The geography of political ideologies in Switzerland

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Abstract

In this paper, partisan-sorting forces and income-sorting processes are hypothesized to be interrelated phenomena leading to the clustering of people having similar levels of income and political ideologies. This paper determines the predominant political ideology of each Swiss municipality and examines whether there is any spatial concentration of political ideologies. The contribution of this research is that it proposes a new way to capture social interactions, based on the geographical concentration of political ideologies, and it shows that these concentrations are correlated with income and income inequality.

JEL classification: O18, O43, P48, R1

Keywords: Political ideologies, Economic geography, Spatial cohesion, Geography of discontent.

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1. Introduction

Geographical sorting processes are phenomena that many societies all over the world have been experiencing for centuries, usually leading to the clustering of population based on socio-economic, religious or ethnic characteristics. Following the economic literature, individual income level plays an important role in sorting processes. On one hand, income could represent a constraint in the residential decision of people, as already formalized in the bid-rent theory (Fujita, 1989, based on the pioneering work of von Thünen, 1826 and Alonso, 1964), and, on the other hand, as already highlighted by Tiebout (1956), people prefer to live close to other people who are similar to themselves, also in terms of wealth. From an alternative perspective, in the political science literature there has been an increasing interest in the phenomenon of partisan sorting, which analyzes whether individuals are nowadays more geographically sorted according to their political preferences (Bishop, 2008; Abramowitz, 2010; Abrams and Fiorina, 2012; Tam Cho et al., 2013). Moreover, the literature on voting behavior highlights how individual socio-economic characteristics are important predictor of political preferences (Meltzer and Richard, 1981; Rueda and Stegmueller, 2014). This implies that people sorting themselves based on socio-economic characteristics are also expected to share similar political ideologies. Hence, various sorting processes are hypothesized to cluster people with similar political preferences and analogous socio-economic characteristics. The clustering of people having similar political ideologies as well as similar levels of income links to recent findings on the importance of economic geography and regional differences in terms of economic welfare in explaining how people vote. The results of the Brexit referendum represent a key example, clearly showing that the level of local economy was an important driver, even after carefully controlling for individual characteristics (Los et al., 2017). This has led to the term "the geography of discontent", referring to the spatial distribution of discontent in a country, reflecting inequalities between regions in terms of economic welfare (Los et al., 2017; Rodríguez-Pose, 2017; McCann, 2018). Hence, as already highlighted by O'Laughlin et al. (1994), the spatial dimension is extremely important and needs to be considered.

The aim of this paper is to propose a new definition of spatial cohesion, representing a new way to capture social interactions, based on the geographical concentration of political ideologies. More specifically, this paper contribute to the existing literature by empirically identifying whether there is any spatial concentration of political ideologies in the context of Switzerland and determining the spatial extension of these concentrations. Moreover, this study analyzes whether this clustering of political preferences is correlated with income and income inequality. The analysis focuses on

Switzerland, which represents a very interesting case because it practices a semi-direct democracy, which allows having a rich dataset on many referenda, which is independent from short-term, candidate-related and party-related factors.

Following Hermann and Leuthold (2003), this paper analyzes the results of 312 federal referenda between 1981 and 2017 at the municipal level. This study identifies Hermann and Leuthold (2003)'s three dimensions representing the Swiss political ideology space and expressing the following political beliefs: left vs. right, liberal vs. conservative and ecological vs. technocratic. Additionally, on each of these three dimensions, this paper empirically assesses the existence of spatial concentrations of Swiss municipalities sharing the same political ideology. This result is particularly interesting because it shows that the various sorting processes leading to the concentration of people sharing similar political preferences extend beyond municipal borders. Finally, based on these results, this research finds significant differences in the level of income and income inequality of Swiss municipalities, depending on their belonging to a political ideology cluster. This result contributes and further supports the findings and claims of other scholars, related to the concept of "the geography of discontent", according to which economic geography is particularly important in understanding how people vote.

The rest of the paper is organized as follows. Section 2 presents a review of the related literature. The third and fourth sections describe the methodology and the database adopted for this research, respectively. In section five the results are presented and discussed, and the last section concludes.

2. Literature review

Clustering processes refer to the geographical aggregation of people, usually sharing a specific characteristic, and are often the result of spatial sorting phenomena. Spatial sorting refers to the redistribution of population groups into different neighborhoods in both urban and non-urban areas (Kawachi and Berkman, 2003) and is a key characteristic of many cities and nations across the world (Bailey et al., 2017). In fact, for centuries societies have been experiencing processes of spatial sorting, typically based on socio-economic, religious or ethnic characteristics. Economists, among others, have been studying this phenomenon for many decades. Already in the classic framework of the bid-rent theory (Alonso 1964; Beckman, 1969; Muth, 1969; Mills 1972 based on the pioneering work of von Thünen, 1826), as shown by Fujita (1989), the price for real estate, changing with the distance from the city center, shapes the residential choices of various income groups within a society, generating income sorting. In this setting, spatial sorting is the result of different willingness to pay

for different income classes. Another growing body of literature in economics links sorting processes to social interactions (Schelling, 1971; Clark, 1991; Fossett, 2006), where residential decision are driven by individual preferences for the neighborhood composition. In particular, people prefer to live in places in which other people are similar to themselves (McPherson et al., 2001; Musterd et al., 2015). The idea that people with similar preferences cluster in particular municipalities is the focus of another important stream of literature in economics, which goes back to Tiebout (1956), where, in a fiscal decentralized setting, people sort themselves according to their preferences to achieve an efficient provision of local public goods. This model has then been extended to analyze the important role of differences in income in explaining sorting processes (Ellickson, 1971; Westhof, 1977; Ross and Yinger, 1999; Schmidheiny, 2006). Hence, various theoretical frameworks analyze and give possible explanations of those sorting processes which can be found in many contexts all over the world.

From a slightly different perspective, in the political science literature, there has been a growing interest in the phenomenon of partisan sorting and there is currently a large debate on whether individuals are nowadays more sorted according to their political preferences. As highlighted by O'Laughlin et al. (1994), the spatial dimension is extremely important and needs to be considered in order to fully understand the political forces underlying this phenomenon. This is particularly relevant whenever the political power is partially decentralized (such as in a federal political system), given that various political institutions and political ideologies within the same country can generate different political contexts. Various studies find that, in the last decades, there has been an increase in the geographic polarization of voters (Kim et al., 2003; Bishop, 2008; Abramowitz, 2010; Wing and Walker, 2010; Tam Cho et al., 2013; Kinsella et al., 2015; Lang and Pearson-Merkowitz, 2015). The potential causes of this geographic polarization of voters are partisan migration, generational replacement and the fact that parties are more polarized, making it easier for voters to identify themselves with a party (Vegetti et al, 2017). Bishop (2008) argues that a potential drawback of this sorting process is that homogeneous communities might encourage extremism by ignoring differing opinions. In contrast with these results, other authors find that voters are nowadays no more geographically sorted than in the past and relativize its importance (Glaeser and Ward, 2006; Levendusky and Pope, 2011; Abrams and Fiorina, 2012; Strickler, 2016).

