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## The effect of reduced unemployment duration on the unemployment rate: a Synthetic Control Approach

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**Abstract.** This paper examines the impact of the fourth partial revision of the law of unemployment insurance (AVIG) on unemployment dynamics in Switzerland at a cantonal level. The authors apply the Synthetic Control Method (SCM), a matching method for comparative case studies. A counterfactual analysis of the cases studied is performed by combining a control group of several untreated units, which provides a better comparison to the treatment group than a single unit. The control unit is designed as a weighted average of the available cantons in the donor pool, taking into account the similarities between the chosen controls and the treated unit. Once policy changes are controlled, the results suggest a significant effect on the unemployment rate at a cantonal level: the reform had a discernible impact on lowering the unemployment rate in the Italian- and French-speaking cantons in Switzerland.

**Keywords.** labour market reforms; unemployment; treatment effects; Synthetic Control Method.

**JEL Codes.** C52; E24; J65

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### 1. Introduction

The present research attempts to contribute to the extensive literature on labour economics and social welfare, studying the effect of a revision of the unemployment law (AVIG) on the return on job of unemployed workers. The focus of the paper is on the fourth partial revision of the law of unemployment insurance in Switzerland in 2011. This law eliminated a previous measure to lengthen the maximum unemployment duration in disadvantaged cantons affected by the economic downturn. What we want to analyse is whether this shorter unemployment duration had an effect on the unemployment rate in Ticino, the most affected of the five cantons subject to the law's revision. The dataset consists of observations on the 26 Swiss cantons, and we analyse the unemployment rate, defined according to the standards of the Swiss State Secretariat for Economic Affairs (SECO)<sup>1</sup>. This standard is valid for the definition of the number of unemployed persons and the computation of the corresponding unemployment rate. Our

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<sup>1</sup> Registered unemployed are defined as persons who are enrolled at the regional placement service (RAV) and are immediately placeable, whether or not they benefit from unemployment compensations. The unemployment rate is calculated as the share of the unemployed divided by the total labour force, collected from the Swiss Federal Statistical Office (FSO) in the annual Structural survey (<https://www.arbeit.swiss/secoalv/de/home/menue/institutionen---medien/statistiken/definitionen.html>).

treated unit is the canton of Ticino, which applied this measure during the pre-treatment period.

Other cantons that partially or entirely applied this optional extension were Geneva, Neuchâtel, Jura and Vaud. Since they experienced the same cut of the measure as the treated canton of Ticino, these four cantons were excluded from the control donor pool; thus, only 21 cantons remained eligible in this pool. Following the considerations of Abadie, Diamond and Hainmueller (2015), the Synthetic Control Method (SCM) was chosen because it works best with a dataset that contains few registrations on an aggregate level that are potential controls and in cases where the impact on the variable takes place on a regional level. Moreover, in a recent paper, Ferman and Pinto (2019) have proven that a modified Synthetic Control (SC) estimator is generally lower biased than the Difference-in-Difference (DiD) estimator. For the study design, we considered seven different scenarios. We included and excluded various predictors and tested the composition of SC, as well as inferences for the post-treatment effects, in a graphic way for each specification. We applied an additional placebo test, following the approach proposed by Abadie, Diamond and Hainmueller (2015) and McClelland and Gault (2017). Our results show that the impact of the law revision led to a reduction in the unemployment rate in Ticino, while the unemployment rate for the SC displayed a similar trend in the years following the pre-treatment period. We can clearly see that the adoption of the law, which reduced the maximum unemployment insurance duration, had a substantial impact on reducing the unemployment rate in Ticino, reaching the lowest value since 1996.

The article is organised as follows. Section 2 reviews the previous works in the literature. Section 3 provides background information on the introduction of the fourth partial revision of the AVIG law and the economic conditions in Switzerland. Section 4 describes the SCM approach in detail from a theoretical point of view. It also describes the model and dataset as well as the seven different specifications applied in this research. Section 5 presents the results of the specifications and the placebo test for Ticino and the remainder of the treated cantons. In Section 6, robustness tests check for the results' validity. Section 7 comments on the results obtained in the canton of Ticino, and finally, Section 8 concludes.

## **2. Literature Review**

In evaluating policy interventions, scientists refer to estimations in comparative case studies with aggregate databases. This implies an examination of a control group with the group of interest. One of the most famous studies with this setup is Card and Krueger (1994), who analysed the impact of minimum wages on employment in the fast-food industry, comparing the treated state of New Jersey to the control state of Pennsylvania. For the part concerning the rule of the maximum length of the beneficiary period of the unemployment insurance on the exit rate from unemployment, Cahuc, Carcillo, and Zylberberg, (2014, p. 296) refer to a number of previous studies that confirm the outcome of their job search model. In particular, Meyer (1990) focuses on the behaviour of the unemployed in the period just before they reach the maximum duration of unemployment and notes an increase in the unemployment exit rate towards its end.

Dormont, Fougère, and Prieto (2001) distinguish by qualification of workers and point out the opportunistic behaviour of higher qualified French workers when leaving unemployment. In the Austrian context, Card, Chetty, and Weber (2007) identify a difference between the exit rate from unemployment and the entry rate of employment, which diverges when reaching the maximum unemployment duration, this is a result of unemployed transiting into other labour market states, as training programs or leaving the active labour force completely. Last, Pellizzari (2006) attributes the scarce impact of policies reducing the unemployment benefit programs generosity on unemployment to the coexistence of other social assistance programmes, which makes recipients react in a less sensitive way on policy changes.

For the analysis of such problem sets, comparative case studies have significant potential, as many introduced policies take place on an aggregate level. Nevertheless, two weaknesses can be identified. First, there is ambiguity surrounding how the comparison groups are chosen. Second, in employing data on an aggregate level, estimating the effect without error is not always possible, as the counterfactual fit of the control group in reproducing the outcome variable might be biased by uncertainty. The idea behind applying a SC is that combining a control group of several untreated units provides a better comparison to the treatment group than a single unit (Abadie, Diamond, & Hainmueller, 2010, p. 493). The clear advantage of constructing a SC to address this kind of problem is that the dataset is composed of few aggregate units, and therefore, a weighted average of all potential comparison units reproduces the characteristics of interest in the best way (Abadie, Diamond, & Hainmueller, 2010, p. 496).

The essential features of the SCM are that the control unit is designed as a weighted average of the available non-treated units and that it takes into account the similarities between the chosen controls and the treated unit. The weighting technique also ensures that the control does not need to be checked for extrapolation problems. A second advantage of the method is that researchers do not have to know the impact on the variable of the treatment ex-ante, but any variable can be chosen to analyse a possible effect of an introduced policy on it (Abadie, Diamond, & Hainmueller, 2010, pp. 493-494).

Comparative case studies have been broadly applied in various fields, such as political science (Tarrow, 2010); labour market effects of migration, as described in Card (1990); and even economic costs of terrorist conflicts in Spain (Abadie & Gardeazabal, 2003). The potential of comparative case studies has grown with the availability of aggregated data. As described in Abadie, Diamond and Hainmueller (2015, p. 500), the SCM applies best in studies with a limited number of untreated, eligible units for the control and in studies on impacts on the aggregate level, such as regions. Furthermore, a well-functioning model requires a sizable number of pre-intervention periods to reach a proper fitting and to ensure that the outcome of interest tracks the same trend as the SCM over a more extensive period.

In the introduction to their paper, Kaul, Klößner, Pfeifer and Schieler (2017) state that the “SCM involves the comparison of outcome variables between a unit representing the case of interest, i.e. a unit affected by the intervention, and otherwise similar but unaffected units reproducing an accurate counterfactual version of the unit of interest in the absence of the

intervention. An algorithm-derived combination of precisely weighted comparison units is supposed to better depict the characteristics of the unit of interest than either any single comparison unit alone or an equally weighted combination of all or several available control units” (p. 2).

The SCM has thus been applied to diverse research topics, rapidly becoming an intuitive alternative for constructing counterfactual units. Athey and Imbens (2017) state that the SCM “is arguably the most important innovation in the policy evaluation literature in the last 15 years” (p. 9). Applications of the SCM in an economic and political contexts include Nannicini and Billmeier (2011) as well as Billmeier and Nannicini (2013) (economic growth), Hosny (2012) (free trade), Jinjarak, Noy and Zheng (2013) (capital inflows), Acemoglu, Johnson, Kermani, Kwak and Mitton (2016) (political connections), Eren and Ozbeklik (2016) (right-to-work laws). Possebom (2017) as well as Gobillon and Magnac (2016), in particular, performed impact evaluations on enterprise zones.

Concerning theoretical contributions to the SC literature, Gardeazabal and Vega-Bayo (2017) find that the SCM estimator performs well in comparison to alternative panel approaches. Klößner and Pfeifer (2017) extend the SCM to the forecasting context, and Klößner, Kaul, Pfeifer and Schieler (2017) provide a critical note on the applied cross-validation technique applied in Abadie, Diamond and Hainmueller (2015). Developments of the SCM include Cavallo et al. (2013) as well as Dube and Zipperer (2015) (pooling multiple synthetic case studies), Li (2017) (modified SCM to estimate ATE), Galiani and Quistorff (2016) (a development of the `synth_runner` package to conduct placebo and inference) and Quistorff (2016) (corresponding instruction on the possible placebo tests). Finally, Firpo and Possebom (2018) analysed sensitivity and confidence intervals for the SCM, while Ferman and Pinto (2019) and Arkhangelsky et al. (2019) considered a demeaned SCM and synthetic DiDs.

