

The Impact of Maternity Leave on Female Labor Market Performance

A case study of Switzerland's policy change

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Abstract—This paper takes the Switzerland's maternity leave policy change in 2006 as an example to examine the impact of maternity leave length on female labor market performance. To accurately identify the effect of the policy change on labor market performance of females, three dimensions of the labor market are being focused on; namely, gender discrimination, female workers' willingness to work and employment opportunities; as measured with the gender wage gap, the labor force participation rate, the employment-to-population ratio and the unemployment rate. Statistical results of the study, in which Switzerland is taken as experimental group while control group is composed of culturally, geographically and economically similar countries and in which the difference-in-difference (DD) framework along with individual fixed effects in the first stage and the difference-in-difference-in-difference method (DDD) are utilized, demonstrate that increased maternity length leave had negative impact on female workers' willingness to work and reduced their employment opportunities while not significantly changing the gender discrimination.

Keywords—maternity leave, female employment

I. INTRODUCTION

Female workers have been playing an increasingly important role in the labor market contributing huge forces to economy. Gender discrimination with female occupations always existed mainly due to gender stereotypes, differential respect and female family responsibility. OECD or developed regions have adopted further protective policies which are important to improve female employment, such as extending statutory maternity leave, increasing maternity allowance, and providing paternity leave allowance, as well as parental leave for both males and females, etc. It aims to increase the number of female employment and improve the quality of employment, liberates mothers from family care after childbirth, returns to work and improves the involvement of the fathers role in family care.

As early as 1877, Switzerland passed legislation to provide females maternity leave in 8 weeks. After that, European countries generally encouraged childbearing and called for further protection of female basic rights. In Switzerland, the average female employment rate was 59.4% in 2000s, which is

higher than the European Union's. The Swiss employment rate of the mothers with children below age of 6 years has considerably increased to 22% in 2000. Against this background, public policies regulating maternity and employment. Switzerland extended maternity leave to 14 weeks on July 2006 and further to 16 weeks in 2013. In this paper, we focus on the impacts of maternity leave length change on the labor market performance with regard of female workers, the data from 1990 to 2017, and pick the 2006 maternity leave policy change in Switzerland as a case study to quantitatively analyze its impacts on the gender discrimination, employment opportunities that offered to females and female worker's willingness to work. Our differential models allow us to explore the change in maternity leave had an impact on mother labor participation and mimic the policies followed in Switzerland, the gender participation gap and the direct impact of choice on wages. Moreover, with quantitative results estimated by the model, we try to give some voice to the sound theories that explain the hiding mechanisms operate behind maternity policy and encourage the implementation of related government policies that make labor markets efficient or advance sexual equality.

Different from some previous studies, this paper introduces the synthetic control method to fit the reference group with difference-in-difference(DD) model by making suitable assumptions about the situation before and after the policy change, and extend our DD model to difference-in-difference-in-difference(DDD) in which some pre-assumptions are relaxed and the output is more robust. The result of the model operation meets our expectations.

This paper is organized as follows. The second section reviews the related literature. The third section introduces variables. The fourth section focuses on data. The fifth section explains our empirical strategy. Subsequent sections focus on the synthetic control method that we employed and Models and Results and finally reach out our conclusions.

II. LITERATURE REVIEW

At present, the research on the impact of the change of paid maternity leave duration on employment discrimination and employment opportunity and willingness to work is abundant

and mostly conducted with two different methods: theoretical analysis and empirical studies.

In early studies, Ruhm(1996) argued that the theory that statutory maternity leave enable women to share more equal status with men in the workplace thereby reducing the risk of unemployment and discrimination among women, is unreliable.[1] In a fully competitive internal labor market, statutory maternity leave benefits reduce economic benefits by limiting the right of employers and employees to voluntarily choose the optimal leave-remuneration compensation scheme. Even if the cost of benefits exceeds the benefits of doing so, the company is still required to provide maternity leave. As these costs are passed on to employees, the reduction of effective compensation results in a meaningless loss of efficiency. If the company's ability to cut wages is limited (such as the minimum wage), then the loss of layoffs and efficiency may be greater.

Ruhm's comparative static analysis in 1998 proved this point[2]: at a given wage level, statutory benefits increase the total benefit of women born, so women' labor supply curve shifts to the right, labor demand curve shifts to the left. At this time, women' employment rate and wage level have declined. Ruhm offers three explanations. First, in the absence of statutory maternity leave, employers and workers can always voluntarily negotiate maternity leave through the two-way choice of the labor market, thereby reducing unemployment and retaining specific investment. Secondly, due to the fierce labor market competition, women will pay their maternity leave benefits by getting lower wages. Therefore, if maternity leave is mandatory, women of childbearing age will continue to receive lower wages. Thirdly, the benefits of allowing long vacations may lead employers to restrict women to work in relatively low-cost jobs, thereby increasing occupational discrimination.

However, some recent international studies have found that paid maternity leave increases the likelihood of women joining the workforce before giving birth, as well as the pace and probability of returning to work after maternity leave, which leads to the growth of female employment rate. A sample survey of 53 developing countries by Mohammad Amin et al. (2016) [3] showed that in countries requiring maternity leave, the employment of women in private enterprises was significantly higher than in countries do not require maternity leave. A conservative estimate shows that the proportion of female employees associated with compulsory maternity leave has increased by 6.8%. Some studies suggest that this may be because maternity leave promotes women' career continuity and increases the percentage of women returning to work after their vacation. Some other studies suggest that paid maternity leave makes women feel more social care and improves their physical and mental health. Some scholars believe that a reasonable paid maternity leave system means the country's legal system that prevents gender discrimination and pregnancy discrimination is relatively perfect, and the level of feminization in the industry is relatively high. [4][5]

