, S., Kim, J. (2021). The Gendered Impact of the COVID-19 Recession on the US Labor Market, *NBER Working Papers*, No. 28505, Available online: <http://www.nber.org/papers/w28505> [Accessed 18 May 2021]
- Albanesi, S., Sahin, A. (2018). The Gender Unemployment Gap, *NBER Working paper*, no.23743, Available online: <https://www.nber.org/papers/w23743> [Accessed 18 May 2021]
- Alon, T., Doepke, M., Olmstead-Rumsey, J., Tertilt, M. (2020). The Impact of COVID-19 on Gender Equality, *NBER Working Paper*, no. 26947, Available online: <https://www.nber.org/papers/w26947> [Accessed 18 May 2021]
- Alon, T., Coskun, S., Doepke, M., Koll, D., Tertilt, M. (2021). From Mancession to Shecession: Women’s Employment in Regular and Pandemic Recessions, *IZA Discussion Paper*, no.14223.
- Bluedorn, J., Caselli, F., Hansen, N., Shibata, I., Tavares, M.M. (2021). Gender and employment in the COVID-19 recession: Cross-country evidence on “she-cessions”, *CEPR Covid Economics*, no.76, pp.87-109
- Borjas, J. G. (2020). *Labor Economics*, Eighth Edition, New York: McGraw-Hill Education
- Born B., Dietrich A.M., Müller G.J. (2021). The lockdown effect: A counterfactual for Sweden. *PLoS ONE*, Vol.16, no.4, Available online: <https://doi.org/10.1371/journal.pone.0249732> [Accessed 18 May 2021]
- Campa, P., Roine, J., Strömberg, S. (2021). Inequality in the Pandemic: Evidence from

Sweden, Stockholm Institute of Transition Economics. Available online: <https://www.hhs.se/en/research/institutes/site/News/inequality-in-the-pandemic-evidence-from-sweden/> [Accessed 17 May 2021]

Doepke, M., and Tertilt, M. (2016). Families in Macroeconomics, in J.B.Taylor & H. Uhlig (eds), *Handbook of Macroeconomics*, vol. 2, North Holland, pp.1789-1891

European Centre for Disease Prevention and Control (2020). COVID-19 in children and the role of school settings in transmission - first update. Available online: <https://www.ecdc.europa.eu/en/publications-data/children-and-school-settings-covid-19-transmission> [Accessed 16 May 2021]

Fabrizio, S., Gomez, B.P. D., Tavares, M.M. (2021). The COVID-19 she-cession: The employment penalty of taking care of young children, *CEPR Covid Economics*, vol. 72, pp.136-166

Försäkringskassan. (2020). Barnhushållens ekonomi – resultatindikatorer för den ekonomiska familjepolitiken 2020 [pdf], Available online: <https://www.forsakringskassan.se/wps/wcm/connect/856e730f-8974-42bd-b262-c611ccb61998/barnhushallens-ekonomi\%E2\%80\%93resultatindikatorer-for-den-ekonomiska-familjepolitiken-2020-svar-pa-regeringsuppdrag-dnr-001390-2020.pdf?MOD=AJPERES&CVID=> [Accessed 4 May 2021]

Galasso, V., Foucault, M. (2020). Working during COVID-19: Crosscountry Evidence from Real-time Survey Data. *OECD Social, Employment and Migration Working Papers*, No. 246 Available online: https://www.oecd-ilibrary.org/social-issues-migration-health/working-during-covid-19_34a2c306-en [Accessed 18 May 2021]

Hale, T., Webster, S., Petherick, A., Phillips, T., and Kira, B. (2020). Oxford COVID-19 Government Response Tracker, Blavatnik School of Government, Available online: <https://covidtracker.bsg.ox.ac.uk/> [Accessed 15 April 2021]

Hale, T., Anania, J., Angrist, N., Boby, T., Cameron-Blake, E., Ellen, L., Goldszmidt, R., Hallas, L., Kira, B., Luciano, M., Majumdar, S., Nagesh, R., Petherick, A., Phillips, T., Tatlow, H., Webster, S., Wood, A., Zhang, Y. (2021). Variation in Government Responses to COVID-19, *Blavatnik School of Government Working Paper*, Available online: <https://www.bsg.ox.ac.uk/sites/default/files/2021-03/BSG-WP-2020-032-v11.pdf> [Accessed 15 April 2021]

ILO (2021). Mean weekly hours actually worked per employed person by sex and economic activity - Quarterly, Data [Online], Available online: https://www.ilo.org/shinyapps/bulkexplorer26/?lang=en&segment=indicator&id=HOW_TEMP_SEX_ECO_NB_Q

[Accessed 15 April 2021]

Juranek, S., Paetzold, J., Winner, H., Zoutman, F., (2020). Labor Market Effects of COVID-19 in Sweden and Its Neighbors: Evidence from Novel Administrative Data, CESifo Working Paper, No. 8473, Available online: <https://www.cesifo.org/en/publikationen/2020/working-paper/labor-market-effects-covid-19-sweden-and-its-neighbors-evidence> [Accessed 18 May 2021]

Kleven, H., Landais, C., Posch, J., Steinhauer, A., Zweimüller, J. (2019). Child Penalties across Countries: Evidence and Explanations, *AEA Papers and Proceedings*, vol.109, pp. 122-126

OECD (2021a). Employment rate, Data [Online], Available online: <https://data.oecd.org/emp/employment-rate.htm> [Accessed 15 April 2021]

OECD (2021b). Quarterly National Accounts: GDP per capita, Data [Online], Available online: <https://stats.oecd.org/index.aspx?queryid=66948#> [Accessed 15 April 2021]

OECD (2021c). Unemployment rate (indicator), Data [Online], Available online: https://www.oecd-ilibrary.org/employment/harmonised-unemployment-rate-hur/indicator/english_52570002-en [Accessed 15 April 2021]

OECD (2021d). Family benefits public spending, Data [Online], Available online: https://www.oecd-ilibrary.org/social-issues-migration-health/family-benefits-public-spending/indicator/english_8e8b3273-en [Accessed 15 April 2021]

Public Health Agency of Sweden (2020). FAQ about COVID-19, Available online: https://www.folkhalsomyndigheten.se/the-public-health-agency-of-sweden/communicable-disease-control/covid-19/covid-19-faq/?exp=72835#_7283 [Accessed 7 May 2021]

Stanfors, M. (2007). Mellan arbete och familj – ett dilemma för kvinnor i 1900-talets Sverige, First Edition, Stockholm: SNS förlag

Swedish National Mediation Office (2020). Löneskillnaden mellan kvinnor och män 2019. Vad säger den officiella lönestatistiken? [pdf], Available online: <https://www.mi.se/nyheter/2020/fortsatt-minskning-av-loneskillnaden-mellan-kvinnor-och-man/> [Accessed 18 May 2021]

Swedish National Mediation Office (2021). Avtalsrörelsen och lönebildningen 2020 – Medlingsinstitutets årsrapport [pdf], Available online: https://www.mi.se/app/uploads/AR20_ori_skm.pdf [Accessed 18 May 2021]

World Bank, World Development Indicators (2021a), Population, total. Available online:

<https://databank.worldbank.org/reports.aspx?source=2&series=SP.POP.TOTL> [Accessed 15 April 2021]

World Bank, World Development Indicators (2021b), Urban population (% of total population), Data [Online], Available online: <https://databank.worldbank.org/reports.aspx?source=2&series=SP.URB.TOTL.IN.ZS> [Accessed 15 April 2021]