The vast majority of the studies analyzing the phenomenon of partisan sorting and polarization are based on presidential election in the US. As highlighted by Abrams and Fiorina (2012), data based on presidential elections are weak, because they are the result of short-term, candidate-related and party-related factors. Moreover, it is difficult to capture the complexity of the distribution of political

ideologies with a single manifestation of the personal political preference, occurring only once every four years.

Additionally, the literature on voting behavior finds that socio-economic characteristics, such as income and the degree of income inequality, determine voting outcomes and are important predictors of party choice, at the individual level (Meltzer and Richard, 1981; McCarty et al., 2008, Rueda and Stegmueller, 2014).

Hence, different sorting processes are, on one hand, hypothesized to group people sharing political preferences which are very much alike, and, on the other hand, cluster people with analogous socio-economic characteristics, in particular with similar levels of income. At the same time, according to the literature on voting behavior, people sorting themselves based on socio-economic characteristics are also expected to share similar political ideologies. The implication is that partisan-sorting forces and income-sorting processes are likely to be interrelated phenomena, leading to the clustering of people having similar levels of income and political ideologies. The hypothesis of clusters of people with similar political preferences as well as analogous levels of wealth links to recent findings on the importance of economic geography and regional differences in terms of economic welfare in explaining how people vote, in particular when the vote is used as a "mean of protest". In particular, the results of the Brexit referendum, in which voters were asked whether they wished to leave or remain in the European Union, represent a key example, clearly showing that the level of local economy was an important driver (Los et al., 2017; Chen et al., 2018; Crescenzi et al., 2018). In fact, people in regions with lower levels of income who perceived to have suffered from modern globalization were more likely to vote "leave" than those from areas with higher levels of income (McCann, 2018). This has led to the term "the geography of discontent", referring to the spatial distribution of discontent in a country, reflecting inequalities between regions in a country (Los et al., 2017; Rodríguez-Pose, 2017; McCann, 2018).

This paper contributes to the existing literature by proposing a new definition of spatial cohesion, based on the geographical concentration of political ideologies. In particular, the aim of this research is to empirically identify whether there is any spatial concentration of political ideologies in the context of Switzerland in order to determine in a new way the existence of social interactions, and determine the spatial extension of these concentrations. Moreover, following the argument of "the geography of discontent", this study analyzes whether this concentration is correlated with income and income inequality.

Switzerland represents a very interesting case because it has strong institutions, it is a federal republic with highly decentralized political power and, at the same time, it practices a semi-direct democracy, in which Swiss citizens directly vote on various issues. More specifically, any constitutional change needs to be approved by a mandatory referendum. Furthermore, an optional referendum can be demanded for any change in the Swiss law decided by the federal parliament . Additionally, any Swiss citizen may propose a popular initiative to introduce amendments to the federal constitution . The outcome of any vote is legally binding. Approximately, Swiss citizens vote four times a year and the most frequent topics on which they vote are healthcare, taxes, social welfare, drug policy, public transport, immigration, political asylum and education. The availability of referendum data allows overcoming the limitations of presidential election data mentioned above, and better determining the spectrum of political ideologies of voters. In particular, given that Swiss citizens directly express their opinion on various issues, the information available is independent from short-term, candidate-related and party-related factors. Moreover, the political preference is manifested several times every year. Hence, unlike the analyses on presidential elections or the Brexit referendum, this study simultaneously considers the results of several referenda, capturing the underlying long-term structure of political ideologies.

3. Methodology

The analysis presented in this study proceeds in three phases. The first step is to identify what is the political ideology of each municipality in Switzerland. Second, a spatial cluster analysis is performed in order to determine whether and where there is a significant geographical concentration of political ideologies. Finally, some tests are carried out to analyze whether the level of income and income inequality of municipalities belonging to different political ideology clusters are significantly different.

The first task is to establish the political ideology of each municipality. To do so, this study follows Hermann and Leuthold (2001; 2003), by considering the federal referenda collected at the municipal level in Switzerland and performing an exploratory factor analysis on them. The underlying idea is that the referenda are the observed outcome of fewer independent and unobserved dimensions characterizing the political ideology space. This hypothesis is supported by qualitative and quantitative considerations related to the data used. In particular, from a qualitative perspective, several referenda concern the same (or at least very similar) topic. One can therefore expect that the outcome of referenda on similar topics are highly correlated because are driven by the same underlying political preference. Indeed, from a quantitative perspective, the distribution of referenda shows that they are spatially associated, indicating that the variance of the referenda exhibits similar

patterns. In order to maximize the explained variance, the exploratory factor analysis is performed with VARIMAX-rotation.

The results of the factor analysis allow extracting the statistical relationship among the referenda in order to determine the underlying unobserved factors. However, as highlighted by Hermann and Leuthold (2003), in order to meaningfully interpret them and identify the related ideological content, a qualitative interpretation of the specific political objects is needed. The combination of the factor analysis with the qualitative inspection of its results allows finding the dimensions representing the Swiss political ideology space.

In the second step, in order to measure the degree of geographical concentration of the political ideology, a spatial cluster analysis is performed. Following Kim et al. (2003), Darmofal (2008), Wing and Walker (2010) and Kinsella et al. (2015), this study computes the vector of Local Moran's I statistic (Moran, 1948; Cliff and Ord, 1981; Anselin, 1995) for each factor identified in the previous phase. The Local Moran's I statistic associates a vector of observed values of a specific variable with a weighted average of the neighboring values and compares the real distribution with random spatial distributions, in order to capture significant spatial pattern. In particular, this analysis is able to establish whether a municipality has a significantly high (low) value on a specific factor and is surrounded by municipalities with high (low) values on the same factor, or whether the value of the municipality is not significantly high or low. Hence, this analysis allows determining if and where there is a significant geographical concentration of the different typologies of political ideologies identified with the previous step.

Finally, the analysis focuses on empirically testing whether there is any evidence suggesting that there are significant differences in the level of income and income inequality of municipalities belonging to different typologies of political ideology clusters. The aim of this exercise is to verify the importance of economic geography in understanding how people vote within the Swiss context, by simultaneously considering the results of several referenda, capturing the underlying long-term structure of political ideologies. To do so, Kruskal-Wallis tests are performed (Kruskal and Wallis, 1952). Similar to ANOVA, this test is used to verify whether the distribution of a specific variable is significantly different between more than two independent groups. However, differently from ANOVA, the Kruskal-Wallis test does not require the assumptions of homogeneity of variance between the groups and the normality of residuals. The result of the Kruskal-Wallis test indicates whether there are significant differences among the groups, however, it does not provide information regarding which pairs of groups are significantly different. Hence, this final phase is extended by computing the Dunn's test (Dunn, 1964), which is a post hoc pairwise multiple comparison suitable

to deepen the analysis after a rejection of the Kruskal-Wallis test. In order to account for the fact that multiple comparisons are conducted at the same time, Dunn's tests are performed with the Benjamini-Hochberg procedure (Benjamini and Hochberg, 1995).