### **3. The Institutional Context**

In Switzerland, starting in 2003, the debt of the unemployment insurance system reached a level that demanded control in order for the system to prosper in the future. To address the debt problem, policymakers developed a recovery plan. In 2011, the accumulated debt reached 7.8 billion Swiss Francs. Consequently, the Federal Council raised insurance contributions. Additionally, a solidarity percentage was introduced for medium to high earning workers. These measures were enacted starting in April 2011 and were a part of the fourth partial revision of the AVIG law. The primary purpose was the achievement of the balance of the revenues and expenditures of the insurance and the clearance of the structural debt and was achieved within one year. Later, in the period following the application of the new policy, the accumulated debt was reduced significantly. The austerity measures of the law’s revision foresee a stronger connection of the contribution period to the possible beneficiary period. Additionally, several latencies have been augmented, and numerous individual cases for free treatment of beneficiaries have been reduced. The consequence is that the new measures have had impacts

on various worker segments. Specifically, the expiration of the beneficiary period has been shortened for some profiles of unemployed persons. The policy change raised the expiration rate in the year of application, while in the longer run, the rate converged to a slightly higher level compared to the period before 2011.

The main issue of the revision was to design the revenues and expenditures of the unemployment insurance to achieve a balance, which should be independent of conjuncture. Cost cuts are achieved mainly through the adaptation of the beneficiary system of coverage that reduces beneficiary periods as well as the long wait time for compensation. At its core, the insurance principle is reinforced, and the labour market reintegration measures are designed more efficiently (SECO Staatssekretariat für Wirtschaft, 2013).

One of the main concerns of the debate was the effects on the unemployment rate. The revision could lead to a lower unemployment rate, as a higher share of unemployed persons would leave the workforce and no longer be statistically registered. This reduction in the unemployment rate would be artificial and distorted and not due to an actual improvement in economic conditions in the labour market. However, data show that the exit rate of unemployment did not change between the periods preceding and following the introduction of the new law. The effect of a temporarily higher exit rate from unemployment was inconsistent and observed only in the first months. Even the duration of unemployment did not fall below the level of the preceding years. The duration increased only temporarily, as a momentarily higher concentration of long-term unemployed persons exiting from the labour force was registered (SECO Staatssekretariat für Wirtschaft, 2013, pp. 40-43). No significant differences among workers with different demographic profiles were identified. The only observation to mention is that younger workers were slightly more affected than elderly workers.

From a geographic point of view, the Italian- and French-speaking parts of Switzerland were more strongly affected by the law's revision than the German-speaking part; this was due to the omission of the measure to optionally lengthen the beneficiary period in cases of locally high unemployment rates, which affected those regions in particular. The SECO foresaw that the effects of the law's revision in the short run would reduce the unemployment duration and the unemployment rate marginally. At that time, no significant, long-term impact on these two variables was expected (SECO Staatssekretariat für Wirtschaft, 2013, pp. 5-6).

## **4. Methods and Empirical Framework**

### **4.1. Data and Sample**

Table 1 describes the included variables for Ticino and the cantons that, in the following computation, compose the SC for Ticino. (The complete table for all cantons and variable definitions is reported in Appendix 1).

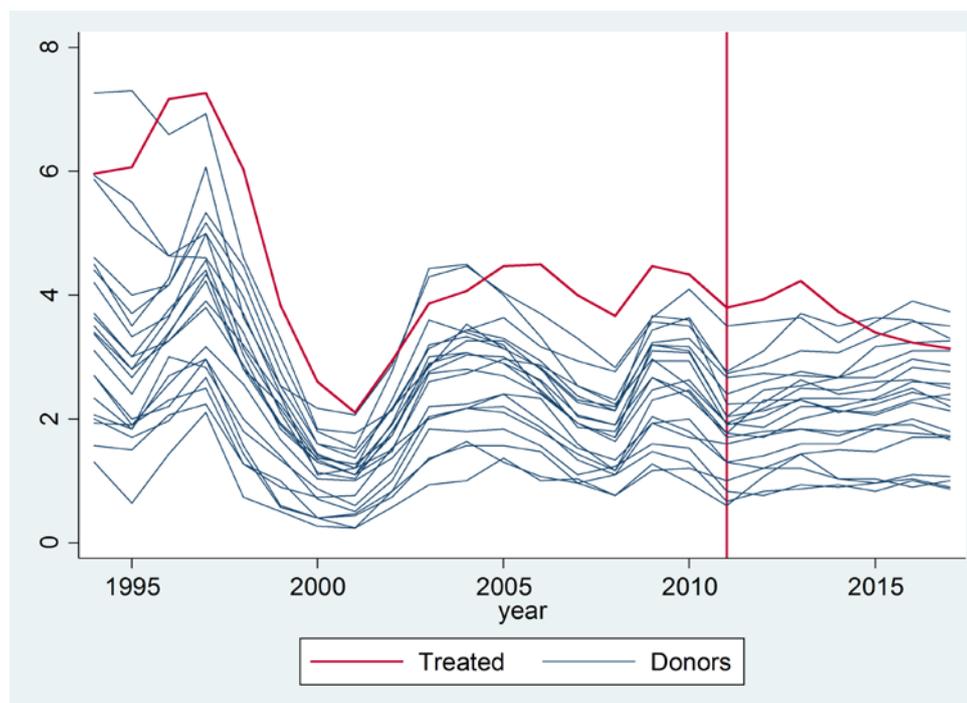
**Table 1.** Descriptive statistics for Ticino and cantons composing the SC for Ticino.

Canton	unit	Unemployment rates				Employment		Social indexes		Education	
		SECO rate	ILO rate	swiss rate	foreign-ers rate	annual growth rate	tertiary sector share quota	assist-ance quota	poverty quota	median taxable income CHF	maturity quota
Basel-Stadt	mean	3.738	4.038	2.814	5.672	0.007	0.718	6.144	11.067	52175	31.571
	sd	0.904	0.585	0.639	1.811	0.013	0.019	0.445	1.316	3022	8.651
Schaffhausen	mean	2.978	3.444	1.993	6.172	0.009	0.680	2.367	5.144	49293	29.512
	sd	0.916	0.498	0.559	2.350	0.012	0.015	0.194	0.340	2819	7.377
Thurgau	mean	2.467	3.444	1.724	4.942	0.009	0.680	1.656	3.144	48495	23.141
	sd	0.740	0.498	0.488	1.769	0.012	0.015	0.124	0.159	3280	7.629
Ticino	<b>mean</b>	<b>4.283</b>	<b>5.869</b>	<b>3.325</b>	<b>6.517</b>	<b>0.014</b>	<b>0.752</b>	<b>2.078</b>	<b>8.833</b>	<b>44508</b>	<b>41.269</b>
	<b>sd</b>	<b>1.328</b>	<b>1.045</b>	<b>0.960</b>	<b>2.141</b>	<b>0.018</b>	<b>0.012</b>	<b>0.273</b>	<b>0.296</b>	<b>4279</b>	<b>7.898</b>
Valais	mean	3.811	6.356	2.800	7.532	0.016	0.809	1.456	3.156	41840	29.296
	sd	1.595	0.979	1.308	2.946	0.014	0.012	0.159	1.063	4166	6.627
Zürich	mean	3.417	4.025	2.514	6.146	0.011	0.830	3.344	5.333	55540	29.130
	sd	0.921	0.512	0.679	1.908	0.019	0.018	0.235	0.458	3766	6.031

To develop the model, a number of data series from different sources were taken into account. In order to control for the seasonality of the data, we chose to take the second quarter of every year as a reference and to compare these quarterly data in the constructed cantonal panel data set. The reason for this choice is that each of the Swiss Cantons has a different seasonality (most of them reaching the annual maximum during winter or summer months) in unemployment, and in fact, it is the second quarter, which fits best in comparing the realities for most of the cantons. The dependent variable is the unemployment rate, which is computed as an average of the three monthly datasets for the second quarter of each year (simple average of April, May and June), in order to be consistent with the remainder of the data. The unemployment rate is determined from data published monthly by the SECO. Furthermore, we included annual tax data from the Federal Tax Administration Office for each of the 26 Swiss cantons as covariates. We also list the quarterly unemployment rate, measured according to the definition of the International Labour Organization (ILO) from the Federal Statistical Office (FSO). Other data refer to employment levels from the Swiss Labour Force Survey (SLFS), education indicators (high school degree quota), social assistance statistics (poverty index, social assistance), job statistics (labour force composition and unemployment structure) and the national account (gross domestic product per canton). All data come from various FSO statistics, on either an annual or quarterly basis.

#### 4.2. Computational Issues: Constructing a Synthetic Control for Ticino

There are several challenges in constructing a SC for this case. In observing the time trends of the unemployment rate of each of the donor cantons and the treated canton of Ticino, the first issue is that the unemployment rates in Ticino were higher than those in the donor pool for most of the years in the pre-treatment period. This is clearly visible in Figure 1.



**Figure 1.** Unemployment rates (SECO) of Ticino (treated) and cantons in the donor pool.

Figure 1 helps us understand that the synthetic version of Ticino, combining different cantons from the donor pool, will not achieve the same high unemployment rate and therefore formulates a constraint to the SCM. In order to achieve a parallel trend for the outcome variable in the pre-treatment period of the synthetic Ticino we need to extend the standard SCM procedure described by Abadie, Diamond and Hainmueller (2015, p. 498), who state that the outcome variable should produce similar trajectories over an extended period. We therefore demeaned the data on unemployment for all units. This SCM extension was proposed by Ferman and Pinto (2019) and helps to reduce the bias and variance of the SCM. Furthermore, as introduced by Doudchenko and Imbens (2016), through the demeaning of the unemployment data we can fulfil the no-intercept rule of SCM, making the treated and control cantons producing a feasible trajectory.