The impact of changes in maternity leave policies based on a particular country on women' employment outcomes is complex. For example, Baker and Miligan(2008) 's research shows that in Canada[6], a modest extension of 17-18 weeks of

maternity leave does reduce the proportion of women leaving their jobs and increase the proportion of women returning to work. However, they did not look at the effect on wages or more specific employment outcomes. Maternity leave has a significantly positive effect on the employment rate of married women, but no significant effect on wages (Gregg et al., 2007)[7]. Natasha(2016)[8] based on the survey data found the opposite result: a longer paid maternity leave will have a negative impact on the employment of women of child-bearing age, with the employment declining by about 2%. Dahl et al[9](2016) based on the results of a series of studies on paid maternity leave extension policies in Norway showed that there was no impact on labor market participation or income. Other studies have looked at the impact of policy changes on the long-term job market. In Germany, while the extension of short-term maternity leave is strong in the short term in delaying women' return to work, in the long term the economic expansion has had little effect on women' labor supply. In addition, women' wages have been cut because of delays in working hours. However, this negative effect is offset by a positive selection effect, leading to zero or even a positive overall effect (Schnberg and Ludsteck 2007).[10] Stearns(2018) studied the impact of extended maternity leave policies on the UK Labor market by using the 'difference in differences' approach.[11] The study found that access to paid maternity leave increased women' chances to return to work in a short term after childbirth, but had no impact on long-term employment. And there was few evidence which meat the policy affects average incomes.

When it comes to the impact of maternity leave length on gender pay equity, current researches generally suggest that relatively short rest days (maternity leave in these discussions) have a little impact on wages, but longer rest days may have a greater positive or negative impact. Women from different sectors and educational background may also be affected differently.

III. DATA & METHODOLOGY

A. Data

The data used in this analysis is derived from the OECD database and LABORSTA statistics. The OECD is known as a statistical agency, as it publishes comparable statistics on wide content of subjects, and an unique feature of this database is that it contains credible data through long time interval with consistent measurements across various subjects and different countries. Whereas LABORSTA is the international leading source of labor statistics, which has a wide range of collected data about the labor market.[12]

All of the four indicators are collected range from 1990 to 2017 with unbalancedness. Gender Wage Gap is collected from LABORSTA where it subjects to all the age groups without differing gender and estimated as a percentage. The other three indicators subject to the 15 to 64 age group are acquired from the OECD database and separately collected with regard of gender. It is worth to mention that 15 to 64 age group is defined as a childbearing group by World Health Organization (OWH) and recognized by OECD as working age group too. Because maternity leave policy only focuses on the females in

this age group, so by narrowing data to them will exclude other factors that may not be affected by the policy change but still happened In Switzerland. Moreover, there is no Gender Wage Gap with respect to age group is available in ILO database, so we assume here that Gender Wage Gap data in some certain extent are subjects to the 15 to 64 age group.

TABLE I. DATA DESCRIPTION(1)

Variable	Sex	Observations	Mean	Std. Dev	Min	Max
GWG	—	68	16.681	5.406	3.3	24.5
WPR	Female	168	63.978	8.342	42.194	79.502
UMR	Male	168	80.066	5.443	71.339	91.137
	Female	168	9.979	6.428	2.6	31.842
EPR	Male	168	7.678	4.513	1.2	25.731
	Female	168	57.914	10.198	31.531	75.4
	Male	168	74.001	7.219	60.082	90

Table I shows the descriptive statistics of each variable by differing gender except Gender Wage Gap. Gender Wage Gap statistics in the first row has 68 observations where all other three indicator consist of 168 observations. Unlike micro-studies accessible with massive observations this study rather have relatively small set of statistics. however, one advantage of our Difference-in-Difference model is that it doesn't require large amount of data to achieve solid estimations and with further implementation of the DDD model estimate results are enhanced under the constrains of data unbalancedness. Other descriptive statistics also presented in Table I which includes Mean, standard deviation and minimum and maximum of the every indicators.

B. Variables

In this paper, we focus on the impacts of maternity leave length change on the labor market with regard of female workers and pick the 2006 maternity leave policy change in Switzerland as a case study to quantitatively analyze its impacts on gender discrimination and female worker's willingness to work and employment opportunities that offered to females. So exploring adequate indicators to measure those three labor market elements is significant for sound conclusions. Based on second version of the ILO Manual on Decent Work Indicators published by ILO in 2013 and other indicator concepts, we adopt Gender Wage Gap to measure gender discrimination in labor market and Labor Participation Rate which refers to worker's willingness to work and with Unemployment Rate and Female Employment-To-Population Ratio to indicate female employment opportunity in labor market. Precise definitions are extracted from OECD Statistics and Manual on Decent Work Indicators (see ILO,2013) and are presented as below:

· **Gender Wage Gap:** The gender wage gap is defined as the difference between the median earnings of men and women relative to median earnings of men. Data refer to full-time employees on the one hand and to the self-employed on the other.

· **Labor Participation Rate:** The labor force participation rates are calculated as the labor force divided by the total working-age population. The working age population refers to people aged 15 to 64. This indicator is broken down by age group and it is measured as a percentage of each age group.

· **Unemployment Rate:** the Unemployment rate is the number of unemployed people as a percentage of the labor force.

· **Employment-To-Population Ratio:** For a given component group of the working age population, the EPR is the percentage of this group that is employed.