4. Data

This research analyzes the results at the municipal level concerning all the 312 federal referenda between 1981 and 2017. This information is obtained from the section Politics, Culture and Media of the Swiss Federal Statistical Office (FSO)[2]. In particular, the factor analysis performed in order to identify the political ideology of each Swiss municipality is computed on the yes-share of all the 312 federal referenda considered[3]. In order to compare and combine the data in terms of geo-political unit, all the referenda are based on the 2017 municipal definition of the FSO, which includes 2240 municipalities.

As explained above, the most frequent topics on which Swiss citizens vote are healthcare, taxes, social welfare, drug policy, public transport, immigration, political asylum and education. In order to capture changes in the political ideology of each municipality through time, the factor analysis is computed on different time-subsamples of the whole dataset. In particular, the first subsample considers all the 65 referenda between 1981 and 1990, the second subsample takes into account all the 106 referenda between 1991 and 2000; the third one contains all the 82 referenda between 2001 and 2010, and the fourth subsample considers all the 59 referenda between 2011 and 2017. As the results show, given that the Swiss population periodically votes on the same topics, the factor analyses computed over different time-subsamples generate factors which are built in a very similar way, allowing comparing the results from different periods.

To perform spatial analyses, there exist different specification of the spatial dependence matrix, W. In order to take into consideration the impact of the extremely uneven topographical context of Switzerland[4] on the actual distance between two municipalities, this study considers a spatial weight matrix based on the inverse travel time between the centroids of the municipalities. Travel time data are provided by the Swiss Federal Office for Spatial Development and consider the trip by car in minutes. To keep the spatial analysis at a local level, after examining the distribution of distances between Swiss municipalities, a cutoff is imposed at a distance of 20 minutes travel time.

[2] It is possible to download the municipal-level results of Swiss referenda at the following webpage: https://www.bfs.admin.ch/bfs/de/home/statistiken/politik/abstimmungen/stimmbeteiligung.assetdetail.3362356.html
[3] The factor analysis is able to account for the fact that the wording of referenda on similar topics could be inconsistent, by giving positive or negative factor loadings.
[4] Switzerland is characterized by flat areas and regions with very high mountains.

Moreover, following the spatial econometric literature (Anselin, 1988; Kelejian and Prucha, 1998; LeSage and Pace, 2009), the W matrix has been standardized, such that each row sums to unity.

In the final part of this research, the aim is to test whether there are significant differences in the economic welfare level of municipalities belonging to different typologies of political ideology clusters. In particular, this study considers the median income and the Gini coefficient of the income distribution of each municipality. All these variables are obtained from the Swiss Federal Tax Administration. The analysis is done for each of the four time-subsample and the reference year for the economic welfare variable is the first year of the considered period[5].

5. Results and discussion

This section first presents the results of the exploratory factor analysis and describes the identified dimensions of the political ideology space. Subsequently, the results of the spatial cluster analysis are shown. Finally, the discussion ends focusing on the results of the tests, which aim at verifying whether there are significant differences in the income level and income distribution of municipalities belonging to different typologies of political ideology clusters.

Factor analysis

In order to be consistent with the existing literature on the identification of the Swiss political ideology structure, this study follows Hermann and Leuthold (2003) and performs a factor analysis[6] for each period identifying the same three unobserved factors they found. These three factors are able to capture between 55 and 60% of the overall variance of all the referenda, depending on the period considered. This indicates that the majority of political ideologies in Switzerland can be represented by three main dimensions. In order to give a meaningful interpretation to the resulting factors, the analysis considers from a qualitative perspective the ideological content of the referenda building them.[7]

Considering the most important referenda building factor 1 in the period 1981-1990, factor 3 in the period 1991-2000, factor 2 in the decade 2001-2010 and factor 1 in the period 2011-2017, it emerges that they are based on topics related to the protection of the workforce (e.g. the popular initiative on shortening working hours in 1988, the popular initiative for a flexible retirement age in 2000, or the popular initiative for a minimum wage in 2014), the welfare state (such as the amendment

[5] For the third period, data on median income and Gini coefficients are not available for the year 2001. Hence, information for the year 2003 are used instead.
[6] The results of the factor analysis are reported in Appendix A.
[7] The final factors are built considering all the votes whit a factor loading of at least 0.5 (in absolute terms).

to the federal law on aged and bereaved insurance in 1995, the popular initiative "Health has to be affordable" in 2003, or the popular initiative for a basic income in 2016), and the national security policy (for example the popular initiative for a Switzerland without army and a comprehensive policy of peace in 1989, the popular initiative for a voluntary civilian peace service in 2001, or the popular initiative on the abolition of compulsory military service in 2013). Hence, as in Hermann and Leuthold (2003), these factors represent the "Left-Right" dimension of the political ideology space. In particular, these factors are capturing the debate between those who are in favor of the welfare state, the protection of the workforce, personal freedom and pacifism on one hand (i.e. with a left-wing perspective), and on the other hand those that have more propriety-oriented values, support the military strength and entrepreneurial freedom (i.e. with a right-wing perspective).

A different dimension of the political ideology structure of Switzerland is represented by factor 3 in the decade 1981-1990, factor 1 in the period 1991-2000, factor 1 in the decade 2001-2010 and factor 2 in the period 2011-2017. Analyzing the main referenda contributing to the construction of these factors, it appears that they link to topics related to foreign integration (such as the federal decree for a review of the procedure for naturalizing young immigrants in 1994, the popular initiative against the construction of new minarets in 2009, or the popular initiative against mass immigration in 2014), liberal economic policies (e.g. the federal decree on joining Bretton Woods in 1992, the popular initiative for Switzerland to join the United Nations in 2002, or the federal decree on extending the agreement on free movement of people to new countries of the European Union in 2005), and regulatory modernization (for example the federal law on government and administrative organization in 1996, the federal decree on a new Swiss Federal Constitution in 1999, or the federal decree on the non-introduction of public initiatives in 2009). Also in this case, the results are in line with those of Hermann and Leuthold (2003), in fact, these factors express the "Liberal-Conservative" dimension of the political ideology space. In particular, this dimension is representing the debate between those who support the opening of the country, are in favor of liberal economic policies and the modernization of institutions (i.e. with a liberal attitude), and those who are more skeptical towards changes and the opening of the country, prefer to preserve the existing regulations and mistrust the political and economic elites (i.e. with a conservative attitude).