For the further SC computation, we excluded data from the cantons of Geneva, Neuchâtel, Jura and Vaud from the sample, since in the years preceding the AVIG law revision, they applied the option of increasing the unemployment duration by 120 days in situations of high unemployment as well. This step is required for a clear distinction between treated and untreated cantons.

### 4.3. Specification of the Synthetic Control Estimator

We define seven different specifications and linear combinations of the pre-treatment outcome variables to be included in the estimation of the SC. We mainly follow the five specifications proposed by Ferman, Pinto and Possebom (2017, p. 23), adapting them to the context of our research. We add the following variables to the predictors of the original specification:

- (1) Original specification: no pre-treatment outcome values, only predictors
- (2) Pre-treatment outcome mean:  $X_j = [\sum_{t=1}^{T_0} Y_{j,t}/T_0]$ ;
- (3) All pre-treatment outcome values:  $X_j = [Y_{j,1} \dots Y_{j,T_0}]'$ ;
- (4) The first half of the pre-treatment outcome values:  $X_j = [Y_{j,1} \dots Y_{j,T_0/2}]'$ ;
- (5) The first three-fourths of the pre-treatment outcome values:  $X_j = [Y_{j,1} \dots Y_{j,3T_0/4}]'$ ;
- (6) Pre-treatment outcome values of even-numbered years:  $X_j = [Y_{j,1} Y_{j,3} \dots Y_{j,T_0-1}]'$ ;
- (7) Pre-treatment outcome values of odd-numbered years:  $X_j = [Y_{j,2} Y_{j,4} \dots Y_{j,T_0-2}]'$

where  $T_0 = 2011$  and  $Y_{j,1}$  the outcome of the year 1994.

## 5. Results and discussion

Ferman, Pinto and Possebom (2017) recommend testing the composition of SC by considering different scenarios of predictors. In the results summary in Table 2 and the following sections, the results for each of the seven scenarios are listed and compared. Depending on the chosen scenarios, the synthetic version of Ticino is constructed as a mix of the cantons of Valais, Basel-Stadt, Zürich, Schaffhausen and Thurgau. The highest relative importance for the trend is the canton of Valais, whose labour market is similar to the one of Ticino, based on the chosen predictors. In section 6, placebo tests will determine the validity of this composition. For all scenarios, we obtain a rather high post/pre RMSPE ratio (comparing the post- and pre-treatment ratios of the mean squared prediction errors (RMSPE<sup>2</sup>)). This indicates that for each specification, as the treatment was not assigned randomly, at least the same value could have been achieved with a probability of 60% (for the entire post-treatment period). This is unsurprising, as, in this period, the unemployment rate of Ticino continues to rise in the first two years and decreases only later. Only in this second step, its values are closer to the rates of the remainder of the cantons in the donor pool. More importantly for the overall post-treatment period are the p-values<sup>3</sup> of the probability of obtaining the unemployment rate by chance in every single year of the post-treatment period.

<sup>2</sup> (Ferman, Pinto, & Possebom, 2017) follow a proposal of (Abadie, Diamond, & Hainmueller, 2015) who adopt a straightforward placebo test, as a possible inference procedure. Furthermore, they compute the test statistic, computing the RMSPE (ratio of the mean squared prediction errors):  $RMSPE_j := \frac{\sum_{t=T_0+1}^T (Y_{j,t} - \hat{Y}_{j,t}^N)^2 / (T - T_0)}{\sum_{t=1}^{T_0} (Y_{j,t} - \hat{Y}_{j,t}^N)^2 / T_0}$

<sup>3</sup> (Ferman, Pinto, & Possebom, 2017, p. 10) propose to calculate a p-value to reject the null hypothesis of no effect. The test is conducted at a pre-specified significance level. In the specification,  $\mathbb{1}$  is the indicator function of the event:  $p := \frac{\sum_{j=0}^{J+1} \mathbb{1}[RMSPE_j \geq RMSPE_1]}{J+1}$

**Table 2.** Summary of the SC and placebo effects (p-values).

<b>Summary Synthetic Control - Unemployment Insurance Reform</b>							
	<b>Scenario 1</b>	<b>Scenario 2</b>	<b>Scenario 3</b>	<b>Scenario 4</b>	<b>Scenario 5</b>	<b>Scenario 6</b>	<b>Scenario 7</b>
<b>RMSPE</b>	0.4260	0.4661	0.4846	0.4494	0.5019	0.4692	0.523
<b>W-weights controls</b>							
- Control Zürich			0.430	0.072		0.232	
- Control Valais	0.524	0.534	0.570	0.565	0.568	0.591	0.552
- Control Thurgau	0.298						
- Control Schaffhausen	0.103	0.349		0.363	0.224	0.166	0.157
- Control Basel-Stadt	0.075	0.117			0.208	0.011	0.291
<b>post/pre RMSPE ratio Ticino</b>	1.61	1.53	1.53	1.79	1.53	1.39	1.54
<b>p-values years after treatment</b>							
<b>1</b>	0.857	0.667	0.650	0.571	0.600	0.700	0.650
<b>2</b>	1	0.952	1	0.857	0.950	1	1
<b>3</b>	0.095	0.095	0.150	0.095	0.150	0.150	0.150
<b>4</b>	0	0	0	0	0	0	0
<b>5</b>	0	0	0	0	0	0	0
<b>6</b>	0	0	0	0	0	0	0

Summarizing, we can state that the probability of a randomly obtained value is high in the first two years after the AVIG revision, which is the period it took to have full impact on the unemployment rate. Therefore, in the first two years after the law's revision (time required to be fully adopted in Ticino) the probability of obtaining the value of the synthetic Ticino by chance was almost 1. Starting with the third year, when the law's revision had a full impact, the p-values are lower and undermine that the unemployment rate was not decreasing by chance.

The second important point is to consider how the cantons that comprise the SC of Ticino are chosen from the cantons in the donor pool. In each of the scenarios, a different set of predictor variables defines how and how strongly the predictors influence the relative importance of a canton in composing the SC. In the composition of the SC version of Ticino, the characteristics that define the quality of the matching of every single variable predicting the SC out of the cantons in the donor pool are given by the V-weights matrix. This predictor weights of the SCM are calculated as a vector over the combination of the included predictor variables (weights are listed by scenarios in Table 3).

**Table 3.** Predictor V-weights in defining the SC from the cantons in the donor pool.

Variables Matrix V-weights – Quality of the prediction							
Predictors	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7
Unempl. % (ILO)	0.0029216	0.0126819	0.0251016	0.0003355	0.0178546	0.0608614	0.1030930
Unempl. % Swiss	0.0079965	0.0058136	0.0305801	0.0040307	0.0000000	0.0000061	0.0000427
Unempl. % Foreigners	0.0017593	0.1575096	0.1602247	0.2563659	0.0522683	0.4462761	0.0174129
Empl. growth	0.0524550	0.0104868	0.0050203	0.0910613	0.0101024	0.0882374	0.1116625
% of 3rd sector firms	0.5339663	0.1133374	0.0001609	0.0835999	0.0585871	0.0114713	0.0542441
% of social aid	0.2806241	0.5113206	0.0054987	0.0505141	0.1710640	0.1558218	0.2433129
Poverty index	0.0000026	0.0861157	0.0012954	0.0080217	0.0758434	0.0001324	0.1494127
Median taxable income	0.1195161	0.0272772	0.0063893	0.0397639	0.1014102	0.0549717	0.0596940
% of high school grad.	0.0007581	0.0201676	0.0541417	0.0166663	0.0036179	0.0000641	0.0155404
SECO unempl. % (average 1994-2011)		0.0552891					
SECO unempl. % (1994)			0.1174882	0.0810530	0.0820655	0.0428916	
SECO unempl. % (1995)			0.0000000	0.0005544	0.1738635		0.1474132
SECO unempl. % (1996)			0.0000000	0.0000004	0.0071515	0.0036269	
SECO unempl. % (1997)			0.0806469	0.0095650	0.0006242		0.0054000
SECO unempl. % (1998)			0.1625513	0.3171984	0.0928863	0.0373949	
SECO unempl. % (1999)			0.0811219	0.0090562	0.1093570		0.0293314
SECO unempl. % (2000)			0.0002206	0.0084711	0.0241066	0.0013137	
SECO unempl. % (2001)			0.0035450	0.0035092	0.0048304		0.0016268
SECO unempl. % (2002)			0.0663867	0.0202324	0.0012570	0.0627973	
SECO unempl. % (2003)			0.0363450		0.0017574		0.0108765
SECO unempl. % (2004)			0.0518272		0.0071014	0.0287362	
SECO unempl. % (2005)			0.0000000		0.0008485		0.0497369
SECO unempl. % (2006)			0.0406707		0.0034017	0.0035184	
SECO unempl. % (2007)			0.0000000				0.0000000
SECO unempl. % (2008)			0.0059918			0.0003590	
SECO unempl. % (2009)			0.0430760				0.0011992
SECO unempl. % (2010)			0.0217150			0.0015189	

In Table 4, we further compare the predicted SCM predictor averages for each of the seven scenarios to the sample average of the predictors in Ticino. This simple matching helps to understand the quality of the matching and prediction of the unemployment rate.