For the sake of convenience for expression, the abbreviations of these indicators are employed and presented in Table II.t)

TABLE II. VARIABLES AND ABBREVIATIONS

Variables	
GWG	Gender Wage Gap
WPR	Labor Participation Rate
UMR	Unemployment Rate
EPR	Employment-To-Population Ratio

^a Note:(1)OECD (2019), Gender wage gap (indicator). doi: 10.1787/7cee77aa-en (Accessed on 03 March 2019) (2)OECD (2019), Labour force participation rate (indicator). doi: 10.1787/8a801325-en (Accessed on 03 March 2019) (3)OECD (2019), Unemployment rate (indicator). doi: 10.1787/997c8750-en (Accessed on 03 March 2019) (4)Decent work indicators : guidelines for producers and users of statistical and legal framework indicators: ILO manual: second version / International Labour Office. - Geneva: ILO, 2013

C. Methodology

The subsequent analysis is carried out by difference-in-difference (DD) framework and later extended to difference-in-difference-in-difference (DDD).[13] These two techniques require two subsets of groups for comparison—an experimental group which suffers policy change and the control group which doesn't. Usually, scholars tend to choose a neighboring country as a control group that shares similar economic and geographic and cultural elements. However, for the purpose of better robustness, we employ the synthetic control method to compose controlled Switzerland which didn't experience a

policy change in 2006. It requires observed covariates unaffected by intervention to estimate and predict the indicators that are used to measure the four dimensions in the labor market with respect to female workers which we mentioned earlier. Therefore, we collected Median Wage with logarithmic value, GDP Growth, Trade Union Density and Labor Compensation Growth Rate and Inflation these five statistics from policy unchanged countries around Switzerland to proceed. Under the unbalancedness of the data, only limited countries with time constraints are putted into the donor pool which consists of Austria, Belgium, France, Germany, Luxembourg, Spain, Netherlands. GWG is highly unbalanced, Switzerland's statistics is collected in once a two years bases from 1999 to 2016 whereas the value from other periods are null. By taking average between adjacent years we are able to avoid the regression problem (Synthetic Control Method requires strongly balanced data). [14] Moreover, balanced data is available from Austria and Belgium and Germany from 1991 to 2007 so for GWG. Trade Union Density and Labor Compensation Growth Rate and Median Wage are weakly balanced, to avoid technical difficulties averaged value of adjacent years are employed respectively from 1990 and 1996 and 1991 to the year treatment starts. By adopting backward fitting method we eliminated some possible side-effects that potentially undermine the credibility of the result and more details will be given in following sections. Shown as Table III.

TABLE III. DATA DESCRIPTION (2)

Variable	Observations	Mean	Std. Dev	Min	Max
Inflation	168	84.701	13.267	48.703	104.142
GDP Growth Rate	168	1.839	1.797	-5.6	5.3
Trade Union Density	158	24.045	14.821	7.794	56.362
Labor Compensation Growth Rate	131	2.291	1.678	-1.521	9.565
Median Wage	168	37,735.92	19,149.71	11,775	87,760.98

^b Note:(1)OECD (2019), Inflation (CPI) (indicator). doi: 10.1787/eee82e6e-en (Accessed on 10 March 2019) (2)OECD (2019), Gross domestic product (GDP) (indicator). doi: 10.1787/dc2f7aee-en (Accessed on 10 March 2019) (3)OECD (2019), "Trade Unions: Trade union density", OECD Employment and Labour Market Statistics (database), <https://doi.org/10.1787/data-00371-en> (accessed on 09 March 2019). (4)OECD (2019), Labour compensation per hour worked (indicator). doi: 10.1787/251ec2da-en (Accessed on 10 March 2019) (5)OECD (2019), Average wages (indicator). doi: 10.1787/cc3e1387-en (Accessed on 10 March 2019)

Most and foremost, we believe that Switzerland's maternity leave policy change in 2006 did not immediately have any impact on female labor market performance because certain policies always need at least one or two year to realize itself

(we can't expect people suddenly change their mind especially the business sector alter their practices right after the policy change, it always takes some time to see the actual effect). So we chose the 2007 at the starting point when labor market fully absorbed policy adjustment and it is reflected into statistics.

Data unbalancedness puts a strict constraint on our results but we still believe that by fully incorporate existing data, sound findings would be explored with proper assumptions and models.

IV. EMPIRICAL STRATEGY

To identify the effect of maternity leave policies on employment performance, we employ a difference-in-difference (DD) framework with individual fixed effects in the first stage and for the sake of better robustness we extend our DD model to difference-in-difference-in-difference (DDD) in which some pre-assumptions are relaxed and output is more accountable. The experimental group is Switzerland whereas the control group is composed with synthetic control method under backward fitting regression by taking culturally and geographically and economically similar countries into donor pool.

V. REFERENCE GROUP

Comparing the gender wage gap, employment rate, unemployment rate and labor participation rate between Sweden and the reference countries during the whole period (1990-2016), the result would not only reflect the impact of extended paid maternity leave but also blend with other differences. Therefore, we proceeded with synthetic control method to study the maternity leave policy change in Switzerland by comparing the outcome with that of synthetic control. Since the second policy change (from 14 weeks to 16 weeks in 2013) has less impact on employment status and employment discrimination, this paper exclusively focuses on the extended paid maternity leave policy in 2006 while ignoring the minor change in 2013 as presented in Table IV. It proceeded with incorporating four years of statistics between 2013 to 2017 under 16 weeks of maternity leave policy into maternity leave policy with 14 weeks. By doing so we assume that there is no significant impact when maternity leave length changes from 14 weeks to 16 weeks. We may suffer inaccuracy to a certain extent but we see this assumption makes analyzing method feasible. The first step to generate synthetic control is to identify predictors of the outcome variable. Those predictors should be immune from the maternity leave policy change happened in 2006 in Switzerland and correlated with predictors. Median Wage with logarithmic value, GDP Growth, Trade Union Density and Labor Compensation Growth Rate and Inflation these five indicators are selected, but under the constraint of unbalancedness as we mentioned earlier, particular time range over which the predictors will be average prior to treatment starts is assigned as we discussed in section 2.