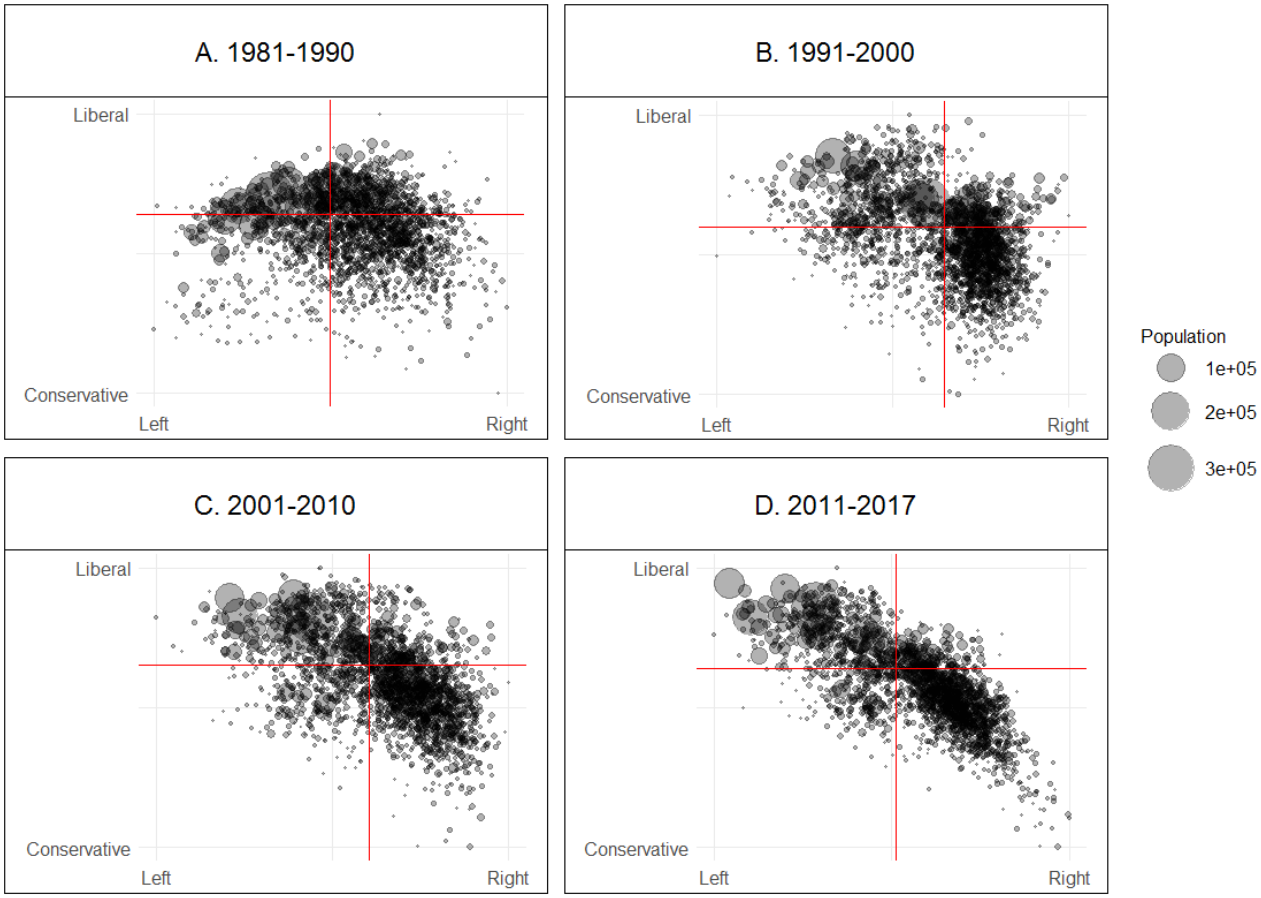
Finally, the third dimension of the Swiss political ideology space is captured by factor 2 in the decades 1981-1990 and 1991-2000, and factor 3 in the periods 2001-2010 and 2011-2017. This dimension is based on topics related to traffic (e.g. the popular initiative "Stop the concrete - for a limitation on road making" in 1990, the popular initiative for the protection of the alpine region from traffic in 1994, or the popular initiative on lowering the urban speed limit to 30 km/h in 2001), and

environmental protection (such as the federal decree on varying tolls based on engine power or mileage in 1994, the federal decree on providing enhanced legal protection for animals in 2010, or the popular initiative for the introduction of a tax on non-renewable energy in 2015). These factors represent the "Ecological-Technocratic" dimension identified by Hermann and Leuthold (2003). More specifically, this dimension expresses the debate between those who support the protection of the natural environment and are in favor of policies reducing the negative impact of human activities on nature (i.e. with an ecological attitude), and those who believe that the natural environment should be transformed to create more security and comfort, and used to generate technological progress (i.e. with a technocratic attitude).

The results of the factor analysis show that the political ideology of Swiss municipalities can be represented in a three-dimensional space, in which the three independent axes express the following political debates: left vs. right, liberal vs. conservative and ecological vs. technocratic. Figure 1 shows the political ideology position of Swiss municipalities on two of these three dimensions, for each considered period. In particular, the horizontal axis expresses the "Left-Right" dimension, while the vertical axis maps the position of each municipality on the "Liberal-Conservative" dimension[8]. Each dot represents a municipality, and the size of the dots indicates the dimension of the municipality, in terms of inhabitants in the first year of the considered period. The red lines show the overall national position on these two dimensions. This graphical representation allows highlighting the following two remarks. Firstly, in the first two decades the positions of Swiss municipalities are spread on all four quadrants, however, in the last two periods (in particular in the last one) the political ideology positions of Swiss municipalities are mainly concentrated in the "Left-Liberal" and "Right-Conservative" quadrants. Hence, this first graphical representation highlights a phenomenon of increasing polarization that is characterizing the Swiss political ideology space. Moreover, to better capture political preferences and the underlying political forces, it is important to consider more than a single political dimension, which, additionally, should be independent from short-term, candidate-related and party-related factors. Secondly, by simultaneously taking into considerations both these dimensions and the size of each municipality, in terms of number of inhabitants, it emerges that the position on the political ideology space is also a manifestation of the rural-urban divide. In fact, in line with Hermann and Leuthold (2003), cities and bigger municipalities are mainly positioned in the "Left-Liberal" quadrant, while smaller and rural communes are mainly found in the "Right-Conservative" quadrant.

[8] The two-dimensional graphical representation is preferred to the three-dimensional one because easier to interpret. The choice of the two dimensions to consider is based on their importance in explaining the overall variance of political preferences, as indicated from the results of the factor analysis.

Figure 1 – The political ideology position of Swiss municipalities



The identification of the political ideology of Swiss municipalities allows continuing the analysis with spatial cluster methods in order to empirically assess the degree of geographical concentration of political ideologies.