**Table 4.** Predictor weights in defining the SC from the cantons in the donor pool.

Synthetic control predictor averages compared to Ticino (predictor balance)								
	Ticino	SCM Scenario 1	SCM Scenario 2	SCM Scenario 3	SCM Scenario 4	SCM Scenario 5	SCM Scenario 6	SCM Scenario 7
Unempl. % (ILO)	5.25	4.78	4.82	5.14	4.89	4.96	5.07	4.97
Unempl. % Swiss	3.19	2.16	2.22	2.41	2.17	2.32	2.30	2.40
Unempl. % Foreigners	5.98	5.59	5.78	6.05	5.84	5.82	5.96	5.80
Empl. growth	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
% of 3rd sector firms	0.75	0.75	0.76	0.82	0.77	0.76	0.79	0.77
% of social aid	1.92	1.92	2.28	2.25	1.88	2.60	2.06	2.94
Poverty index	8.70	3.64	4.45	3.77	3.77	4.83	3.77	5.30
Median taxable income	46925	47342	47624	49827	47587	47634	48463	47946
% of high school grad.	43.87	29.74	30.98	30.96	30.86	31.09	30.92	31.19
SECO unempl. % (average 1994-2011)	4.01		3.59					
SECO unempl. % (1994)	5.97			6.12	6.03	6.33	6.16	
SECO unempl. % (1995)	6.07			5.88	5.76	6.04		6.09
SECO unempl. % (1996)	7.17			5.55	5.54	5.65	5.61	
SECO unempl. % (1997)	7.27			6.25	6.18	6.14		6.09
SECO unempl. % (1998)	6.03			4.54	4.46	4.39	4.50	
SECO unempl. % (1999)	3.83			3.17	3.08	3.02		2.99
SECO unempl. % (2000)	2.60			1.82	1.75	1.85	1.79	
SECO unempl. % (2001)	2.10			1.67	1.64	1.76		1.81
SECO unempl. % (2002)	2.93			2.41	2.19	2.29	2.29	
SECO unempl. % (2003)	3.87			3.69		3.31		3.43
SECO unempl. % (2004)	4.07			3.89		3.67	3.71	
SECO unempl. % (2005)	4.47			3.79		3.60		3.67
SECO unempl. % (2006)	4.50			3.23		3.20	3.16	
SECO unempl. % (2007)	1.00			2.76				2.90
SECO unempl. % (2008)	3.67			2.57			2.52	
SECO unempl. % (2009)	4.47			3.51				3.51
SECO unempl. % (2010)	4.33			3.56			3.47	

The following section graphically shows and discusses the results for the third of the listed scenarios (the remainder are in Appendix 3). The only variation between the scenarios consists of the included predictors, which define the relative similarity of the cantons in the donor pool and the treated Ticino. We chose Scenario 3 as a benchmark specification since the SCM goal is to fit the levels of the outcome variable and this works best if the entire pre-treatment period is completely included.

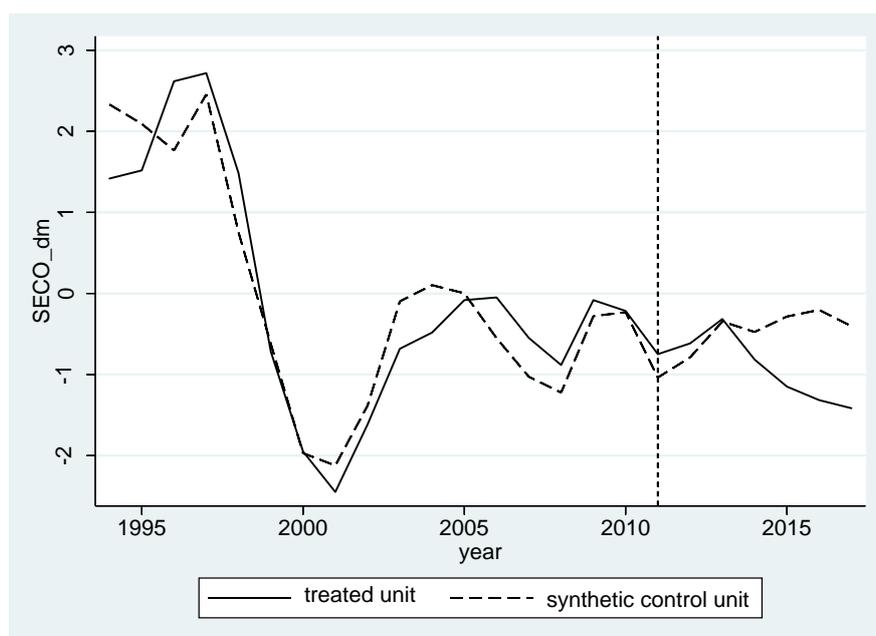
### 5.1. Specification including all pre-treatment outcome values singularly (Scenario 3)

The third specification includes, in addition to the basic scenario, a vector with all the pre-treatment outcome values from every single year. This helps to create an additional weight that searches for similarities in the single unemployment rates of the pre-treatment period among all

the included cantons. The SC in this scenario is composed of only two cantons, Valais and Basel-Stadt, with a stronger weight of Valais (*W*-weights in Table 2). In this specification, no great difference in the slope of the SC unit can be noticed in Figure 2.

With regard to the effect of the introduction of the law's revision in the post-treatment period, we note two observations. First, the previous parallel trend of unemployment rates changes. Initially, this translates into a smoother growth in the unemployment rate for Ticino compared to its SC. Most workers work more than two years before losing their jobs and therefore have a maximum of 400 workdays covered by insurance (five workdays per week). The main effect of the omission of the possibility of lengthening the beneficiary period by 120 days in Ticino has the greatest effect with a delay of 400 workdays after the revision of the law. This means, as our reference period is the second quarter of the year, that the main effect of the omission of this additional measure would be visible within two years of the law's revision (April 1st, 2011). Thus, the 2013 data should make the effect visible for the first time. The second observation is that starting in 2013, Ticino's unemployment rate drops significantly and falls below the rate of its SC for the first time since 2005. This provides evidence that a part of the chronically higher unemployment rate in Ticino is due to the potentially longer beneficiary period compared with the control cantons in the donor pool.

The graphical illustrations of the results for the remainder of the scenarios contained in the results table can be found in Appendix 3. In addition to the specifications, further robustness tests are described in the following Section 6. First, a DiD model with a linear fit for the controls and the treated canton was computed. Second, the SCM was used to analyse the remainder of the cantons that applied for the additional measure of extending the maximum unemployment duration. The results are discussed in comparison with Ticino.



**Figure 2.** Demeaned SC and Ticino unemployment rate, including all pre-treatment variables as predictors.

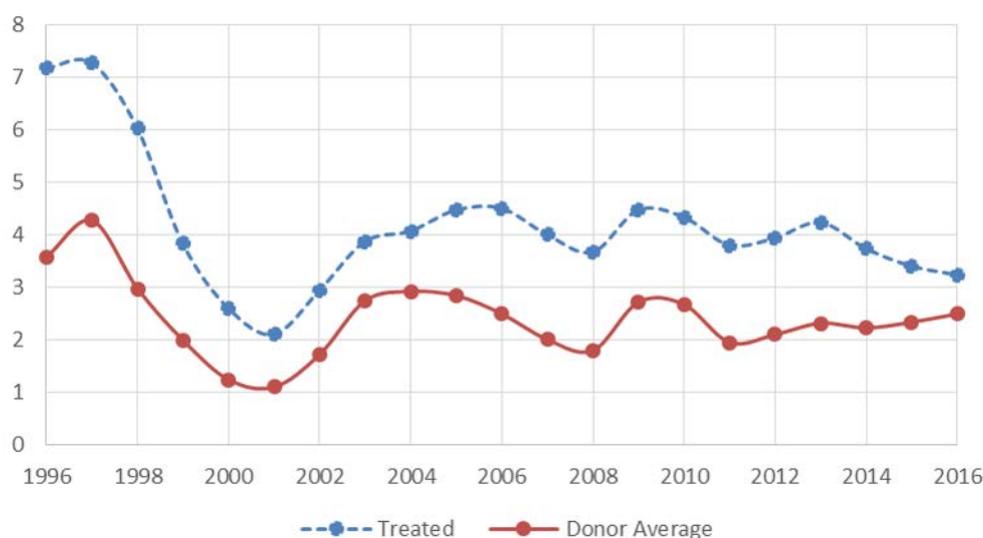
## 6. Robustness Tests

To test the validity of the results, two placebo tests following the literature were performed. First, the data were analysed in a DiD context, allowing for a differentiated view of the problem set. Second, SC were constructed for the remainder of the cantons affected by the law's revision to identify common tendencies and differences among those treated. As shown, in Appendix 3, all different scenarios introduced in Section 4.3 were calculated for Ticino, checking for the robustness of the results by varying the relative importance of the pre-treatment outcome variables as predictors of the SC of Ticino. This different scenarios do not show any variation of the results from the previously discussed scenario 3 and therefore undermine the obtained results for Ticino.

### 6.1. Difference-in-Difference Computation of Ticino and the Donor Pool Average

To verify the diverging trend of the unemployment rates in Ticino and the weighted average of the donor pool cantons, a DiD analysis was conducted. The data illustrated in Figure 3 compares the time trend of Ticino, represented by the blue line, with a weighted average of all donor pool cantons. The weights correspond to the respective size of the labour market in the remaining cantons.