The second step is to identify possible donor states to synthesize the control state. We cautiously excluded states that are either culturally or geographically far from Switzerland and particularly had a look on the consistency of the maternity

leave policy make sure that the states selected into donor pool have consist maternity leave length throughout the period and didn't deviate from each other out of three weeks as presented in Table IV. Moreover, unbalancedness as a major constraint is considered when we choose states. Austria and Belgium and Germany are selected for GWG while Belgium, France, Germany, Spain, Netherlands these five countries are included into donor pool for EPR and UMR and WPR. The wights that are given to countries in the donor pool are present in Table Valong with members of the donor pool. In the second column of Table V, it shows every country is attributed with certain weight as Austria is 1 while other countries are 0 in term of Gender Wage Gap Which means Austria's Gender Wage gap data is used as reference. In column four, Male Work Participation Rate is predicted by weighting Belgium as 0.239 and Netherlands as 0.761.

One thing should be the highlight here is that due to the limitation of actual event and donor countries maternity leave policy, we adopt a different fitting method from the general synthetic control method: use the data after 14 weeks of maternity leave (2007-2016) as the reference set. It means that setting the year before 2007 as an experimental period whereas after 2007 as a control group. The reason why we do this is crystal clear, by observing the Table IV, we can easily find that after 2006 Switzerland has similar maternity length compare with donor pool member countries but before 2006 there was a huge difference as much as 8 weeks, and as we mentioned earlier in section 4, an assumption is made that we chose 2007 as starting point when labor market fully adjusted according to the new policy and the adjustments are reflected in statistics.

The third step is to choose a method for selecting predictor weights. We employed a data-driven regression-based method to obtain the optimal variable weights. This method relies on a constrained quadratic programming routine, that finds the best fitting W-weights conditional on the regression-based V-matrix. This procedure is fast and often yields satisfactory results in term of minimizing the MSPE, and the results are presented in Table V. We also did robustness check by running the previous method optimization three times using three different starting points.

And at the end, we have to evaluate pretreatment period goodness-of-fit of the synthetic control state. The Root Mean Squared Prediction Error (RMSPE) of all the synthetic indicators are displayed in the last row of Table V and outcome path of synthetic control during the pretreatment period follows that of the treated state is presented in Fig. 1 to Fig. 7. We found that RMSPE results are relatively small compared with variable values. For example, male's WPR has highest RMSPE result which equals 6.294 but the actual value of this variable ranges from 71 to 92 which means prediction error is acceptable.

Falsified inspection is proceeded, after calculating the weight of each country's data, we picked the country with the most weight and assumed that the country experienced the same change in maternity leave length policy. Then we made

the prediction upon those variables and the results are present in Fig .8 to Fig .14.

Overall, our synthetic data is satisfactory besides data unbalancedness which imposed huge constraints.

VI. MODELS AND RESULTS

(1)DD

In the basic setting, outcomes are observed for two groups for two time periods. One of the groups is exposed to a treatment in the second period but not in the first period. The second group is not exposed to the treatment during either period. We use the composite control method to obtain the predicted values of Gender Wage Gap, Employment-To-Population Ratio, Unemployment Rate and Labor Participation Rate as a control group which didn't experience maternity leave policy change. meanwhile, we already acquired control groups data which is actual Switzerland's data through this period.

The Difference-In-Difference model is presented as the blow, in which A represents the Non-Experimental Switzerland and B the Experimental Switzerland (the real Switzerland), 1 represents pretreatment period whereas 2 is the treatment period:

$$y_{it} = \beta_0 + \beta_1 dB + \delta_0 d2 + \delta_1 d2 \cdot dB + u$$

y_{it} performs linear regression on, dB, d2 and dB· d2. These three regressors are dummy variables that dB captures possible differences between the Experimental Switzerland and Non-Experimental Switzerland prior to the policy change. d2 captures aggregate factors that would cause changes in y over time even in the absence of a policy change.

The Difference-In-Difference (DD) estimates is:

$$\hat{\delta}_1 = (\bar{y}_{B,2} - \bar{y}_{B,1}) - (\bar{y}_{A,2} - \bar{y}_{A,1})$$

The parameter coefficient of dB· d2 estimates the impact of the maternity leave policy change on the dependent variable. By subtracting the Non-Experimental Switzerland 's dependent variable deviation before and after the policy change from the Experimental Switzerland's deviation. We acquire the policy impact on the dependent variable.

It is worth the mention that in the Switzerland case, the treatment period is pre-2007 period when maternity leave length set as 8 weeks, while post-2007 period set as pretreatment period. By doing this we keep the policy consistent between Switzerland and other donor countries and eliminate possible misconduct.

The parameter estimate results subject to the four indicators are present in Table VI:

