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The effect of Swiss regional nature parks on agricultural earnings

Marina Cracco[1] | **Christian Ritzel**[2]

[1]Institute of Geography and Sustainability, University of Lausanne, Lausanne, Switzerland

[2]Economic Modeling and Policy Analysis Group, Agroscope, Ettenhausen, Switzerland

Correspondence
Marina Cracco, Institute of Geography and Sustainability, University of Lausanne, Lausanne, Switzerland.
Email: marina.cracco@unil.ch

Christian Ritzel, Economic Modeling and Policy Analysis Group, Agroscope, Ettenhausen, Switzerland
Email: christian.ritzel@agroscope.admin.ch

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Abstract

The establishment of Swiss regional nature parks has been coupled with the need for sustainable regional development. Regional nature parks are one type of park in Switzerland, which may be considered analogous to the International Union for the Conservation of Nature's Protected Area Management Category V. These regional nature parks differ from other Swiss parks in their objectives and management. Some researchers and decision makers consider regional nature parks as instruments for bridging the development divide between economically advantaged and disadvantaged areas. The natural capital of regional nature parks may attract economic opportunities, generating agritourism and increasing regional agricultural product demands. The agricultural sector is especially vital for these regions. Regional park status may cause economic benefits through the intensification of agritourism or increasing sales of regional labeled products. Accordingly, our study examines the effect of gaining regional nature park status on farm earnings. For this purpose, we used agricultural earnings submitted to the Old Age and Survivors' Insurance System in regional nature parks established between 2010 and 2013 and compared them with the agricultural earnings of non-regional park areas in Switzerland. We hypothesized that regional nature park status had no effect on the agricultural earnings of farmers inside a park. Employing causal analysis methods (i.e., matching in combination with a difference-in-difference estimator), we analyzed the regional nature park effect on agricultural earnings at the national, regional, and individual levels. The results show that for most regional nature parks, regional park status had neither statistically significant positive nor negative effects on agricultural earnings. As we included most of the parks belonging to one park category (regional nature parks), we extended our results to that entire category. Our results serve as a basis for policymakers and park managers to adapt current activities and design and implement measures to enhance the economic situation of farmers in these regional parks.

KEYWORDS

difference-in-differences, impact evaluation, matching, protected areas, quasi-experiment

1 | INTRODUCTION

Besides nature conservation, protected areas have been considered to foster socioeconomic benefits for their inhabitants (Heagney et al., 2015) and to alleviate poverty (Adams et al., 2004; Oldekop et al., 2016). Even though in some cases protected areas have been shown to have negative effects on local communities (West et al., 2006), protected areas have also been seen as a way to bridge the divide between economically advantaged and disadvantaged areas (Scherl et al., 2004). As humans depend on natural systems and nature's contributions for their well-being and livelihoods (Pascual et al., 2023), conserving natural areas and promoting their sustainable use turns into a societal goal (UN, 2015, p. SDG 15). If these protected areas are to be sustained and improved to achieve their biodiversity and socioeconomic targets, their impacts and effectiveness need to be evaluated to inform management and policy (Hockings et al., 2006).

Almost two decades ago, scholars have called for designing and implementing impact evaluations to understand the effect of conservation measures and policies on biodiversity, ecosystem services, and human well-being (Ferraro & Pattanayak, 2006; Ferraro & Pressey, 2015; Pressey et al., 2015). Impact evaluations have been used to understand the effects of protected areas on rural household incomes mainly in developing countries (e.g., Blackman, 2015; Estifanos et al., 2020; Ma et al., 2018; Miranda et al., 2016). In developed countries, impact evaluations to understand the effects of protected areas on incomes have been rare, with a few cases focusing on income in Australia and Italy (e.g., D'Alberto et al., 2023; Heagney et al., 2015) or evaluating protected areas on employment (Sims et al., 2019) and several outcomes including median income (Chen et al., 2016) in the USA. A gap in the literature exists (McKinnon et al., 2016; Naidoo et al., 2019).

Swiss regional nature parks (RNPs) were established to promote a sustainable regional economy (Hunziker & Hofstetter, 2020; Siegrist et al., 2007). RNPs include as objectives those to conserve and promote the cultural and natural landscapes, support a sustainable economy, and contribute to environmental education and awareness (SPN, n.d.-a). Although not formally categorized as IUCN protected area management category V (protected landscapes), RNPs in Switzerland have been likened to such category (Salomon-Cavin, 2017).

Agriculture is an essential income source for rural areas (EDA, n.d.). One main assumption is that agriculture is relevant to RNPs because farmers contribute to nature conservation and the maintenance of traditional cultural landscapes. Similarly, RNPs are assumed to offer farmers opportunities for business and benefits through cooperation, as well as agricultural services and products (Trachsel et al., 2021). By promoting label products, fostering biodiversity (e.g., through the establishment of green hedges and other connectivity areas within farms) to attract more direct payments for biodiversity conservation, and adopting more culturally defined beautiful landscapes to attract tourism, RNPs seek to provide additional income to farmers.

Swiss RNPs make an important contribution to tourism and ensure the country's food security (Baranzini & Rochette, 2008; Knaus & Backhaus, 2014; Poisson & Delfosse, 2012) and cultural landscape heritage (Song et al., 2020). There is an assumption that RNPs encourage cultural aspects and promote rural development and sustainable business activities, including agriculture and agritourism, through the product label, which identifies products and services originating mainly in the RNP (OFEV, 2014). Through their activities, RNPs promote family-driven, economically viable, and environmentally sustainable agriculture (Margot et al., 2021). The RNP label provides a "soft regulation" (Gerber, 2018, p. 65) or incentives to pursue agreements and cooperation between sustainable use and conservation *in lieu* of strict environmental regulations. The RNP category has been created with the assumption and expectation that it positively affects farmers' agricultural earnings because of increased RNP and product label promotion (Ritzel et al., 2023).