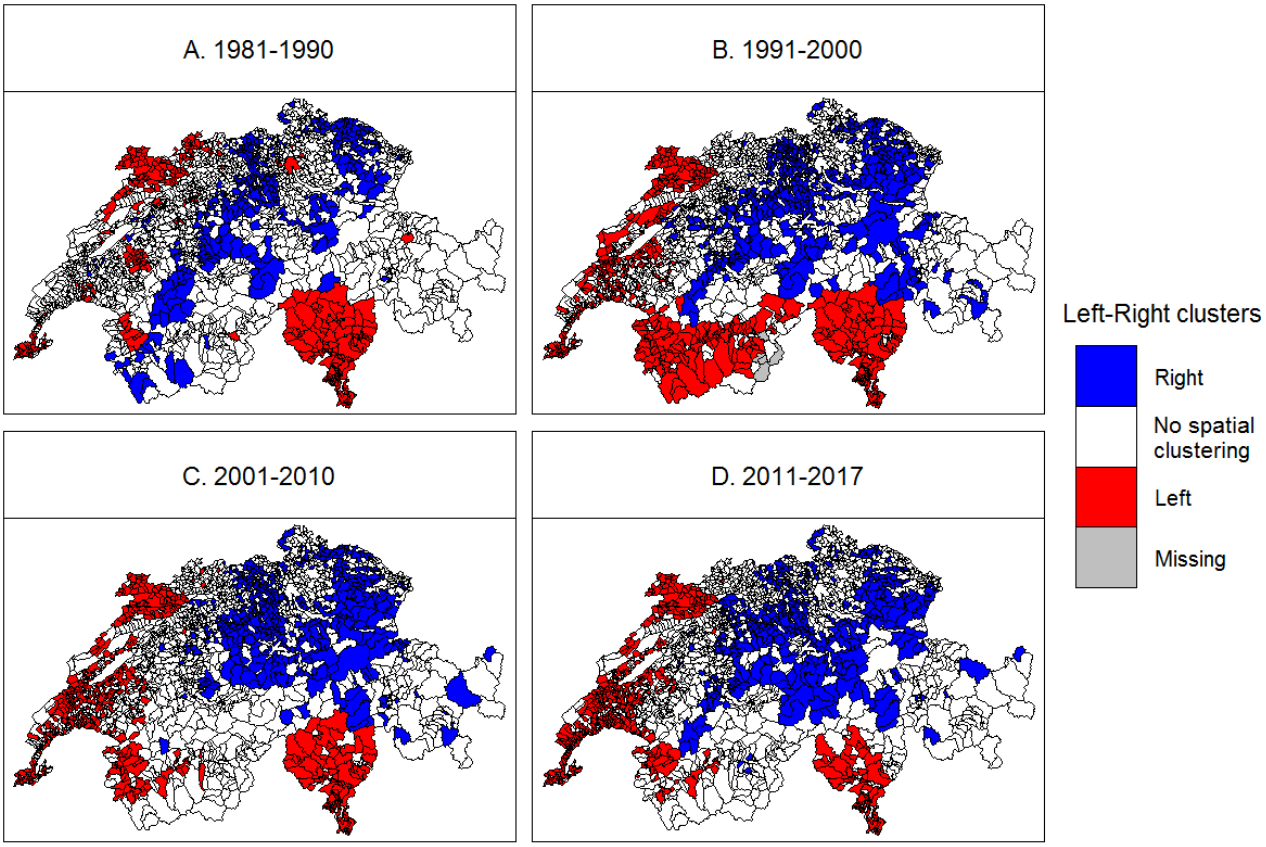
Spatial cluster analysis (Local Moran's I)

Following Kim et al. (2003), Darmofal (2008), Wing and Walker (2010) and Kinsella et al. (2015), the second phase of this analysis applies spatial cluster analysis to identify whether and where the political ideologies of Swiss municipalities are geographically concentrated. In particular, local Moran's I statistics for each of the three dimensions determined with the factor analysis are computed and then plotted in order to visualize the spatial pattern of significant concentration of political ideologies.

Figure 2 plots the results of the local Moran's I statistics for the "Left-Right" dimension as a set of significance maps for the four different periods. Municipalities exhibiting significant spatial clustering of the right-wing political ideology are shown in blue, while those belonging to a significant geographical concentration of the left-wing political ideology are colored in red. This

graphical visualization clearly illustrates that the "Left-Right" dimension of the Swiss political ideology space is characterized by geographical concentrations of municipalities with similar political preferences. More specifically, in line with the results of Hermann and Leuthold (2003), right-wing municipalities are predominantly clustered in the rural areas of the German speaking part of Switzerland, i.e. the center and north-east parts.