The data displayed in Figure 4 suggests a linear fit across the years in the pre-treatment period from 2003 to the revision of the unemployment law in 2011, identifying a common trend in the time before the revision. We defined two scenarios: the first one was a cut-off in the fitted values in 2011, when the actual law revision took place, and the second one was a time lag of two years when the last unemployed person benefitting from the additional beneficiary periods left unemployment. This is graphically illustrated in Figure 4.



**Figure 3.** Unemployment rates (SECO) of Ticino (treated) and weighted average (by employees) of the donor pool. Second quarter of the year.

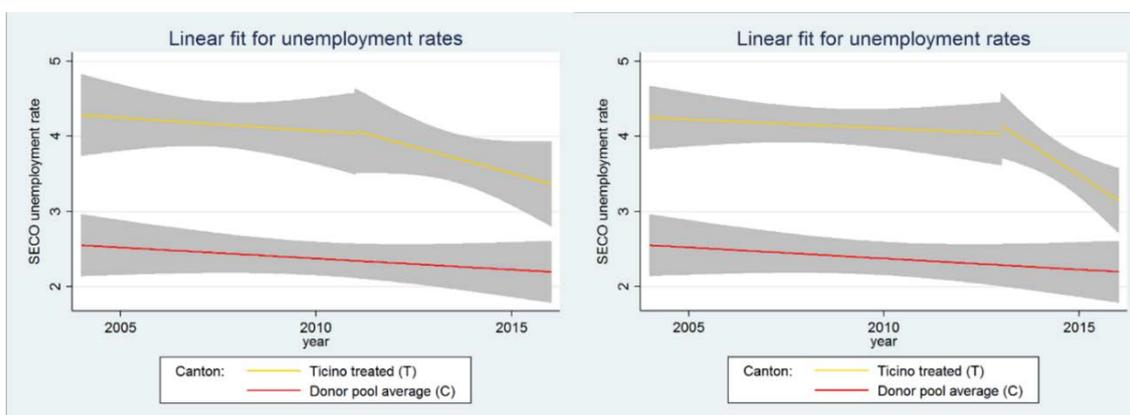


Figure 4. Linear fits for Ticino and donor pool with cut-offs in 2011 (left) and 2013 (right).

The numerical results for the DiD analysis are illustrated in Table 5. In the pre-treatment period, Ticino systematically displays a higher unemployment rate compared to the donor pool average (1.74% for 2011 cut-off and 1.77% for 2013). The DiD result, assuming the continuity of the common trend of decreasing unemployment rates over time from the pre-treatment period, suggests a reduction in unemployment in Ticino with the revision of the unemployment insurance law. This reduction on average was as large as -0.33% in the first scenario and as large as -0.66% in the second scenario.

Table 5. Difference-in-Difference outcomes for Ticino and donor pool canton average unemployment rates.

VARIABLES	(1) Cut-off 2011	(2) Cut-off 2013
Time	-0.130 [0.171]	-0.029 [0.148]
Treated	1.738*** [0.197]	1.765*** [0.164]
DiD	-0.326 [0.271]	-0.663*** [0.220]
Constant	2.425*** [0.159]	2.381*** [0.132]
Observations	26	26
R-squared	0.861	0.881

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 6.2. Results for Other Cantons Affected by the Additional Measure

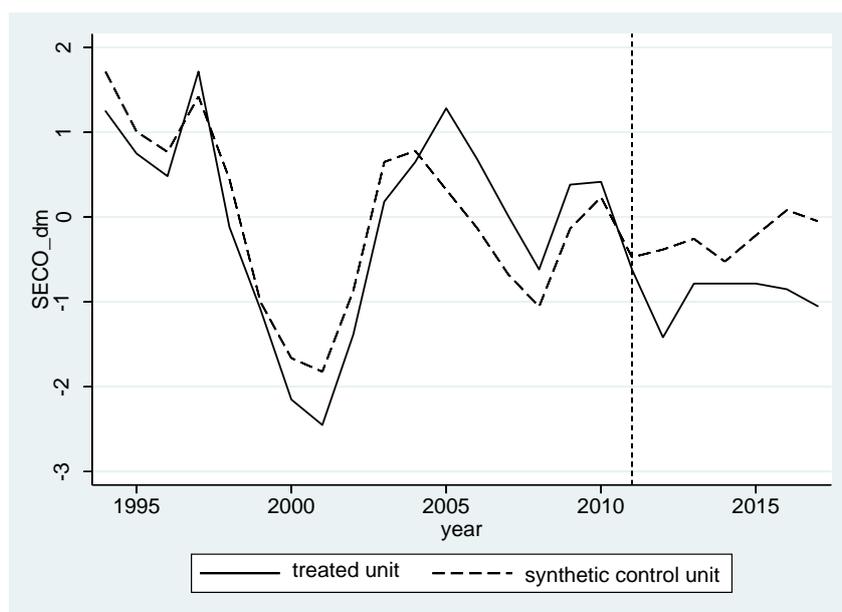
A second placebo test aimed to compare and test the validity of the results by researching the effect the reform had in the remainder of the cantons that applied the measure to lengthen the maximum number of days of unemployment in the period preceding the revision of the unemployment law. For each of these, a SC unit was constructed and compared graphically to their unemployment rate trends. Table 6 summarizes the main results of these computations.

For three of the four remaining cantons that had applied the optional lengthening of the maximum unemployment duration, it was possible to construct a complete SC analysis and to compare the trend of their unemployment rate with their respective SC. With the available data for the canton of Geneva, it was not possible to reproduce a complete SC analysis that followed a similar trend in the pre-treatment period, so only partial results are available for this case.

The first canton analysed is Geneva. Unlike Ticino, Geneva did not implement the optional lengthening of the maximum unemployment duration in the six months preceding the revision of the unemployment insurance law. Consequently, the full effect is observed earlier in Geneva than in Ticino. Figure 5 shows that the difference between Geneva's demeaned unemployment rate and that of its SC is larger after the law's revision. This is visible in Figure 5, where the difference between Geneva and its SC is larger after the law's revision, but different from Ticino the effect of a shorter unemployment duration is noticed earlier.

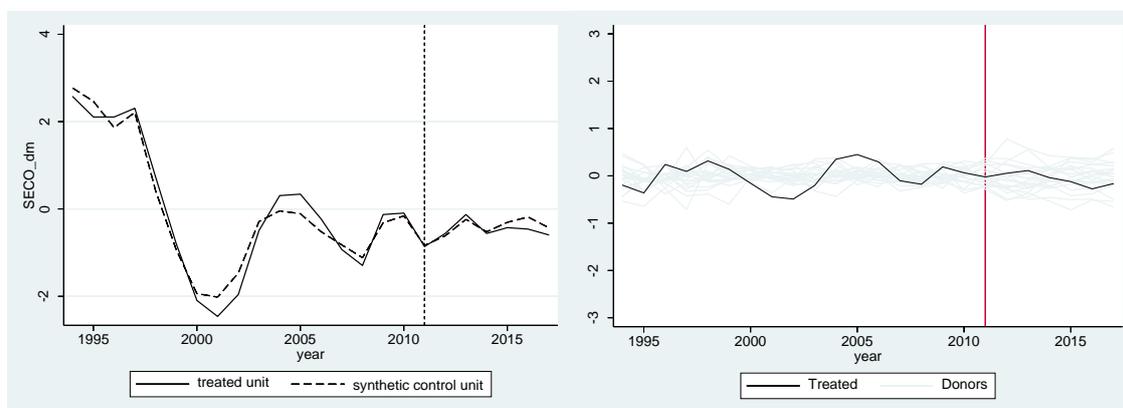
**Table 6.** Summary of the SC computation of other cantons affected by the new policy.

Summary Synthetic Control - Unemployment Insurance Reform				
	Canton Geneva	Canton Vaud	Canton Jura	Canton Neuchâtel
<b>RMSPE</b>	0.512	0.282	0.495	0.641
<b>W-weights controls</b>				
- Control Valais		0.580	0.143	0.242
- Control Basel-Stadt	0.641	0.420	0.377	0.758
- Control Zürich	0.359			
- Control Solothurn			0.480	
<b>p-value (post/pre RMSPE ratio)</b>		0.547	0.823	1.577
<b>p-values years after treatment</b>				
1	No convergence achieved in synth_runner (derivatives cannot be calculated)	0.75	0.15	0.15
2		0.70	0.55	0
3		0.85	0.90	0
4		0.75	0.45	0
5		0.30	0.10	0
6		0.50	0	0

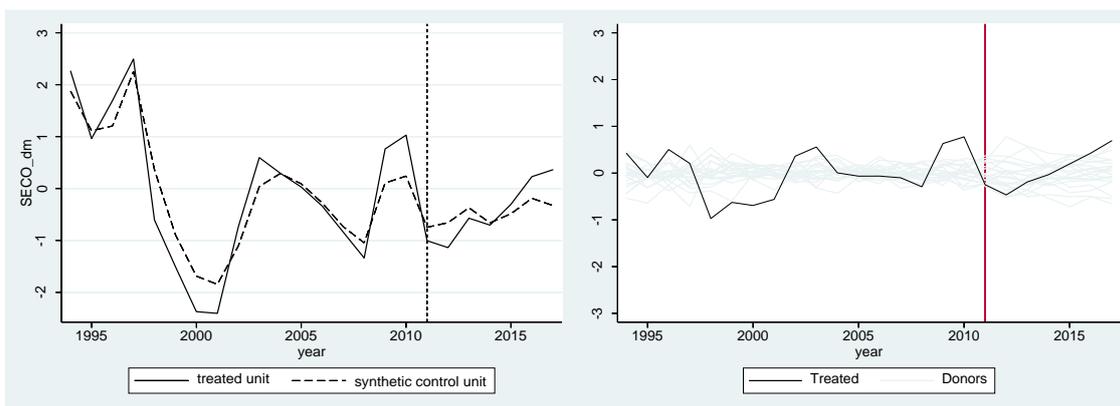


**Figure 5.** Outcome for Geneva: Demeaned SC and unemployment rate, including all pre-treatment variables as predictors.