Our aim is to fill the gap identified in the literature on the effect of protected areas on income for developed countries while contributing to the call for more impact evaluations at the international level. Therefore, we set out to answer the research question: *Are RNPs an effective instrument? Do farmers inside RNPs achieve more in income due to RNP status?* Answers to our questions contribute to a general understanding of the impact of RNPs on promoting regional economic development. Based on Ritzel et al.'s (2023) results, which showed that the park status of two Swiss parks (the Gantrisch RNP and the UNESCO Biosphere Reserve) did not have an effect on farm income, we hypothesize that RNP status has no effect on the agricultural earnings of farmers inside RNPs. Although our analysis rests on similar methods (matching and difference-in-differences) and outcomes, the main advantages and added value of our study vis-à-vis that of Ritzel et al. (2023) are that we design and implement an impact evaluation on several individual RNPs, most of which have not been evaluated before. Beyond its contributions to the Swiss context, our study offers the advantage of estimating the RNP effect at the national (analyzing all the study RNPs), regional (all the study RNPs within each main Swiss biogeographic regions), and individual (analysis of each study RNP

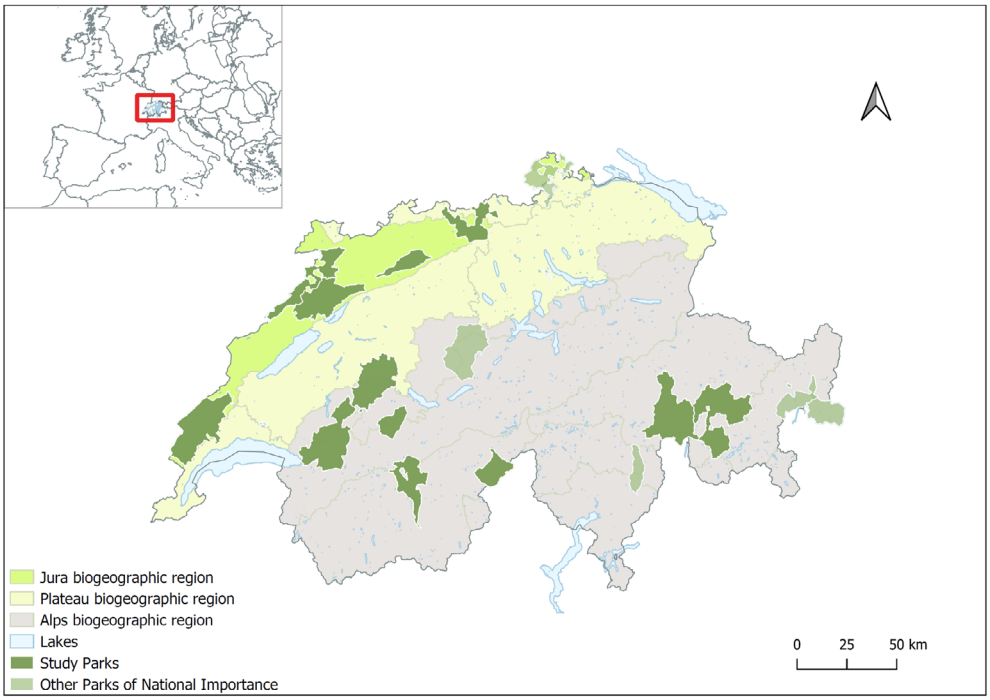

FIGURE 1 Map of Switzerland's three main biogeographic regions highlighting the study parks (as of 2021). Periurban/discovery parks are not visible on the map (Data sources: ©swisstopo swissBOUNDARIES3D and GrandLacsCH; ©FOEN 2021 Revision Park Perimeter, and biogeographic regions 2022; SPN, 2021).

within its Canton) levels, increasing the number of units compared at the national and regional levels. Furthermore, we use a different data source to measure the outcome, circumventing the challenge and process of previously used data (El Benni et al., 2012; Ritzel et al., 2023). Seldom has the impact evaluation literature presented results for an entire protected area category for a country (e.g., Cremer-Schulte & Dissart, 2015 for French RNPs). As all the parks we evaluate belong to one of the four categories of Swiss parks of national importance, and most of them are included in this study, we also provide evidence of the effects of this specific park category (RNP) on agricultural earnings.