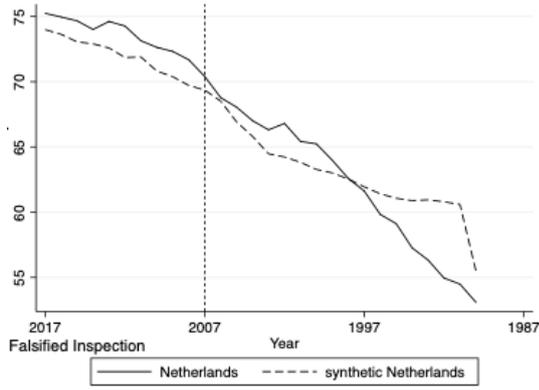


Fig. 1. Female Labor Participation Rate

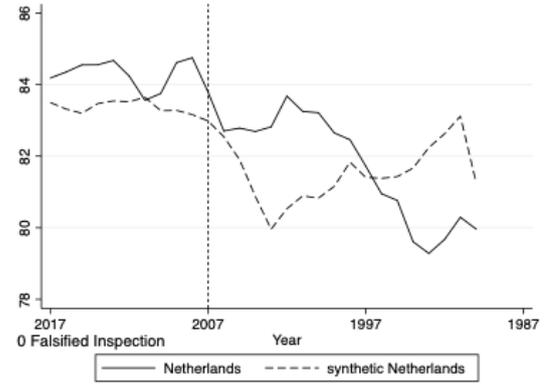


Fig. 2. Male Labor Participation Rate

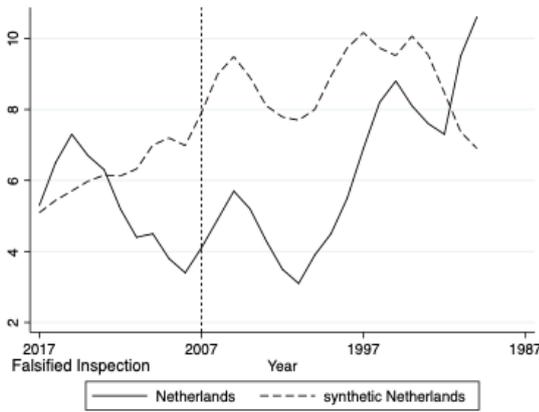


Fig. 3. Female Unemployment Rate

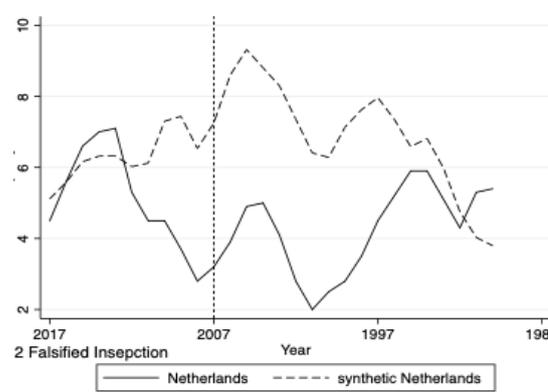


Fig. 4. Male Unemployment Rate

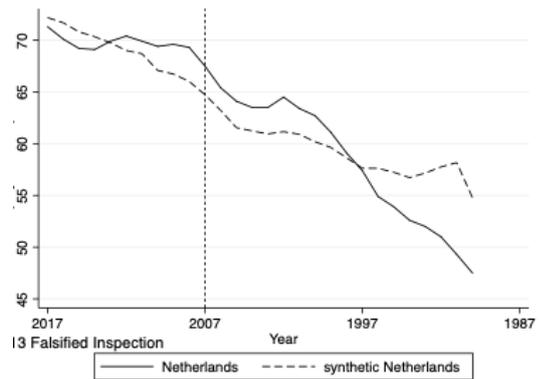


Fig. 5. Female Employment To Population Ratio

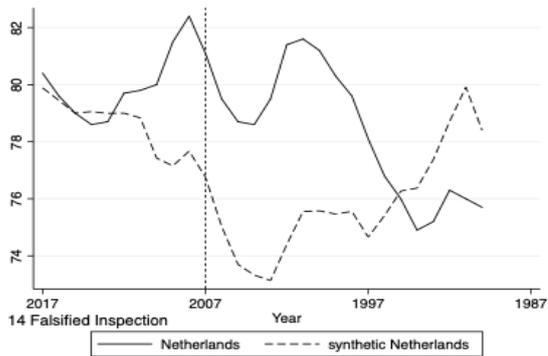


Fig. 6. Male Employment To Population Ratio

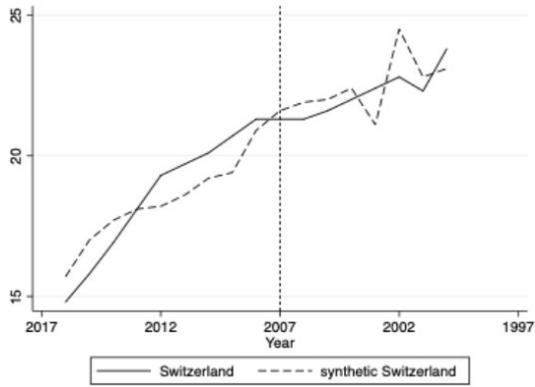


Fig. 7. Gender Wage Gap

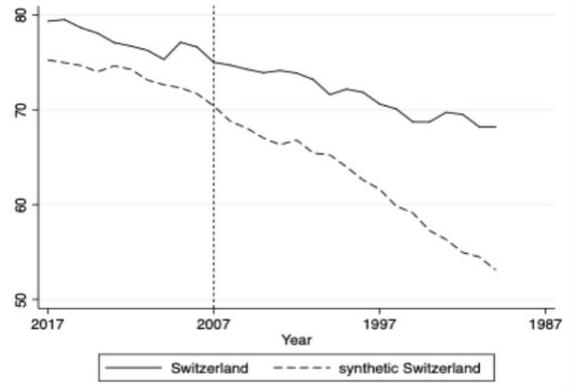


Fig. 8. Female Labor Participation Rate

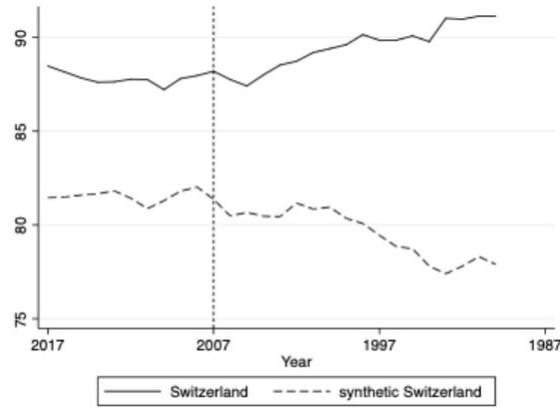


Fig. 9. Male Labor Participation Rate

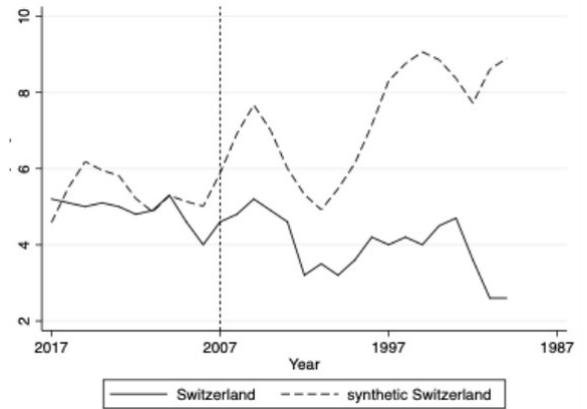


Fig. 10. Female Unemployment Rate

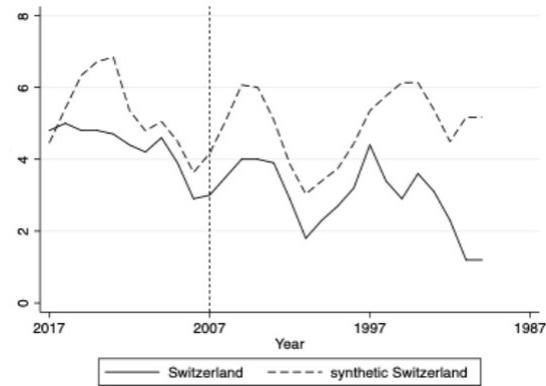


Fig. 11. Male Unemployment Rate

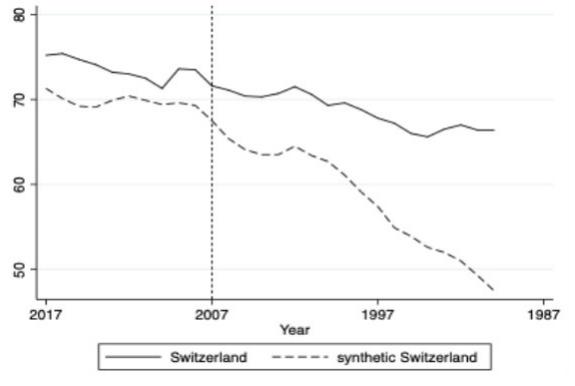


Fig. 12. Female Employment To Population Ratio

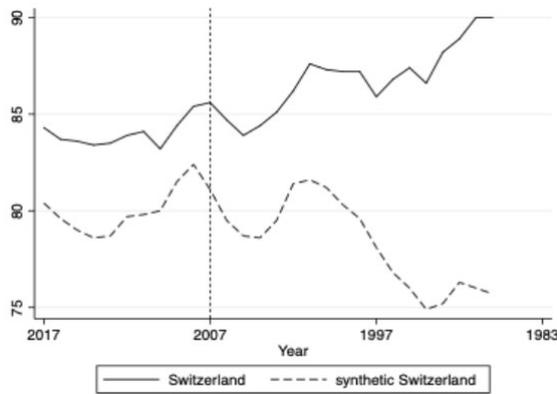


Fig. 13. Male Employment To Population Ratio

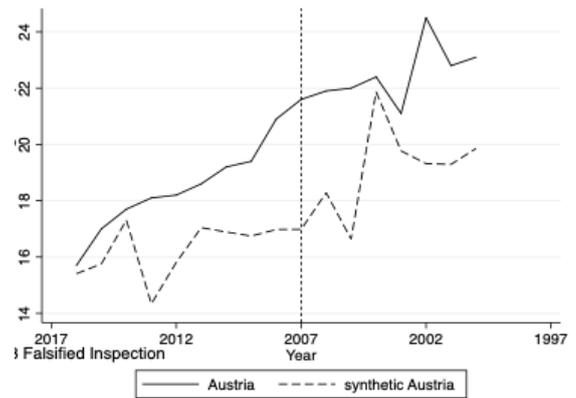


Fig. 14. Gender Wage Gap

In the first row of the Table VI, the After Policy Change means after the policy change in 2006 and Time Difference For State estimates captures aggregate factors that would cause changes in dependent variable over time even in the absence of a policy change in Experimental and Non-Experimental Switzerland. State Difference At a Point In Time captures possible differences between the Experimental Switzerland and Non-Experimental Switzerland prior and after to the policy change. Number of observations subject to each DD result are given under the name of every indicators along with goodness-of-fit.

As in Table VI presents, Gender Wage Gap statistically insignificant but its sign supports some claims that lowering maternity leave would reduce labor hiring cost so that promotes gender equality, meanwhile estimates of Time Difference For State is -3.514 for Experimental Switzerland and -3.903 for projected Switzerland in 0.01 significance level which manifests in the absence of policy change the overall Gender Wage Gap is significantly decreasing over time. Policy change happened in 2006 decreased female Labor Participation Rate by 5.968% in 0.01 significant level which means that with the introduction of the new maternity leave policy fewer woman wanted to enter the labor market and the overall willingness decreased by 5.968%. Moreover, The estimates results of Time Difference For State are both statistically and economically significant suggest that exterior factors that are excluded from our analysis are pushing female willingness to work higher. Female Unemployment Rate increased 2.781% while Employment-To-Population Ratio decreased 6.826% in 0.01 level which suggests that the employment opportunity of Swiss women was compressed significantly due to the change of maternity leave duration in 2006.