The second analysed canton is Vaud. The results for this canton (see Figure 6) suggest that starting with 2015 the demeaned unemployment rate started to be lower than its SC. The effect is less visible, a possible explanation being that Vaud already had a lower unemployment rate than Geneva in the pre-treatment period, so the impact of the measure was less evident. Furthermore, analogously to the case of Ticino, Vaud adopted the measure up to the last possible date in 2011, which delays the effect slightly compared to the Geneva case. The unemployment rate in the canton of Jura fluctuates more than that of the previously analysed cantons. Jura is a small canton that is more strongly affected by cyclical unemployment than many other cantons. The analysis, in this case, does not indicate any clear results (Figure 7), especially as the high unemployment rate in 2009-2010 could not be reproduced in its demeaned SC. Nevertheless, starting in 2011, the unemployment rate of Jura falls below its SC for the first time since 2001.

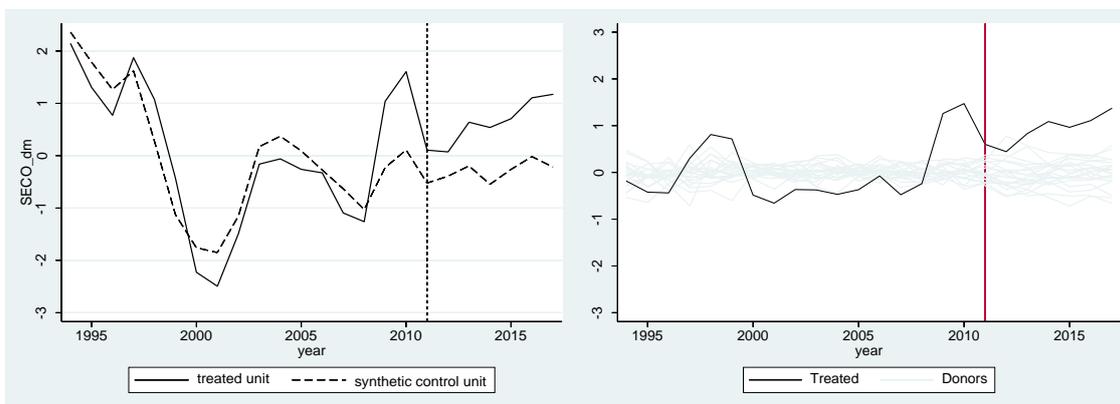


**Figure 6.** Outcome for Vaud: Demeaned SC and unemployment rate, including all pre-treatment variables as predictors.



**Figure 7.** Outcome for Jura: Demeaned SC and unemployment rate, including all pre-treatment variables as predictors.

The last of the treated cantons is Neuchâtel. It was one of the last adaptors of the measure as well. Similar to Jura it has a small and volatile labour market. For this, it is hard to obtain a meaningful SC in this canton since it is impossible to reproduce the volatility of the demeaned unemployment rate of this canton with the ones of the donor pool (results in Figure 8).



**Figure 8.** Outcome for Neuchâtel: Demeaned SC and unemployment rate, including all pre-treatment variables as predictors.

## 7. Comment on Results

The results for different specifications of the SC, as previously proposed by Ferman, Pinto and Possebom (2017), help us gain insight into the sensitivity of the computation. The seven scenarios include different predictor variables of the SECO unemployment rate of the pre-treatment period in addition to the independent predictors composing the basic scenario. With this procedure, we want to test the sensitivity of the construction of the SC of Ticino. As we noticed, the two or more (depending on the scenario) cantons from the donor pool constructing the SC for Ticino remain the same across some of the specifications. Even if their relative weight changes across the scenarios.

For the fact that the control cantons are the five individuated in all scenarios, we can exclude the possibility that one canton is part of the SC only because of a defined predictor or a unique event. The specifications confirm that the weighted composition of the synthetic Ticino, composed up of Valais, and depending on the scenario on one or more additional cantons, is the most similar to the real Ticino.

The results show that in the years preceding the revision of the unemployment law, a parallel trend, with the demeaned unemployment rate for Ticino, is registered. With the revision of the AVIG law, the previous parallel trend approaches its SC. The greatest effect, when the unemployment rate in Ticino falls below that of its SC, is registered two years after the revision of the law. This can be explained by the effect of the annulment of the additional measure to lengthen the beneficiary period for unemployment in Ticino beyond 400 days. In summary, the reform of the unemployment law and the standardisation of the unemployment duration caused the chronically higher unemployment rate of Ticino to fall to a lower level than it would otherwise have been. In the short period, as described in the (SECO Staatssekretariat für Wirtschaft, 2013) report, the movement from unemployment to social assistance increased, but the effect did not persist over time. The lower unemployment rate in the longer term, therefore, is also the result of the changing duration of the maximum beneficiary period and the faster reintegration of the unemployed workforce into the labour market.

Moreover, the achieved results are clearly supported in two of the four analysed cantons in addition to Ticino. Geneva and Vaud, which propose similar to but less accentuated results than Ticino. Nevertheless, both show a reduction in their demeaned unemployment rate in comparison with their SC.

## **8. Conclusions**

This research attempts to identify the effect of the introduction of the partial revision of the unemployment insurance law (AVIG) on the actual unemployment rates in the Ticino region in southern Switzerland. This area was particularly affected by the revision of this law, which eliminated the possibility of increasing the maximum unemployment duration in cases of high regional cyclic unemployment. The data indicate that for the entire period observed, the unemployment rate of the canton of Ticino lies above the average of the cantons included in the donor pool. In the years preceding the reform, the unemployment rate of Ticino was, on average, approximately 1.8% higher than the weighted average of the cantons in the donor pool. Descriptive statistics show that this difference was reduced starting with the introduction of the revised law in 2011, reaching a difference of 0.74% in 2016. Nevertheless, the unemployment rate in Ticino remained higher than the average rate in the donor pool cantons.

The main goal is to compare the trend of the unemployment rate in Ticino with the best-fitting control cantons in order to identify the effect of the measure, which eliminated the possibility for Ticino to lengthen the unemployment duration. The SC identifies a weighted average of the unemployment rate of the most similar cantons regarding a chosen number of predictors in

seven different scenarios. Each of the seven scenarios includes two or more cantons that construct their respective SC. In the years preceding the revision of the unemployment insurance law, Ticino and its SC followed a similar trend, and Ticino's unemployment rate was approximately 1% higher than that of its control. This difference decreased with the introduction of the law's revision, and starting in 2014, the common trend ended. In 2015, for the first time, the unemployment rate in Ticino lay below that of its SC and remained so until the end of the observed period.

We can conclude that the application of the revised unemployment insurance law had a strong effect on reducing the unemployment rate in Ticino, while in the SC, constructed of similar cantons, no such similarity can be identified. Most workers entering unemployment in Ticino contributed two or more years to the insurance and therefore can benefit from insurance coverage for a maximum of 1.5 years. Once this period expires, an additional 120-day benefit prolongation could have been applied in Ticino before the law's application. With the new legislation in Ticino, the unemployment rate decreased. As the SECO Staatssekretariat für Wirtschaft (2013) report shows, in terms of unemployed persons, the French and Italian areas of Switzerland (in large part applying the additional measure) were disproportionately affected by the law's revision, experiencing a greater effect than the German-speaking part of the country. This, in combination with a reduction in the general duration of unemployment, led to a more than proportional and persistent reduction in Ticino's unemployment rate compared with its SC, constructed with cantons from the remainder of Switzerland. These results are in contrast to the forecast of the SECO Staatssekretariat für Wirtschaft (2013) in a report studying all of Switzerland, where, in the long run, no persistent reduction in unemployment rates resulted from the partial revision of the unemployment law.

In conclusion, this means that in the period before the revision of the unemployment law, the return on job of unemployed workers lasted longer than afterwards. A shorter insurance period makes pressure on the job seekers and accelerates their search for a new position. The previous policy adapted especially in the Italian and French-speaking part of Switzerland reduced the intensity of the job search of unemployed as their insurance covered a longer period. In this sense, the law's revision helped especially in those regions to fight the high unemployment rate, by limiting the maximum length of the insured beneficiary period.

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## Appendix 1 – Descriptive Statistics

Table 7. Summary of descriptive statistics for all cantons.