2 | METHODS

2.1 | Study area

There are four categories of Swiss parks of national importance. One is the RNPs, of which 16 exist as of 2021 (Figure 1), and 12 were established between 2008 to 2013 under the RNP category only and not under other legal frameworks (e.g., UNESCO Biosphere reserve or World Heritage Site) (see Table S1). These 12 RNPs are our study areas. The legal basis of these RNPs has been set in different acts, ordinances, and guidelines at the federal level (i.e., the Nature and Cultural Heritage Protection Act of 1966 and amendments). RNPs address the promotion of natural and cultural elements of the landscape (SPN, n.d.-a, n.d.-d; Swiss Confederation, 2007). The law stipulates that the federal government provides financial support for the establishment, operation, and quality assurance of RNPs. A system of product and service labels can also be approved by the park authority in consultation with the federal government, with RNPs indicating specific requirements (FOEN, n.d.; Raemy et al., 2021). Producers of goods and services mainly sustainably processed and produced in RNPs, using RNPs resources, can apply for a product label, with the main assumption that buyers of those products support the conservation of nature and the maintenance of cultural landscapes (BioInspecta, n.d.; SPN, n.d.-c; OFEV, 2014). Swiss municipalities form part of the RNPs, which henceforth we refer to as municipalities inside an RNP. However, the ultimate decision of park establishment rests with the Federal Council, which "[...] shall issue regulation on the requirements for the award of the park label [...]" (Article 23l of the Nature and Cultural Heritage Protection Act of 1966 and amendments; Parks Ordinance, 2007). Notably, park management has no legal power over the park area, its activities, and objectives; rather, it works and manages the area through incentives and collaboration with different stakeholders and the park's population (SPN, n.d.-d; Hammer et al., 2021). RNPs management plans or park management do not constraint agriculture or contain restrictions or particular requirements; these just promote establishing biodiversity or landscape features and a more sustainable agriculture (see as example the strategic objectives 2023–2032 for the RNP Jura Vaudois: Parc Jura Vaudois, 2022). Appendix S1 includes additional information on the study area.

2.2 | Study design

In this study, we used a quasi-experimental research design or impact evaluation, which requires the use of quantitative methods for causal inference (i.e., analysis of cause–effect relationships or pathways). Cause–effect pathways involve a treatment group and a comparison group to observe the effect of a program or intervention on a result or outcome (Angrist & Pischke, 2009). In randomized control trials, the random allocation of individuals or units of analysis to treatment and comparison groups eliminates selection bias (i.e., subjectively placing individuals into one of the two groups) and could be used to identify causal effects (Altman, 1991). However, when randomization is not possible (e.g., the placement of protected areas is seldom random), quasi-experiments with a battery of tools and methods come into play (Harris et al., 2006). Our study was not based on a randomized control trial (i.e., an experiment). However, the groups have been exogenously treated (i.e., with RNP status) by the Federal Office for the Environment (FOEN) (see Figure S1). That is that even though municipalities vote for RNP status, the final decision for RNP establishment is given by the FOEN, which is important when assessing cause–effect relationships. Policies are usually considered an exogenously administered treatment (Chen et al., 2023). Furthermore, we controlled for biophysical (e.g., altitude, sun exposure) and socioeconomic factors (e.g., type of municipality, gender of farmer, type of farm) affecting agricultural earnings.

In our impact evaluation, treated groups comprised municipalities inside an RNP established anytime from 2010 to 2013, and comparison groups comprised municipalities outside RNPs. Municipalities inside RNPs established before or after the studied period (e.g., Candidate Park Calanca, RNP Schaffhausen) or with different or additional legal nominations and status (e.g., UNESCO Biosphere Reserves and Natural World Heritage Sites, Periurban/Discovery parks, National Park) were excluded from the dataset (refer to Table S1 for the list of parks selected for this study).

Our research included three levels of investigation (i.e., national RNP effect, regional effect, and individual RNP effect). At the national level, we used all treated groups from all the studied RNPs. The comparison groups were all municipalities outside RNPs or any other designation. At the regional level, we clustered the pre-Alps and Alps regions into one region (Figure 1). Our treated groups (municipalities) in each region (i.e., Jura and Alps) were compared with comparison groups (municipalities outside the studied RNP) from the same region. Treated groups outside the range of these regions or belonging to non-studied RNPs were excluded. At the individual level, we kept the treated and comparison groups within each canton, which enabled us to maintain the analysis within the same administrative and decision-making contexts. At this level, the treated groups (municipalities within the studied RNP) were compared to groups outside the RNP under study. Some cantons include more than one RNP. In these cases, we compared each RNP separately to the other non-RNP municipalities. In one case only, the Gruyère Pays d'Enhaut RNP is uniformly located across two cantons (i.e., Fribourg and Vaud). For Gruyère Pays d'Enhaut RNP, we divided the municipalities inside the RNP in each canton and analyzed them as "subparks" each in their cantons.

2.3 | Establishing the treatment and comparison groups and the outcome variable

In this section, we briefly present the methods (matching) we used to establish the treatment and comparison groups needed to study the causal effect of gaining RNP status on agricultural earnings. We also present the outcome variable (or variable that we used to measure any potential change or effect). A detailed description of the basic empirical approach can be found in Appendix S2.

Matching methods are statistical processes that help us obtain a comparison group with characteristics as similar as possible to the treatment group (Rosenbaum & Rubin, 1983; Rubin, 1973; Stuart, 2010). We performed the matching at three levels: national, regional, and individual RNP level. In the matching procedure, we controlled for factors that have an impact on earnings, including socio-demographic (e.g., age, economic sector), biophysical (e.g., elevation, precipitation, and regions), and agricultural (e.g., type of agricultural exploitation) factors or variables. Specifically, in the period before RNPs obtained their RNP status (i.e., the pre-treatment period), we matched all the treated groups with comparison groups on these key factors or characteristics (i.e., matching variables). The selection of biophysical and socioeconomic variables for the matching procedures followed theoretical arguments and previous empirical studies. All the data were averaged at the municipality level. We listed all the variables considered in Table 1.

We combined the matching with a difference-in-differences (DiD) estimator (Cunningham, 2021; Dettmann et al., 2020; Imbens & Wooldridge, 2009), which enabled us to assess the average causal effect of the RNP on farmers earnings. DiD is used to understand changes in the outcome before and after an intervention of two groups (treated or municipalities with RNP status

TABLE 1 Overview of selected outcomes and matching variables defined and used in this study.