Beside Gender Wage Gap's statically insignificance all the other results fit with our expectations, and statistically and economically significance give more credibility to our findings. However, one shortcoming of DD approach is that it can not eliminate the domestic movements that affect individuals without differentiating the sexual orientation, especially this shortcoming would be magnified with the implementation of new policies that differ across treatment and control group even if they initially similar. So we employed one extension of the DD approach which is Difference-In-Difference-In-Difference (DDD).

(2)DDD

We further expand the different-in-different model by adding Swiss men' relevant labor market data to construct the different-in-different-in-different model. Compare with DD the different-in-different-in-different model is more relaxed in terms of constraints and has improved robustness. In addition, under the different-in-different-in-different model, we added men' actual Employment-To-Population Ratio, Labor Participation Rate, Unemployment Rate into Experimental Switzerland while added data composed with synthetic control method into Non-Experimental Switzerland.

Let dE be a dummy equal to one if subjected to female and dB be the dummy for Experimental Switzerland and 2 represents treatment period. The equation formed as below:

$$y_{i2} = \beta_0 + \beta_1 dB + \beta_2 dE + \beta_3 dB \cdot dE + \delta_0 d2 + \delta_1 d2 \cdot dB + \delta_2 d2 \cdot dE + \delta_3 d2 \cdot dB \cdot dE + u$$

The OLS estimate $\hat{\delta}_3$ is

$$\hat{\delta}_3 = \left[\left(\bar{y}_{B,E,2} - \bar{y}_{B,E,1} \right) - \left(\bar{y}_{B,N,2} - \bar{y}_{B,N,1} \right) \right] - \left[\left(\bar{y}_{A,E,2} - \bar{y}_{A,E,1} \right) - \left(\bar{y}_{A,N,2} - \bar{y}_{A,N,1} \right) \right]$$

The parameter coefficient of $dB \cdot d2 \cdot dE$ estimates the impact of the maternity policy change on the dependent variable by subtracting the Non-Experimental Switzerland's dependent variable deviation before and after the policy change from Experimental Switzerland's with regards of gender. The male in the country wouldn't be effected by the new policy, by adding male into the consideration we can successfully subtract the hiding impact of the new policies published after 2006.

The parameter estimate results subject to these three indicators are presented in Table VII VIII IX with domestic movements excluded estimates highlighted in DDD column.

TABLE IV. MATERNITY LEAVE LENGTH (WEEKS)

Time	Austria	Belgium	France	Germany	Netherlands	Spain	Switzerland
1990	16	14	16	14	16	16	8
1991	16	15	16	14	16	16	8
1992	16	15	16	14	16	16	8
1993	16	15	16	14	16	16	8
1994	16	15	16	14	16	16	8
1995	16	15	16	14	16	16	8
1996	16	15	16	14	16	16	8
1997	16	15	16	14	16	16	8
1998	16	15	16	14	16	16	8
1999	16	15	16	14	16	16	8
2000	16	15	16	14	16	16	8
2001	16	15	16	14	16	16	8
2002	16	15	16	14	16	16	8
2003	16	15	16	14	16	16	8
2004	16	15	16	14	16	16	8
2005	16	15	16	14	16	16	8
2006	16	15	16	14	16	16	14
2007	16	15	16	14	16	16	14
2008	16	15	16	14	16	16	14
2009	16	15	16	14	16	16	14
2010	16	15	16	14	16	16	14
2011	16	15	16	14	16	16	14
2012	16	15	16	14	16	16	14
2013	16	15	16	14	16	16	16
2014	16	15	16	14	16	16	16
2015	16	15	16	14	16	16	16
2016	16	15	16	14	16	16	16

TABLE V. SYNTHETIC CONTROL METHOD

Indicator:	GWG	WPR		UMR		EPR	
		Female	Male	Female	Male	Female	Male
Austria	1						
Belgium			0.239				
France							
<u>Germany</u>				0.371			
Netherlands		1	0.761	0.629	1	1	1
Spain							
RMSPE	0.941	3.818	6.294	0.693	4.038	4.003	4.038

TABLE VI. DD RESULT

	After Policy Change	Before Policy Change	Time Difference For state
Gender Wage Gap			
Experimental Switzerland	18.8	22.314	-3.514
Non-Experimental Switzerland	18.64	22.543	-3.903*** (0.688)
State Difference At a Point In Time	0.160 (0.779)	-0.229 (1.055)	
Difference-In-Difference		0.389 (1.184)	
Number of observations in the DIFF-IN-DIFF:33			
		After	Before
R-square: 0.57	Treated	10	7
	Control	10	7
Labor Participation Rate			
Experimental Switzerland	77.24	71.547	-5.693

	After Policy Change	Before Policy Change	Time Difference For state
Non-Experimental Switzerland	73.451	61.817	-11.634*** (1.550)
State Difference At a Point In Time	3.789*** (1.401)	9.73*** (1.144)	
Difference-In-Difference		-5.968*** (1.809)	
Number of observations in the DIFF-IN-DIFF:55			
R-square:0.77		After	Before
	Treated	11	17
	Control	11	17
	After Policy Change	Before Policy Change	Time Difference For state
Unemployment Rate			
Experimental Switzerland	4.873	4.05	-0.823
Non-Experimental Switzerland	5.402	7.36	-1.958*** (0.403)
State Difference At a Point In Time	-0.530 (0.388)	-3.310*** (0.317)	
Difference-In-Difference		2.781*** (0.501)	
Number of observations in the DIFF-IN-DIFF:55			
R-square:0.70		After	Before
	Treated	11	17
	Control	11	17
Employment-To-Population Ratio			
Experimental Switzerland	73.464	68.675	-4.789
Non-Experimental Switzerland	69.609	57.994	11.615*** (1.502)
State Difference At a Point In Time	3.855** (1.547)	10.681*** (1.261)	
Difference-In-Difference		-6.826*** (1.998)	
Number of observations in the DIFF-IN-DIFF:55			
R-square:0.74		After	Before
	Treated	11	17
	Control	11	17

*** p<0.01; ** p<0.05; * p<0.1

Note: Due to the limitation of software part of variable's standard deviation and significance level can not be presented.