Canton	unit	Unemployment rates				Employment		Social indexes		Education	
		SECO	ILO	Swiss	foreigners	annual growth rate	tertiary sector share	assist-ence	poverty	median taxable income	maturity quota
		rate	rate	rate	rate	rate	quota	quota	quota	CHF	quota
Appenzell Outer-Rhodes	mean	1.681	3.444	1.297	3.394	0.009	0.680	1.778	3.456	48005.000	28.870
	sd	0.508	0.498	0.389	1.096	0.012	0.015	0.199	0.313	3051.570	7.727
Appenzell Inner-Rhodes	mean	1.015	3.444	0.749	2.702	0.009	0.680	1.111	2.078	46375.000	23.000
	sd	0.427	0.498	0.332	1.159	0.012	0.015	0.169	0.120	3660.152	7.511
Aargau	mean	2.807	4.038	1.944	5.960	0.007	0.718	1.967	3.422	52830.000	25.071
	sd	0.782	0.585	0.542	1.816	0.013	0.019	0.071	0.192	3702.076	6.218
Basel District	mean	2.722	4.038	2.058	5.406	0.007	0.718	2.467	4.100	56765.000	31.944
	sd	0.657	0.585	0.497	1.662	0.013	0.019	0.206	0.235	4134.231	7.592
Basel Stadt	mean	3.738	4.038	2.814	5.672	0.007	0.718	6.144	11.067	52175.000	31.571
	sd	0.904	0.585	0.639	1.811	0.013	0.019	0.445	1.316	3021.654	8.651
Bern	mean	2.479	3.825	1.858	6.229	0.010	0.722	4.144	6.478	47480.000	27.494
	sd	0.850	0.478	0.655	2.256	0.012	0.014	0.133	0.130	4362.713	8.179
Fribourg	mean	2.881	3.825	2.100	6.615	0.010	0.722	2.422	4.556	48180.000	33.678
	sd	1.193	0.478	1.012	2.523	0.012	0.014	0.130	0.274	4917.809	8.415
Geneva	mean	5.989	6.356	5.404	6.800	0.016	0.809	4.389	11.167	56275.000	36.940
	sd	1.078	0.979	1.034	1.199	0.014	0.012	0.807	1.112	4962.902	4.777
Jura	mean	3.974	3.825	3.307	7.607	0.010	0.722	2.111	5.800	44140.000	33.743
	sd	1.275	0.478	1.198	2.159	0.012	0.014	0.333	0.361	3726.350	7.640
Glarus	mean	1.964	3.444	1.357	3.863	0.009	0.680	2.022	3.922	46070.000	22.785
	sd	0.592	0.498	0.381	1.381	0.012	0.015	0.120	0.222	2800.724	5.206
Grisons	mean	1.860	3.444	1.288	4.281	0.009	0.680	1.233	2.800	44980.000	28.756
	sd	0.485	0.498	0.465	1.057	0.012	0.015	0.132	0.100	3253.274	8.818
Lucerne	mean	2.378	2.875	1.631	6.031	0.016	0.729	2.189	4.322	47935.000	24.582
	sd	0.818	0.617	0.546	2.476	0.020	0.020	0.162	0.179	4038.013	7.879
Neuchâtel	mean	4.575	3.825	3.565	7.236	0.010	0.722	6.544	8.911	48035.000	37.332
	sd	1.230	0.478	1.004	1.893	0.012	0.014	0.550	0.662	4370.508	7.733
Nidwalden	mean	1.367	2.875	1.103	3.493	0.016	0.729	0.900	1.967	51860.000	26.096
	sd	0.669	0.617	0.582	1.581	0.020	0.020	0.050	0.141	4272.082	8.330

Canton	unit	Unemployment rates				Employment		Social indexes		Education	
		SECO	ILO	Swiss	foreigners	annual growth rate	tertiary sector share	assistance	poverty	median taxable income	maturity quota
		rate	rate	rate	rate	rate	quota	quota	quota	CHF	quota
<b>Obwalden</b>	<b>mean</b>	1.196	2.875	0.822	3.738	0.016	0.729	1.122	2.578	45795.000	22.498
	<b>sd</b>	0.549	0.617	0.405	1.816	0.020	0.020	0.097	0.156	3994.269	8.038
<b>St Gallen</b>	<b>mean</b>	2.500	3.444	1.660	5.406	0.009	0.680	2.133	4.200	47570.000	23.927
	<b>sd</b>	0.696	0.498	0.466	1.656	0.012	0.015	0.100	0.240	2959.392	6.335
<b>Schaffhausen</b>	<b>mean</b>	2.978	3.444	1.993	6.172	0.009	0.680	2.367	5.144	49292.500	29.512
	<b>sd</b>	0.916	0.498	0.559	2.350	0.012	0.015	0.194	0.340	2819.027	7.377
<b>Solothurn</b>	<b>mean</b>	2.992	3.825	2.083	6.942	0.010	0.722	3.111	5.289	49755.000	23.410
	<b>sd</b>	1.015	0.478	0.715	2.630	0.012	0.014	0.355	0.948	3423.214	5.666
<b>Schwyz</b>	<b>mean</b>	1.682	2.875	1.160	4.174	0.016	0.729	1.500	2.733	51385.000	22.689
	<b>sd</b>	0.588	0.617	0.375	1.880	0.020	0.020	0.100	0.141	5023.343	6.931
<b>Ticino</b>	<b>mean</b>	4.283	5.869	3.325	6.517	0.014	0.752	2.078	8.833	44507.500	41.269
	<b>sd</b>	1.328	1.045	0.960	2.141	0.018	0.012	0.273	0.296	4278.597	7.898
<b>Thurgau</b>	<b>mean</b>	2.467	3.444	1.724	4.942	0.009	0.680	1.656	3.144	48495.000	23.141
	<b>sd</b>	0.740	0.498	0.488	1.769	0.012	0.015	0.124	0.159	3279.999	7.629
<b>Uri</b>	<b>mean</b>	1.111	2.875	0.740	4.030	0.016	0.729	1.144	2.467	46370.000	23.696
	<b>sd</b>	0.442	0.617	0.334	1.693	0.020	0.020	0.053	0.112	3229.975	7.354
<b>Valais</b>	<b>mean</b>	3.811	6.356	2.800	7.532	0.016	0.809	1.456	3.156	41840.000	29.296
	<b>sd</b>	1.595	0.979	1.308	2.946	0.014	0.012	0.159	1.063	4165.700	6.627
<b>Vaud</b>	<b>mean</b>	4.844	6.356	3.764	7.174	0.016	0.809	4.878	7.922	50515.000	30.335
	<b>sd</b>	1.334	0.979	1.114	1.909	0.014	0.012	0.130	0.672	6148.451	5.281
<b>Zug</b>	<b>mean</b>	2.471	2.875	1.765	4.957	0.016	0.729	1.722	3.689	60025.000	30.932
	<b>sd</b>	0.755	0.617	0.531	1.841	0.020	0.020	0.083	0.298	5591.241	9.337
<b>Zurich</b>	<b>mean</b>	3.417	4.025	2.514	6.146	0.011	0.830	3.344	5.333	55540.000	29.130
	<b>sd</b>	0.921	0.512	0.679	1.908	0.019	0.018	0.235	0.458	3766.109	6.031
<b>Total</b>	<b>mean</b>	2.815	3.906	2.109	5.528	0.012	0.727	2.536	4.944	49315.190	28.527
	<b>sd</b>	1.515	1.236	1.282	2.343	0.015	0.046	1.511	2.632	5802.191	8.811

## Appendix 2 – Variables List

**Table 8.** Variables included in the SC computation.

Variable	Definition
<b>SECO unemployment rate</b>	Number of registered unemployed workers (last day of the month - enrolled at the regional labour agency) divided by the number of active labour force members. Labour force is revealed by the structural census and kept fixed over the years.
<b>SECO_dm</b>	SECO unemployment rate demeaned by the canton pre-intervention average SECO unemployment rate.
<b>ILO unemployment rate</b>	Unemployed workers in this sense are all persons form 15-74 years, who were unemployed in the reference week and were actively searching for a job in the previous four weeks and who are available to start a new job.
<b>unemployment rate of Swiss</b>	Calculated as the SECO unemployment rate, but considering Swiss workforce only.
<b>unemployment rate of foreigners</b>	Calculated as the SECO unemployment rate, but considering foreign workforce only.
<b>annual growth rate of employed persons</b>	This includes all persons aged 15 and over, who in the reference week worked at least one hour for payment and although temporarily absent from the workplace had a job as an employee or were self-employed or who worked in a family business without payment.
<b>share of tertiary sector employees</b>	Number or employees defined according to the above specification who worked in a firm of the tertiary sector, divided by the number of employees in the secondary sector in the same period.
<b>social assistance quota</b>	All persons enrolled in social assistance (as part of the permanent residential population) divided by the permanent residential population in December of the previous year.
<b>poverty quota</b>	Share of persons with an equivalent income below the relative poverty threshold
<b>median of taxable income</b>	Median of the taxable income in the canton of natural persons that are contributing to the direct federal tax. Taxable income is defined as the perceived income minus the admitted deductions (on average 30% reduction).
<b>maturity quota</b>	Percentage of youth with a highschool equivalency compare to the total of youth that have finished any degree of mandatory schooling.

### Appendix 3 – Scenarios 1, 2, 4-7 for Ticino

#### 1. Basic specification with no pre-treatment outcomes (Scenario 1)

This first computation is the basic model that does not include any value of the dependent variable (SECO unemployment rate) from the pre-treatment period as an additional predictor. As previously explained, Ticino by construction already has a higher unemployment rate than the remainder of the cantons in the donor pool. A similar trend at the respective level of unemployment is clearly achieved applying the demeaned variable for the SCM through which we can obtain a parallel trend for this case and draw valid results. In this specification, the SC of Ticino is composed of the cantons of Valais, Thurgau, Schaffhausen and Basel-Stadt. The effect is graphically illustrated in Figure 9.