Variables (all data from 2005 to 2019 averaged at the municipality level)	Theoretical and empirical basis for its selection
Outcome variable (1)	
Agricultural earnings submitted to OASI	Use of OASI data as in Hainmueller et al. (2019) to measure the outcome, circumventing the challenge of using a pseudo panel as other studies (El Benni et al., 2012; Ritzel et al., 2023).
Potential influencing factors	
Male/female	Sex affects earnings (Combet & Oesch, 2019; Ferjani et al., 2015; Lalive & Stutzer, 2010;Ritzel et al., 2023; Wallace & Hoover, 1966).
Age	Age affects earnings (Ferjani et al., 2015; Ritzel et al., 2023; Wallace & Hoover, 1966); also "[a]gricultural knowledge and skills in agriculture, such as production, operation, and management, increase with age" (Guo et al., 2015).
Education/skill level	Education level affects earnings (Ritzel et al., 2023; Wallace & Hoover, 1966); Data not available; However, since 2008, Agricultural Law usually requires farm managers complete formal agricultural education and certification (Otomo et al., 2014; Rossier, 2009; Rossier & Wyss, 2007).
Economic sectors (rates: 1, 2, and 3)	We assumed that population growth or density is related to the economic sector type of the municipality (Economic Sector 1 or primary sector, Economic Sector 2 or secondary sector, and Economic Sector 3 or tertiary sectors). This, in turn, is linked to the type of municipality (rural, intermediate, and urban) (see discussion in Buehler et al. (2012). Municipality type is also correlated with access roads and road access effects (Gellrich & Zimmermann, 2007).
Agricultural exploitation type	Type of exploitation affects income (Hochuli et al., 2021; Roesch, 2012).
Arable land organic/conventional (%)	Financial benefits increase with organic farming (Crowder & Reganold, 2015; Grovermann et al., 2021). Farm exit is negatively influenced by organic farming (Ferjani et al., 2015).
Natural meadows/grassland	Percentage of natural meadows affects income. dairy farms with agritourism best for farm income (Hochuli et al., 2021; Roesch, 2012).
Elevation	Elevation affects agricultural output and income. Linked to region and other variables, such as economic sector and municipality type/density (El Benni et al., 2012; Karali et al., 2014).
Precipitation	Crop production is highly influenced by climatic conditions (Holzkaemper, n.d.); Farm size is affected by biophysical and topographical characteristics; environmental policy measure participation by farmers influenced by biophysical factors (Karali et al., 2014; Lehmann, 2013).
Sun exposure	Crop production is highly influenced by climatic conditions (Holzkaemper, n.d.; Karali et al., 2014).
Temperature	Crop production is highly influenced by climatic conditions (Holzkaemper, n.d.; Lehmann, 2013).
Livestock units (sum)	Farm performance is influenced by type of exploitation and livestock units (Boesch et al., 2011; Hochuli et al., 2021; Roesch, 2012; Schulz et al., 2018).
Region (Jura, Alps)	Geography influence income/farm exit (Buehler et al., 2012; El Benni et al., 2012).
Land management intensity	Data not available. However, a recent study showed that both in- and extensification are lucrative (Spörri et al., 2023).

and comparison or municipalities with no RNP status). In the before or pre-treatment period, both groups are not exposed. In the after or post-treatment period, only one group (the treated group) is exposed to treatment (Schwerdt & Woessmann, 2020). For more detailed information on the empirical approach, see Appendix S2.

The average agricultural earnings submitted to the Old Age and Insurance System (OASI) are our outcome variable. OASI is a mandatory national-level insurance that funds basic needs in old age or eventual death (OASI, n.d.). All adults (ages ranging from 18 to 64 for women and 65 for men) living in Switzerland must

contribute a percentage of their annual income to OASI. Final contributions are determined on the basis of the earnings declaration (AVS, 2024). OASI data from individual farmers are available. We used category or key number 9, which indicates income, including the capital gains (e.g., barn, land, etc.) of self-employed farmers. This is the only category linked to a specific profession. All the other categories (0–8) were excluded as they relate to salaried dependent employees in general, even non-self-employed farmers working in agriculture (OFAS, 2023). The selection of biophysical and socioeconomic variables for the matching procedures followed theoretical arguments and previous empirical studies. All the data were averaged at the municipality level. We listed all the variables considered in Table 1.

2.4 | Databases

We summarize our data types, units, and sources in Table S3a.

For the outcome variable (agricultural earnings submitted to OASI) and two of the covariates (sex and age), we used census data from the Federal Statistical Office (see also SNC) and earnings from the Central Compensation Office. Because agriculture is a highly spatial and localized activity, we assumed that farmers live near their agricultural fields and therefore report earnings in the same municipality in which they work. Furthermore, family farms dominate rural areas in Switzerland (Junquera et al., 2022), making the assumption of farmers' close connection to the land where they work more plausible. The raw dataset included information on 100,797 farmers. Since our initial dataset contained extreme individual values/outliers (e.g., retired farmers selling their farms, or selling agricultural land), we excluded the top and bottom 5% earnings of the entire individual earning distribution from the analysis (using Stata version 17: *extreme*, graph box to visualize them and *trim* to exclude them (Cox, 2013)).