TABLE VII. DDD RESULT OF WPR

	After Policy Change	Before Policy Change	Time Difference For state
FEMALE			
Experimental Switzerland	77.240*** (0.736)	71.574*** (0.610)	-5.666*** (0.956)
Non-Experimental Switzerland	73.451*** (0.736)	61.817*** (0.592)	11.634*** (0.945)
State Difference At a Point In Time	3.789*** (1.401)	9.757*** (1.144)	
Difference-In-Difference		-5.968*** (1.809)	
MALE			
Experimental Switzerland	87.855*** (0.736)	89.465*** (0.610)	-1.610*** (0.956)
Non-Experimental Switzerland	84.274*** (0.736)	81.677*** (0.592)	2.597*** (0.945)
State Difference At a Point In Time	3.581*** (0.453)	7.788*** (0.370)	
Difference-In-Difference		-4.207*** (0.585)	
DDD		-1.761	

Number of observations		110	
F-test		219.92	
R-squared		0.9379	
Adj R-squared		0.9336	
Root MSE		2.4419	
*** p<0.01; ** p<0.05; * p<0.1			

^c **Note:** Due to the limitation of software part of variable's standard deviation can not be presented.

TABLE VIII. DDD RESULT OF UMR

	After Policy Change	Before Policy Change	Time Difference For state
FEMALE			
Experimental Switzerland	4.872*** (0.276)	4.050*** (0.229)	-0.822*** (0.358)
Non-Experimental Switzerland	5.402*** (0.276)	7.360*** (0.222)	-1.958*** (0.354)
State Difference At a Point In Time	-0.530 (0.388)	-3.310*** (0.317)	
Difference-In-Difference		2.781*** (0.501)	
MALE			
Experimental Switzerland	4.282*** (0.276)	3.075*** (0.229)	-1.207*** (0.358)
Non-Experimental Switzerland	5.205*** (0.276)	4.959*** (0.222)	0.246 (0.353)
State Difference At a Point In Time	-0.923** (0.392)	-1.884*** (0.321)	
Difference-In-Difference		0.961* (0.507)	
DDD		1.819	
Number of observations		110	
F-test		30.00	
R-squared		0.6731	
Adj R-squared		0.6506	
Root MSE		0.9150	
*** p<0.01; ** p<0.05; * p<0.1			

^d **Note:** Due to the limitation of software part of variable's standard deviation can not be presented.

TABLE IX. DDD RESULT OF EPR

	After Policy Change	Before Policy Change	Time Difference For state
FEMALE			
Experimental Switzerland	73.464*** (0.852)	68.675*** (0.707)	4.789*** (1.107)
Non-Experimental Switzerland	69.609*** (0.852)	57.994*** (0.686)	11.615*** (1.094)
State Difference At a Point In Time	3.855** (1.547)	10.681*** (1.264)	

Difference-In-Difference		-6.826*** (1.998)	
		MALE	
Experimental Switzerland	84.1*** (0.852)	86.713*** (0.707)	-2.613*** (1.107)
Non-Experimental Switzerland	80.073*** (0.852)	78.2*** (0.686)	-1.873*** (1.094)
State Difference At a Point In Time	4.027*** (0.715)	8.513*** (0.584)	
Difference-In-Difference		-4.486*** (0.924)	
DDD		-2.34	
Number of observations		110	
F-test		168.46	
R-squared		0.9204	
Adj R-squared		0.9149	
Root MSE		2.8267	

*** p<0.01; ** p<0.05; * p<0.1

All the results have similar sign and significance with DD estimates, however, the absolute value varied. As those tables present, policy change happened in 2006 decreased female Labor Participation Rate by 5.968% without considering the domestic movement. However, after we added males found that the parameter estimate contrasted to -1.761, domestic movements consumed 4.207% out of 5.968%. Which means with the introduction of the new maternity leave policy fewer females wanted to enter the labor market and the overall willingness decreased by 1.761%. The negative impact on the Female Unemployment Rate decreased from 2.781% to 1.819% while Employment-To-Population Ratio declined 2.34% compared with 6.826% in DD model, this indicates that other domestic policies may partially played a role by reducing Swiss women's employment opportunity after 2006 either.

VII. CONCLUSION

The primary contribution of this paper is to empirically examine the impact of maternity leave length extension in Switzerland on the female labor market performance. Four indicators are proposed to measure three different dimensions, Gender Wage Gap measures gender discrimination and Labor Participation Rate indicates female worker's willingness to work and employment opportunities is measured with Employment-To-Population Ratio as well Unemployment Rate. To identify the effect of maternity leave policies on these indicators, we employ a difference-in-difference (DD) framework with individual fixed effects in the first stage and for the sake of better robustness we extent our DD model to difference-in-difference-in-difference (DDD) in which some pre-assumptions are relaxed and output is more accountable. Experimental group is Switzerland whereas the control group is

^c **Note:** Due to the limitation of software part of variable's standard deviation can not be presented.

composed with synthetic control method under backward fitting technique by taking culturally and geographically and economically similar countries into donor pool rather simply selecting a neighboring country which may have potential differences undermine the credibility of the analysis. The results fit with our expectations that the extension of the maternity leave length in Switzerland did have negative impact by discouraging female willingness to work and reducing employment opportunities. Meanwhile, Gender Wage Gap doesn't have statistical significancy, we think this is mostly due to the insufficiency of the data but its negative sign consists with our expectations which suggests that labor market sexual inequality is enhanced by implementing this policy.

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