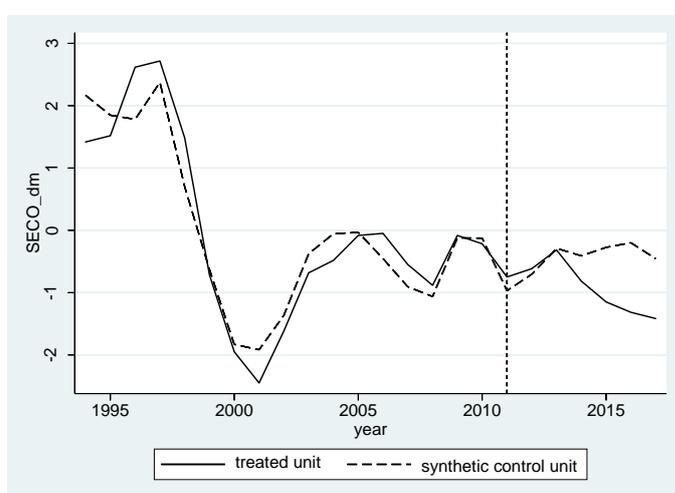


Figure 9. Outcome specification 1.

#### 2. Specification with pre-treatment outcome mean (Scenario 2)

The second specification, in addition to the predictors of the basic scenario, includes a predictor variable that is made up of the average unemployment rate of all the pre-treatment years for the specific canton. The advantage of this additional variable is that it provides a more stable predictor, which is not strongly affected by extraordinary shocks in an examined canton. Only three of the cantons composing the SC of Ticino are the same as in the basic scenario, the relative importance being slightly changed to more weight for Basel-Stadt, Schaffhausen and Valais and compared to scenario 1 it excludes Thurgau from the donor pool. Graphical results are illustrated in Figure 10.

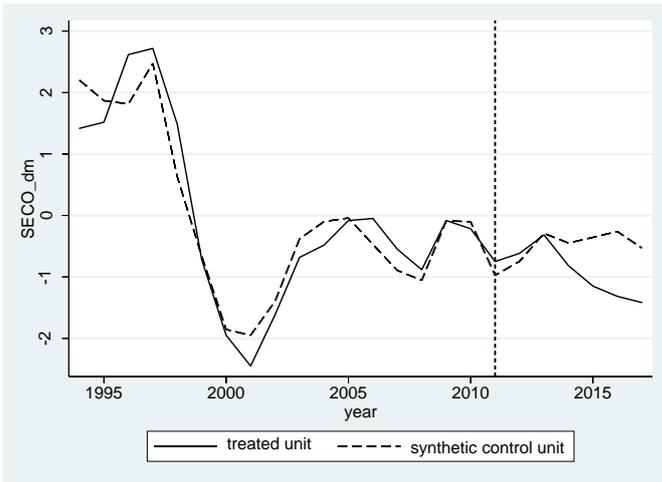


Figure 10. Outcome specification 2.

**3. Specification with the first half of the pre-treatment outcome values singularly (Scenario 4)**

The fourth specification includes a vector of single pre-treatment unemployment rates for the first half of the observed years starting with 1994. This scenario adds additional weight to the early years of the observed period, which are further from the current treatment. Compared to the results of the previous scenario, including the values from all pre-treatment years, the weights do not change, and the SC is again made up of Valais and Schaffhausen with similar weights, but substitutes Basel-Stadt with Zürich in the composition of the SC. Zürich even contributes to the SC in our benchmark scenario 3. Figure 11 shows the comparison of the SC and Ticino demeaned unemployment rate.

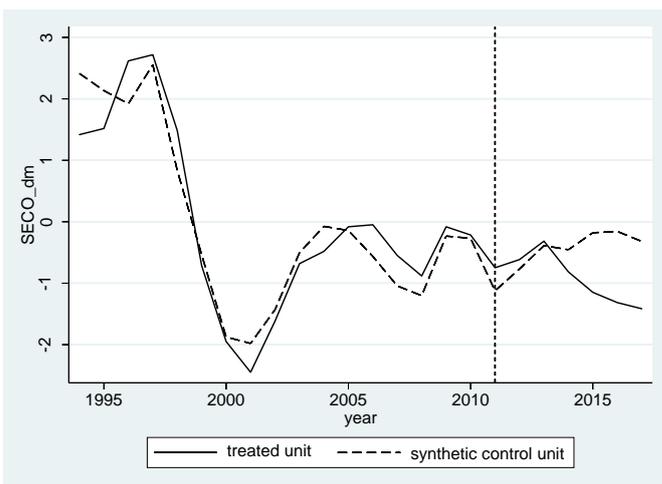


Figure 11. Outcome specification 4.

#### 4. Specification with the first three quarters of the pre-treatment outcomes (Scenario 5)

The fifth specification (Figure 12) follows the same idea as the previous specification. It includes the first three quarters of the unemployment rate in the pre-treatment period as predictor variables. The weights for the cantons composing the SC shift back and again exclude Zürich from the controls, adding Basel-Stadt in comparison with the previous scenario 4. The weights for the cantons are similar to scenario 2, with slightly more weight to Basel-Stadt.

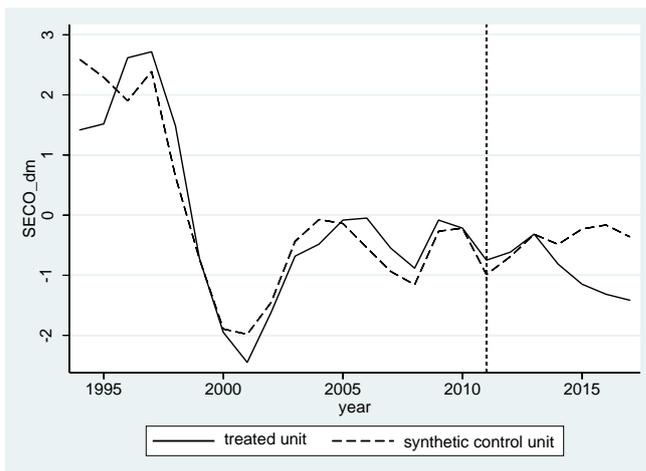


Figure 12. Outcome specification 5.

#### 5. Specification with even-numbered years of the singular pre-treatment outcome values (Scenario 6)

Scenario 6 includes even-numbered years as predictors, starting in 1994; see Figure 13. This helps to remove the weight of extraordinary shocks happening in a single year and strong cyclic down- and upturns. For example, the importance of fitting situations with very low unemployment as in 2001 or very high unemployment in 1997. The combination of the SC is made of the cantons of Valais, Zürich, Schaffhausen and Basel-Stadt.

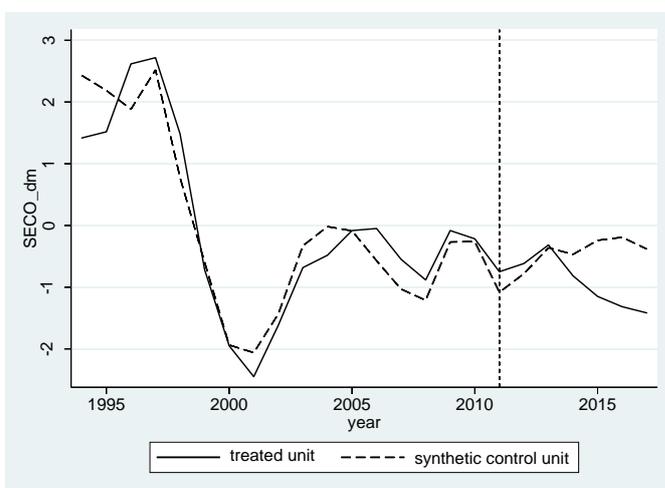


Figure 13. Outcome specification 6.

## 6. Specification with odd-numbered years of the singular pre-treatment outcome values (Scenario 7)

The last specification is based on the definition of scenario 6, but shifts to include the values of the unemployment rate of the odd-numbered years in the pre-treatment period as predictor variables in addition to the basic setup. The cantons composing the SC are Valais, Basel-Stadt and Schaffhausen. Results are illustrated in Figure 14.

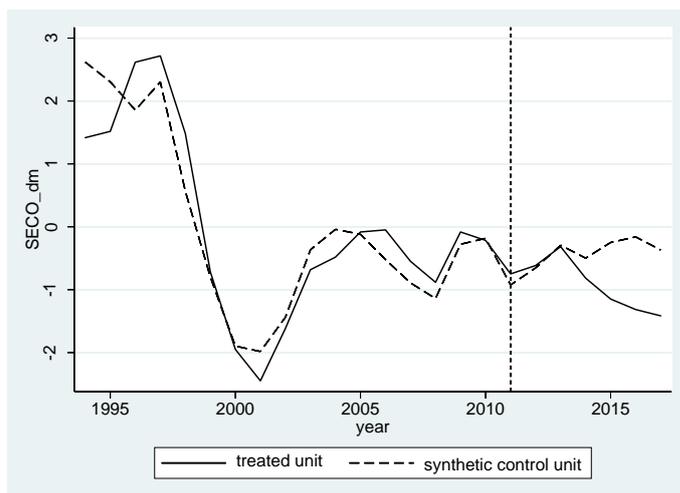


Figure 14. Outcome specification 7.

### List of abbreviations

<b>AVIG</b>	Law of unemployment insurance (Arbeitslosenversicherungsgesetz)
<b>DiD</b>	Difference-in-Difference
<b>FSO</b>	Federal Statistical Office
<b>ILO</b>	International Labour Organization
<b>RMSPE</b>	Ratio of the mean squared prediction errors
<b>SC</b>	Synthetic Control
<b>SCM</b>	Synthetic Control Method
<b>SECO</b>	Swiss State Secretariat for Economic Affairs
<b>SLFS</b>	Swiss Labour Force Survey