For the economic sector covariates and type of farms per municipality, we used Federal Statistical Office raw data. For the biophysical covariates (sun exposure, precipitation, and temperature), we used Meteoswiss open-access data in raster format (maps were translated into values in a CSV file using ArcMap 10.8.1). For the other agricultural-related covariates, we used data hosted by the Agricultural Policy Information System of the Federal Office for Agriculture. The Agricultural Policy Information System comprises all farms in Switzerland. National, cantonal, and municipality boundaries and elevation (shape files) data were obtained through Swisstopo open-access data. Municipalities in Switzerland have been undergoing a process of amalgamation, where one or two municipalities may have merged into another or various municipalities create a new municipality. For this, we used the Data Merger Tool developed by Knechtl and Stutzer (2021).

The FOEN provided RNP boundaries and area shape files (version 2020, before the new charter cycle, when new municipalities joined or left the RNPs). We used QGIS version 3.16.4 to combine the location of the RNP and municipality data and confirmed that municipalities and RNPs overlapped using data provided by the Swiss Parks Network. We averaged all data at the municipality level to form a panel dataset for the entire study period (2005–2019). See Table S3b for descriptive statistics of the main variables.

Raw data on individual earnings submitted to OASI and census data from 2000 to 2020 are sensitive and provided by the Central Compensation Office and Federal Statistical Office, respectively; these institutions require a formal contract stipulating maximum data confidentiality. Although these institutions provide data using pseudonymized identifiers, the potential identification of individuals from municipalities with fewer than four farmers/farms is possible through variable combinations (e.g., type of agricultural activity, gender, and age). A similar identification may be possible for average data at the municipality level. For these reasons, we cannot share the final database used in this study. For data cleaning and analysis, we used *Stata version 17*. Specific packages for analysis included SCM (Abadie et al., 2010; Abadie & Gardeazabal, 2003) and FlexpanelDiD (Dettmann et al., 2020).

3 | RESULTS

3.1 | National and regional levels

At the national level, matching variables tended to be balanced between the treatment and comparison groups, which indicates required statistical aspects of the process are met (see Appendix S4). At this level, we observed no effect of RNPs status on the average agricultural earnings submitted to the OASI of farmers living in municipalities inside the RNPs (Table 2).

At the regional level, Appendix S4 shows the nearest neighbor matching procedure. Similar to the national-level analysis, matching variables tended to be balanced between treatment and comparison units at the three regional levels, which suggests the required statistical aspects are met. Similar results were obtained for the Jura and Alps regions, with no effect of RNP status on the average agricultural earnings submitted to the OASI of

TABLE 2 Conditional[a] difference-in-differences.

Outcome	Mean difference		DiD[b] (CH)	AI robust standard error	z	$p > z$	[95% confidence interval][c]
	Treated (CH)	Comparisons (CH)					
Avg. earnings	9900	9915.6	−15.6	1700	−0.0091	0.992	−3347.6, 3316.4

Note: Average treatment effect for the treated ATT. Estimator: nearest neighbor. Distance metric: statistical DF. No. of treated observations = 167. No. of unique comparisons = 141. Mean no. of matches = 1. Treated here refers to the number of municipalities that are part of a RNP.

[a]When the "parallel trends assumption" holds potentially only after conditioning on observed covariates (Callaway & Sant'Anna, 2020).

[b]Consistent bias-corrected estimator as proposed in Abadie and Imbens (2006, 2011). AI: Abadie–Imbens robust standard errors (adjusted for heteroskedasticity).

[c]We manually calculated the 95% confidence intervals following Altman and Bland (2005).

TABLE 3 Conditional difference-in-differences per region.

Region- Av. earnings	Mean difference		DiD[a] (CH)	AI robust standard error	z	$p > z$	[95% confidence interval]
	Treated (CH)	Comparison (CH)					
Jura	10,100	12,000	−1900	2400	−0.7901	0.431	−6604, 2804
Alps	7700	9600	−1900	3800	−0.504	0.616	−9348, 5548

Note: Average treatment effect for the treated. Estimator: nearest neighbor. Distance metric: statistical DF. No. of treated observations = Jura: 81; Alps: 54. No. of unique comparisons = Jura: 50; Alps: 48. Mean no. of matches = 1.

Abbreviation: AI, Abadie–Imbens robust standard errors (adjusted for heteroskedasticity).

[a]Consistent bias-corrected estimator as proposed in Abadie and Imbens (2006, 2011).

farmers living in municipalities inside the RNPs. The conditional DiD estimation is presented in Table 3.

3.2 | Individual/cantonal level

Matching based on the synthetic control method (SCM) shows mostly balanced variables (see Tables S5a–g of Appendix S5), which are important statistically. Some RNPs attained better balanced matching than others.

Our results showed that 11 of the 13 RNPs studied and established between 2010 and 2013 had neither positive nor negative effects on the outcome of interest (average agricultural earnings submitted to OASI) (Figure 2). Only for the Beverin and Jura Vaudois RNPs did we find statistically significant negative treatment effects. We summarized the DiD estimator, *p*-values, and confidence intervals per RNP (Table 4). We provide a visual of the mean, confidence intervals, and *p-values* for all studied RNPs in Figure S5a. We provide a figure that shows the mean post-treatment effect with confidence intervals and *p*-values for the Beverin and Jura Vaudois RNPs (Figure S5b,c).