Figure 2 - Local Moran's I statistics for the Left-Right dimension

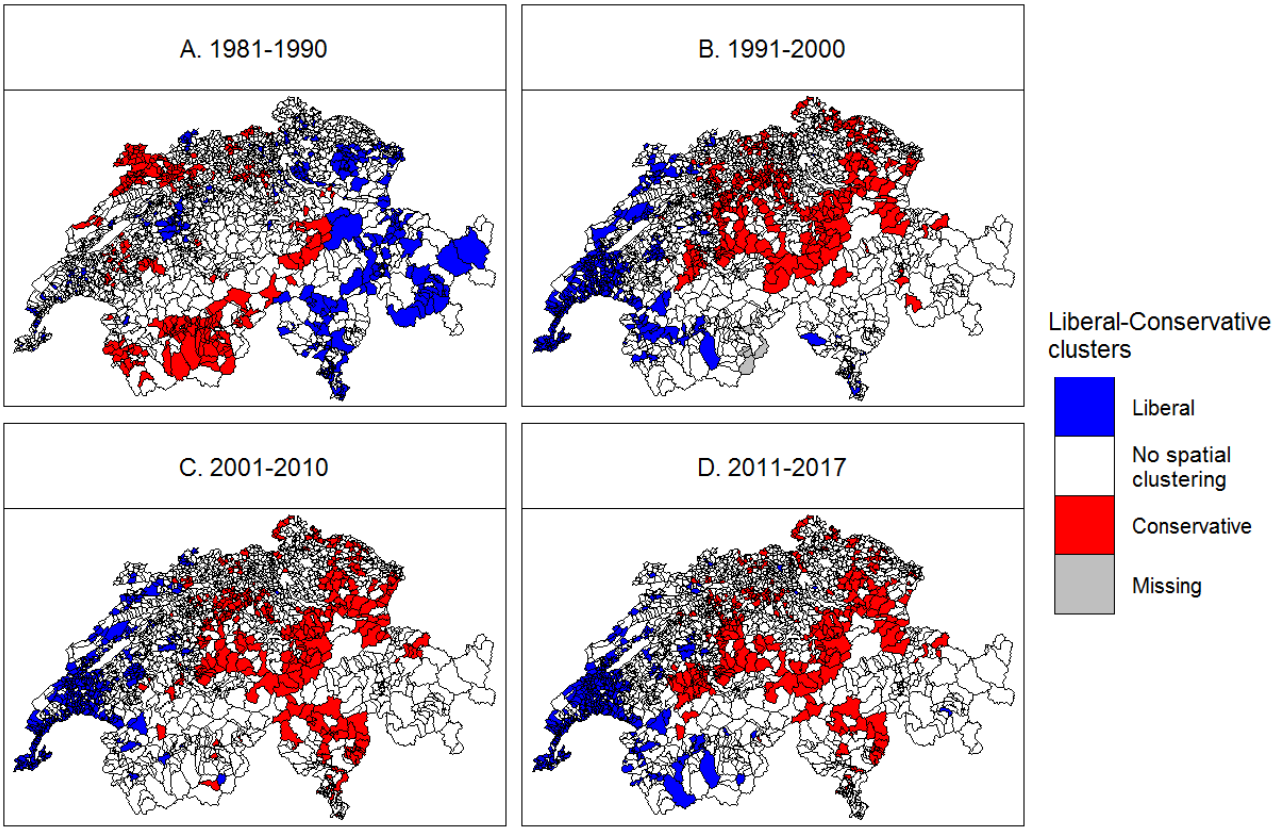


Additionally, left-wing municipalities are mainly concentrated in the Italian and French speaking part of Switzerland, i.e. in the south and in the west parts, respectively. The results also show that through time there has been some minor changes. More specifically, the geographical concentrations of right-wing municipalities are increasing in the central part of Switzerland, while the ones concerning left-wing municipalities are increasing in the western part of Switzerland and decreasing in the south, after an increase in the second period.

The results concerning the spatial cluster analysis on the "Liberal-Conservative" dimension of the Swiss political ideology space are shown in Figure 3. In this case, municipalities marked in blue belong to significant geographical concentrations of communes with a liberal political preference, while those colored in red are municipalities exhibiting significant spatial clustering of

the conservative political ideology. The first consideration emerging from this graphical visualization is that geographical concentrations of political ideologies occurs also on the "Liberal-Conservative" dimension. More specifically, liberal municipalities are mainly clustered around the Swiss central-western cities and in the French speaking part of Switzerland. On the other side, the conservative municipalities are mainly concentrated in the rural areas of the German and Italian speaking parts of Switzerland, i.e. in the east and in the south-east, respectively.

Figure 3 - Local Moran's I statistics for the Liberal-Conservative dimension

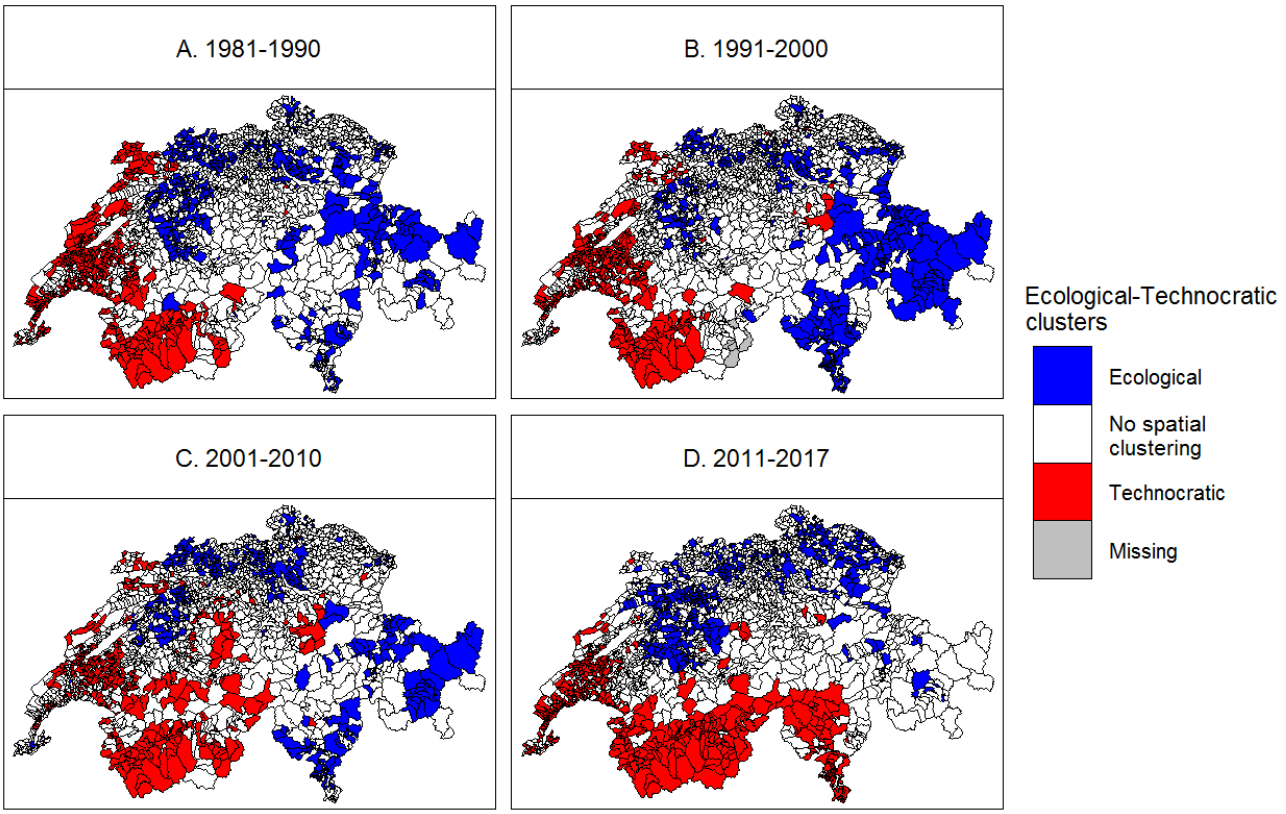


Considering the temporal evolution of the geographical concentrations of political ideologies along the "Liberal-Conservative" dimension, it clearly emerges that the first decade shows different patterns than the other three periods. As highlighted by Hermann and Leuthold (2003), this can be explained by the fact that the debate between liberals and conservatives in Switzerland became significantly important at the beginning of the nineties, when the discussion concerning the relationship between Switzerland and Europe started.

Finally, Figure 4 maps the results of the cluster analysis on the "Ecological-Technocratic" dimension of the Swiss political ideology space. Municipalities belonging to a significant geographical concentration of the ecological political ideology are colored in blue, while communes exhibiting significant spatial clustering of the technocratic political ideology are marked in red. Even

in this case the results show that there are geographical concentrations of municipalities with similar political preferences. Ecological municipalities are mainly concentrated close to the big cities of the German speaking part of Switzerland (i.e. in the center and north-east parts) and in the rural areas in the east and south-east. On the contrary, technocratic communes are predominantly clustered in the rural areas of the French speaking part of Switzerland (i.e. in the west). The temporal perspective allows determining that the geographical concentrations of ecological municipalities have decreased, in particular in the rural areas in the east and south-east part of Switzerland. Moreover, the spatial concentrations of technocratic municipalities have increased in the south, but diminished in the north-west.