4 | DISCUSSION

Impact evaluations inform decision makers on the effect of an intervention and determine the paths toward its adaptation if needed. In general, in our study, the RNP status has not shown a positive effect on the agricultural earnings of farmers located inside the RNPs. We argue that null results are rather due to limited potentials of RNPs to increase earnings of farmers inside the RNPs instead of statistical theoretical and methodological aspects. Therefore, we focus on presenting the limited RNP potentials to increase earnings of farmers living inside the RNPs, while discussing potential sources (i.e., agro-tourism and labeled products) that could create a positive RNP effect. We briefly discuss the statistical problems that could potentially account for the null results in our study in Appendix S6.

Only in two of the RNPs (Beverin and Jura Vaudois), we found a statistically significant negative treatment effect. Particularly for Beverin, our findings are surprising because Reutz et al. (2021) found that the majority of Beverin's population perceived too many RNP activities focusing on farmers during its charter evaluation. However, the negative treatment effect between the treatment and comparison groups diminished toward the end of the post-treatment period for both RNPs. The negative treatment effects could be explained by post-treatment changes in the composition or structure of farm types in the municipalities of the comparison or treatment groups (e.g., farms switching to other types of production for a specific reason, or farms may be increasing or decreasing in size at a higher rate).

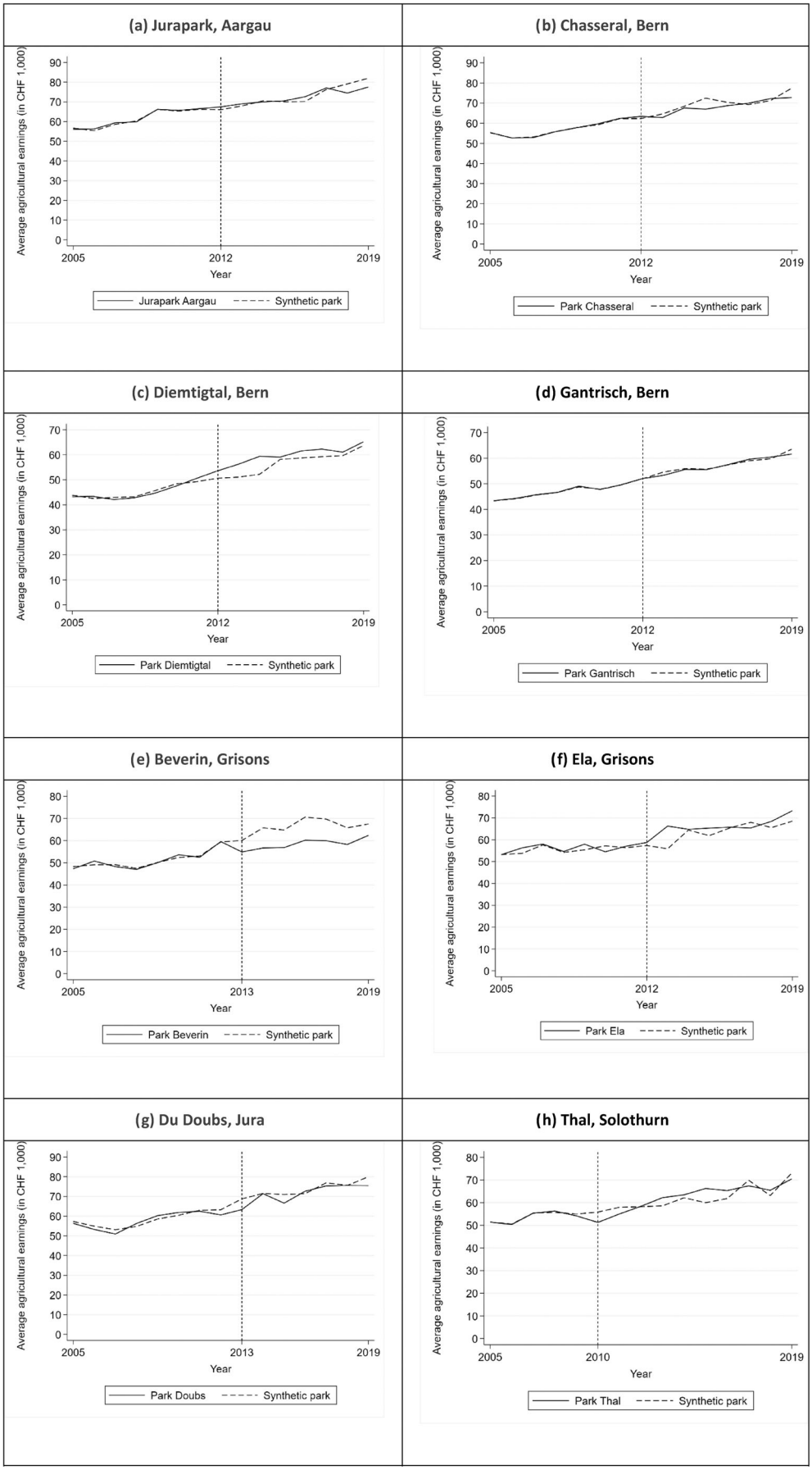

FIGURE 2 Synthetic control method graphs per RNP.

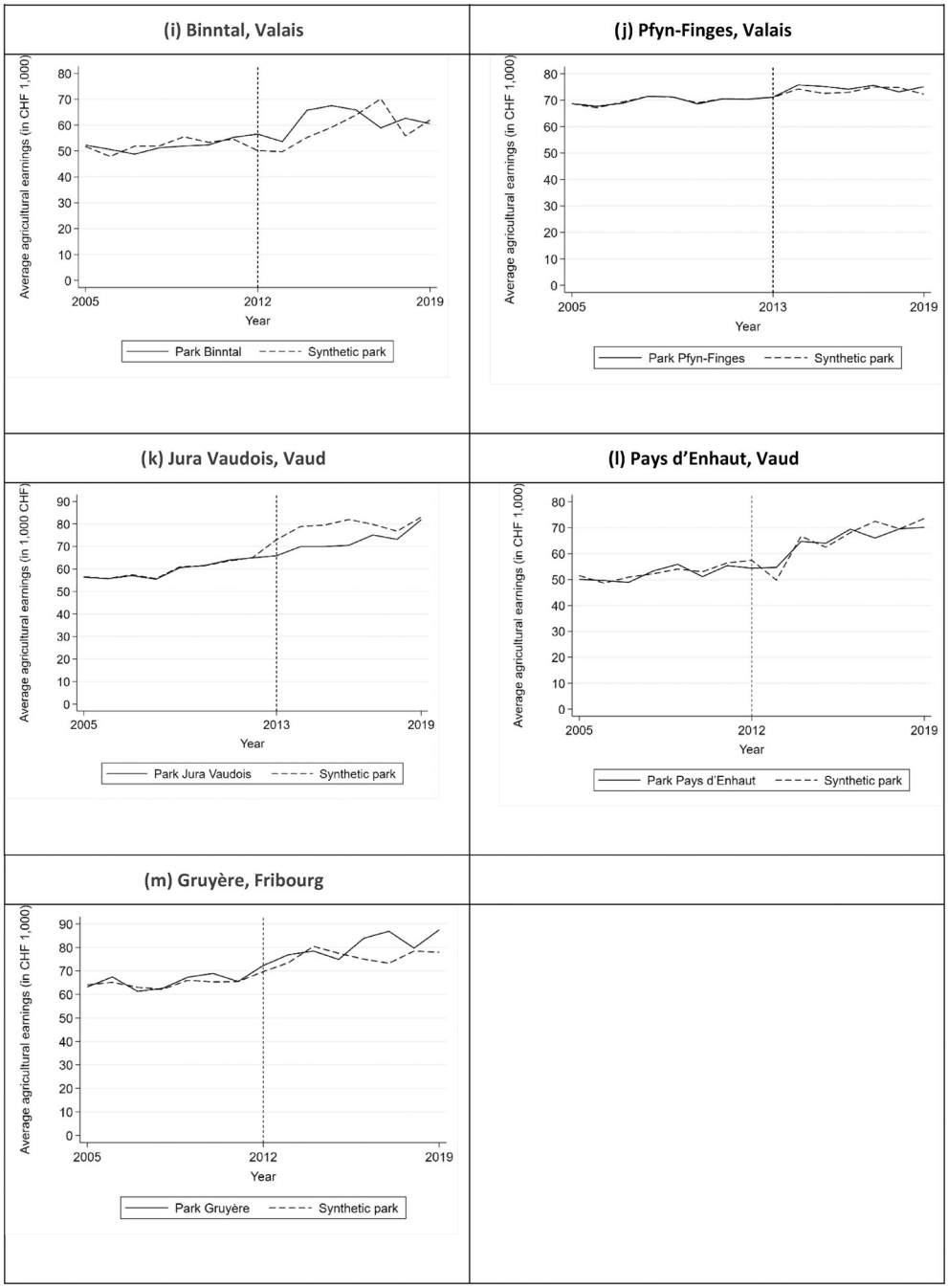

FIGURE 2 (Continued)

A feasibility study on the potential economic effects of Chasseral, Diemtigtal, and Gantrisch RNPs in the canton of Bern and before their establishment (Siegrist et al., 2007) may provide some indication for the lack of treatment effect in at least the Bernese RNPs. The study concluded that the regional economic potential of these three RNPs was rated as medium. According to the authors, "Regional Nature Parks should be seen as a catalyst rather than a driver of the rural economy in the Canton of Bern" (p. 63). "Their direct contribution to value creation is only significant where economic alternatives [e.g., tourism] are available" (Siegrist et al., 2007, p. 63; translated from German to English in DeepL.). A recent study conducted by Hochuli et al. (2021) revealed that dairy farms combined with agritourism have a better farm income in rural areas in Switzerland. Furthermore, certain RNPs (i.e., Binntal, Ela, Jura Vaudois, and Gantrisch) generated a tourism-added value of 1.5–6 times higher than public funds invested by the three Swiss administrative levels (Knaus, 2018). A study by

TABLE 4 Difference-in-differences estimator after SCM, *p*-value, and confidence interval per evaluated RNP.

RNP code/name/Canton	DiD estimator (CH)	Robust std. err.	*p*-value	[95% confidence interval]
1. Beverin/Grisons	−7872.5	2584.4	0.005	−13,185.0, −2560.1
2. Ela/Grisons	2076.6	2391.4	0.393	−2839.0, 6992.4
3. Jurapark/Aargau	−634.8	3449.0	0.855	−7724.5, 6454.7
4. Pfyn-Finges/Valais	1053.8	1090.9	0.343	−1188.5, 3296.2
5. Binntal/Valais	3791.5	3269.5	0.255	−2908.5, 10491.7
6. Gruyère/Fribourg	3625.7	2626.0	0.179	−1772.2, 9023.7
7. Pays d'Enhaut/Vaud	−542.6	3914.6	0.891	−8589.3, 7504.0
8. Jura Vaudois/Vaud	−6548.6	2950.9	0.035	−12,614.3, −482.9
9. Gantrisch/Bern	−75.0	1147.0	0.948	−2432.7, 2282.7
10. Chasseral/Bern	−1496.6	2799.9	0.598	−7252.0, 4258.8
11. Diemtigtal/Bern	3339.4	2629.5	0.215	−2065.7, 8744.6
12. Du Doubs/Jura	−2770.9	2804.9	0.332	−8536.6, 2994.6
13. Thal/Solothurn	−3224.5	5166.2	0.538	−13,843.8, 7394.7

Note: The Arellano–Bond test indicated that for the Gantrisch, Du Doubs, and Thal RNPs, we observed autocorrelation at Lag 1. Accordingly, we used the Prais–Winston regression to correct for autocorrelation and included the results for these three RNPs in this table and Figure S5a.