Figure 4 - Local Moran's I statistics for the Ecological-Technocratic dimension



Overall, the results of the spatial cluster analysis highlight that along all the three dimensions characterizing the Swiss political ideology space there are geographical concentrations of municipalities with similar political preferences. The geographical representations of these results show that the "Left-Right" dimension is characterized by many and wider clusters, while the "Liberal-Conservative" dimension is defined by fewer and narrower concentrations. Hence, it seems that there are stronger sorting and polarizing effects along the "Left-Right" axes and weaker along the "Liberal-Conservative" one, with the dimension related to the "Ecological-Technocratic" debate somewhere in between. These results are particularly interesting because they show that social interactions,

captured as the geographical concentration of political ideologies, extend beyond municipal borders and further support the importance of analyzing these clusters.

Kruskal-Wallis and Dunn tests

The results discussed above indicate that Switzerland is characterized by geographical concentrations of political ideologies along various dimensions. As mentioned above, partisan-sorting processes are expected to be interrelated with income-sorting processes, implying that these phenomena are likely to lead to the clustering of people having similar levels of income and political ideologies. This hypothesis is also supported by the literature on voting behavior (Meltzer and Richard, 1981; McCarty et al., 2008, Rueda and Stegmueller, 2014) as well as the one on "the geography of discontent" (Los et al., 2017; Rodríguez-Pose, 2017; Chen et al., 2018; Crescenzi et al., 2018). Hence, the final phase of this analysis aims at empirically verifying whether there are differences in economic welfare among municipalities belonging to different clusters of political ideologies. In particular, Kruskal-Wallis tests are performed on the median income and the Gini coefficient of the income distribution of each municipality, to verify whether the distribution of these variables are significantly different among municipalities belonging to different aggregations of political ideologies and that do not belong to any cluster. These tests are carried out for each dimension of the Swiss political ideology space and for each period previously considered, separately, and are reported in Table 1, Table 2 and Table 3, along with the median value of the considered variables for each cluster of municipalities. Additionally, Dunn's tests are performed in order to exactly identify which pairs of groups are significantly different. Given that multiple tests are carried out at the same time, these tests are corrected with the Benjamini-Hochberg procedure[9].

Table 1 – Results of the Kruskal-Wallis tests on the "Left-Right" dimension

	1981-1990	**1991-2000**	**2001-2010**	**2011-2017**
Median income	$\chi^2(2) = 55.1$	$\chi^2(2) = 125.3$	$\chi^2(2) = 0.8$	$\chi^2(2) = 62.8$
	$p < 0.001$	$p < 0.001$	$p = 0.66$	$p < 0.001$
Median "Left"	32'500 CHF	44'350 CHF	54'967 CHF	61'800 CHF
Median "Not Significant"	34'000 CHF	48'050 CHF	56'000 CHF	59'550 CHF
Median "Right"	32'250 CHF	48'500 CHF	55'925 CHF	56'600 CHF
Gini coefficient of the	$\chi^2(2) = 75.1$	$\chi^2(2) = 23.6$	$\chi^2(2) = 11.3$	$\chi^2(2) = 113.0$
income distribution	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$

[9] The results of the Dunn's tests are reported in Appendix B, along with the median value of the considered variables for each group of municipalities and for each period.

Median "Left"	0.317	0.329	0.316	0.360
Median "Not Significant"	0.308	0.316	0.310	0.336
Median "Right"	0.290	0.318	0.310	0.328

Considering the "Left-Right" dimension, the results, as reported in Table 1 and in Tables B.1 and B.2 of Appendix B, indicate that the clusters of left-wing and right-wing municipalities are characterized by significant differences in the distributions of both median income and the Gini coefficient of the income distribution, with the exception of the decade 2001-2010 for median income.

By taking into account the median income for each cluster, it is not possible to find a clear pattern showing which cluster of political ideology is associated with higher (lower) values of median income in the four considered periods. On the other hand, the results indicate that municipalities belonging to a geographical concentration of a left-wing political ideology are characterized by a significantly higher Gini coefficient of income distribution, when compared to those with a right-wing political ideology, showing that there is a higher demand for left-wing policies where there are higher degrees of income inequality. Hence, these findings indicate that groups of municipalities with a significant left-wing ideology are characterized by significantly higher degrees of income inequality, in line with the findings of the literature on voting behavior (Meltzer and Richard, 1981; McCarty et al., 2008, Rueda and Stegmueller, 2014).

Focusing the attention to the "Liberal-Conservative" dimension, the results, as indicated in Table 2 and in Tables B.3 and B.4 of Appendix B, show that among the clusters of liberal and conservative municipalities there always are significant differences in the distributions of both median income and the Gini coefficient of the income distribution.

Table 2 – Results of the Kruskal-Wallis tests on the "Liberal-Conservative" dimension

	1981-1990	**1991-2000**	**2001-2010**	**2011-2017**
Median income	$\chi^2(2) = 105.0$	$\chi^2(2) = 97.4$	$\chi^2(2) = 335.6$	$\chi^2(2) = 314.1$
	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Median "Conservative"	30'775 CHF	45'650 CHF	52'200 CHF	54'200 CHF
Median "Not Significant"	33'600 CHF	47'125 CHF	55'800 CHF	59'150 CHF
Median "Liberal"	34'850 CHF	50'050 CHF	62'500 CHF	68'400 CHF
Gini coefficient of the	$\chi^2(2) = 157.9$	$\chi^2(2) = 140.5$	$\chi^2(2) = 120.0$	$\chi^2(2) = 203.0$
income distribution	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Median "Conservative"	0.279	0.304	0.297	0.317

Median "Not Significant"	0.304	0.322	0.311	0.337
Median "Liberal"	0.335	0.338	0.331	0.371

Moreover, both the median income and the Gini coefficient of the income distribution in clusters of liberal municipalities are in each period significantly higher than those of municipalities that do not belong to any cluster, along this dimension, and even higher than those of municipalities linked to a conservative cluster. Therefore, these results show that clusters of municipalities with a significant liberal ideology are characterized by significantly higher levels of economic welfare as well as significantly higher degrees of income inequality.

Finally, considering the "Ecological-Technocratic" axis of the Swiss political ideology space, the results, as reported in Table 3 and in Tables B.5 and B.6 of Appendix B, indicate that the clusters of ecological and technocratic municipalities are characterized by significant differences in the distributions of both median income and the Gini coefficient of the income distribution.