Bänninger (2020) shows that tourists, hotel guests, and society in general have become more interested in and aware of the origin, processing, freshness, seasonality, and labeling of their food. Agritourism providers could improve further by making simple decisions, such as offering regional fruit juices instead of exotic ones (Bänninger, 2020). Nevertheless, we need to remain cautious. Given the characteristics of park tourism in Switzerland, which are similar to those in Germany, seeing an effect on income may imply important changes (e.g., tax rates, supply ties to the regional economy, and enterprises' cost structures) (Mayer et al., 2010).

Another aspect where the RNP is having limited potential could be related to the number of service and product labels farmers solicit and acquire. Although labeled food products have gained popularity in Western economies, they represent a small part of total food consumption (Larceneux et al., 2012). The situation in Swiss RNPs may be similar, as most RNPs have been in existence since 2012, reducing the time labels can show an effect on farmers' earnings. Although over 1700 products have been labeled in 14 Swiss parks of national importance (SPN, n.d.-c), the number of farmers seeking to label their products may remain low in the Swiss RNPs. This is due to the existing constellation of diverse and already positively recognized (by consumers) regional (including mountain attributes) and national labels, reducing the perceived benefit of a specific RNP product label while increasing the costs through an additional certification process (personal communication, Valais wine producer) (see also SPN, n.d.-b; McMorran et al., 2015; Schwab, 2017). A similar case happens between organic and mountain product certifications in Italy, where the mountain product certification masks that of organic certification (Mazzocchi & Sali, 2022). Thus, farmers with labeled products still represent a small part of the total number of farmers in the RNPs, making it difficult to capture a large enough effect of the RNP status on farmers' earnings.

Considering all these implications, RNP management, farmers, and relevant federal institutions can create incentives and build up in number and quality the activities and approaches that could help achieve a large positive RNP status effect. In a Biosphere Reserve in Germany, Kraus et al. (2014) observed that for an established local label, tourism and food processing enterprises differed in their economic conceptions and means of production compared to the comparison group. The authors identified the relationships between these enterprises as a precondition for following a new and more sustainable means of production.

Overall, optimal outputs and impacts of RNPs require a close relationship between farmers and RNP management (Trachsel et al., 2021). Further promotion and investment in a farmer's uptake of these activities is needed within RNPs. For example, in the Gruyère Pays d'Enhaut RNP, even though most farmers were unable to participate in RNP activities given their farm commitments and may be skeptical of RNPs' economic impacts in the short and long term, farmers tended to see the RNP in a positive light (Butticaz, 2013). Nevertheless, the implementation and assessment of approaches for mainstreaming agriculture into RNPs are lacking in agricultural advisory bodies and RNP management (Trachsel

et al., 2021). In the Thal RNP, Angst and Hirschi (2017, p. 316) found anticipated developments in the network dynamics of creating "bonding social capital" over time. However, they did not observe a trend toward a more decentralized and less hierarchical organization. Uptake of activities happens through homophily (the principle that contact between similar [actors] occurs at a higher rate than among dissimilar [actors]; McPherson et al., 2001, p. 416). Our results serve as a basis for policymakers, RNP managers, and farmers to derive and ensure the existence of measures that enhance the economic situation of farmers in the RNPs.

We acknowledge that our study focuses on RNP (analogous to IUCN category V) and that the results may not be applicable to other types of protected areas with stricter conservation statuses.

5 | CONCLUSIONS

In this study, we investigated the effect of RNP status on farmers' agricultural earnings at three levels (national, regional and individual). For this purpose, we used a quasi-experimental research design that combined matching techniques with DiD. The main findings of this study include the lack of effects on farmers' earnings for most of the evaluated RNPs established between 2010 and 2013 and at the three levels of analysis. Two of the RNPs studied showed a statistically significant negative treatment effect of the RNP on farmers' agricultural earnings. However, the negative treatment effect has been diminishing in recent years in both RNPs. The implications of these results for the different RNP stakeholders include further research on the potential mechanisms that foster or hinder RNPs from achieving their sustainable development objectives. Designing and implementing additional impact evaluations of different outcomes, such as revenues from agritourism and tourism, become important, as either a combination of economic activities (agritourism) or alternatives to agriculture (e.g., tourism) could be the activities that may drive an earnings' increase in RNPs. Future studies could replicate previous impact evaluations, conduct meta-analyses of impact evaluations, and use other relevant outcomes to measure the achievement of RNP objectives. Through our study, we contribute concretely to the impact evaluation literature, heeding the calls of several scholars, combining methods and levels of analysis. More importantly, our findings can help adapt RNP management to support livelihoods dependent on and conserving nature.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ORCID

Marina Cracco https://orcid.org/0000-0003-0834-648X
Christian Ritzel https://orcid.org/0000-0002-9020-6648

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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