Table 5.3 – Results of the Kruskal-Wallis tests on the "Ecological-Technocratic" dimension

	1981-1990	**1991-2000**	**2001-2010**	**2011-2017**
Median income	$\chi^2(2) = 31.1$	$\chi^2(2) = 13.7$	$\chi^2(2) = 58.3$	$\chi^2(2) = 7.1$
	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.03$
Median "Ecological"	34'700 CHF	48'000 CHF	58'000 CHF	58'400 CHF
Median "Not Significant"	33'050 CHF	47'400 CHF	55'925 CHF	59'400 CHF
Median "Technocratic"	33'117 CHF	45'938 CHF	53'150 CHF	60'300 CHF
Gini coefficient of the income distribution	$\chi^2(2) = 26.9$	$\chi^2(2) = 128.7$	$\chi^2(2) = 37.0$	$\chi^2(2) = 195.9$
	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
Median "Ecological"	0.311	0.343	0.323	0.327
Median "Not Significant"	0.302	0.313	0.308	0.333
Median "Technocratic"	0.315	0.318	0.307	0.373

In addition, both the median income and the Gini coefficient of the income distribution in clusters of ecological municipalities are significantly higher than those of municipalities belonging to a technocratic cluster, with the exception of the last period, which, interestingly, shows opposite results. Hence, between 1981 and 2010, clusters of municipalities with a significant ecological ideology are characterized by significantly higher levels of economic welfare as well as significantly higher degrees of income inequality. However, in the period 2011-2017 the reverse is true, i.e. clusters

of municipalities with a significant technocratic ideology have a significantly higher median income as well as significantly higher degrees of income inequality.

Overall, these results clearly indicate that there are significant differences in the level of income and income inequality of Swiss municipalities, depending on their belonging to a political ideology cluster. These findings seem to support the hypothesis that partisan-sorting processes are interrelated with income-sorting processes and further support the findings and claims of other scholars, arguing that economic geography is particularly important in understanding how people vote

6. Conclusions

This paper proposes a new definition of spatial cohesion, based on the geographical concentration of political ideologies, which represents a new way to capture social interactions. The application of spatial cluster analysis empirically assesses the existence of spatial concentrations of Swiss municipalities sharing the same political ideology. This first result is particularly interesting because it shows that social interactions, captured as the geographical concentration of political ideologies, extend beyond municipal borders and further supports the importance of analyzing these clusters. Moreover, this result is valid for all the three main dimensions characterizing the Swiss political ideology space, expressing the following political beliefs: left vs. right, liberal vs. conservative and ecological vs. technocratic. Additionally, these findings seems to indicate that there are stronger clustering effects along the "Left-Right" axes and relatively weaker along the "Liberal-Conservative" one.

Moreover, a second important finding of this paper indicates that the geographical distribution of the clusters of political ideologies are also a manifestation of the rural-urban divide as well as the cultural divides among the different linguistic regions of Switzerland. In particular, geographical concentrations of left-wing municipalities are mainly located close to cities and in the French and Italian speaking parts of Switzerland, while clusters of right-wing municipalities are predominantly found in rural areas and in the German speaking part of Switzerland. At the same time, spatial concentrations of liberal municipalities are mostly situated close to cities and in the French speaking part of Switzerland, whereas clusters of conservative communes are mainly located in rural areas and in the German and Italian speaking regions of Switzerland. Additionally, clusters of ecological municipalities are predominantly found around cities and in the German speaking part of Switzerland, while agglomerations of technocratic communes are mostly located in rural areas and in the French speaking region of Switzerland. Moreover, the evolution of such divides between 1981 and 2017

seems to suggest that the Swiss political ideology space is characterized by a phenomenon of increasing polarization.

Thirdly, this study finds significant differences in income levels and income inequalities among Swiss municipalities, depending on their belonging to a political ideology cluster. More specifically, clusters of left-wing municipalities are characterized by significantly higher degrees of income inequality, when compared to aggregations of right-wing municipalities. At the same time, the results indicate that clusters of liberal communes have a significantly higher median income and a higher degree of income inequality, compared to concentrations of conservative municipalities. Moreover, with the exception of the period 2011-2017, clusters of ecological communes have a significantly higher median income and a higher degree of income inequality, compared to concentrations of technocratic municipalities.

Hence, these findings indicate that clusters of communes with a similar political ideology group either urban municipalities with relatively high levels of income and high degrees of inequality (as in the cases of left, liberal or ecological clusters) or rural communes with relatively low levels of income and low degrees of inequality (for the cases of right, technocratic or conservative clusters). Interestingly, the empirical evidence does not show any political ideology clustering of "privileged" communes (i.e. with high levels of income and low degrees of inequality), nor "left-behind" municipalities (i.e. with low levels of income and high degrees of inequality).

In conclusion, besides identifying the political preference of Swiss municipalities, these results highlight the importance of the geography of these political ideologies, and, in particular, of their spatial concentration. This result contributes and further supports the findings and claims of the literature on "the geography of discontent", according to which economic geography is particularly important in understanding how people vote (McCann, 2018; Rodríguez-Pose, 2017). These findings are particularly interesting because they emerge from a study simultaneously considering the results of several referenda, capturing the underlying long-term structure of political ideologies, which is independent from short-term, candidate-related and party-related factors. The existence of differences in economic welfare among municipalities belonging to different clusters of political ideologies implies that future research should consider this new definition of spatial cohesion in order to understand how and why different concentrations of political preferences are associated to different levels of welfare.

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Appendix A – Results of the factor analyses

Table A.1: Factor scores for the period 1981-1990

Vote	Factor 1	Factor 2	Factor 3
Federal decree on the popular initiative for gender equality (counter-proposal)	**0,72**	0,31	0,2
Federal decree on the popular initiative the protection of consumer rights (counter-proposal)	**0,67**	-0,13	0,36
Federal decree on prolonging the federal finance order	0,01	0,01	**0,62**
New federal law on foreigners	-0,42	-0,05	0,39
Amendment to the Swiss penal code	0,2	-0,43	0,49
Popular initiative for the prevention of abusive prices	**0,76**	0,24	-0,06
Federal decree on the popular initiative for the prevention of abusive prices (counter-proposal)	-0,47	0,11	0,22
Federal decree on changes to fuel tax	0,36	-0,1	**0,58**
Federal decree on the constitutional article on energy	0,18	-0,4	0,28
Federal decree on the revision of nationality law in the Federal Constitution	0,18	-0,08	**0,67**
Federal decree aiming at facilitating certain naturalizations	0,21	-0,14	0,49
Federal decree on introducing tolls for heavy goods vehicles	-0,07	**0,71**	0,24
Federal decree on introducing tolls for national routes	0,21	**0,62**	0,41
Popular initiative for a real civilian service based on a proof through demonstration	**0,79**	0,06	0,17
Popular initiative against the abuse of bank client confidentiality and bank power	-0,15	**0,8**	0,03
Popular initiative against slashing the national soil	0,15	**0,67**	0,05
Popular initiative for a future without further nuclear power plants	**0,62**	0,09	-0,05
Popular initiative for a secure, parsimonious and ecologically sound energy supply	**0,59**	0,09	-0,12
Popular initiative for an effective protection of maternity	0,05	**0,55**	**0,57**
Federal decree on the constitutional article on broadcasting	0,29	0,11	**0,76**
Popular initiative for the compensation of victims of violent crimes	**0,76**	-0,17	0,11
Federal decree on abolishing primary school fees	-0,31	0,17	**0,78**
Federal decree on abolishing the government contribution to healthcare spending	-0,35	0,07	**0,76**
Federal decree on education fees	**0,84**	0,01	-0,08
Popular initiative on extending paid leave	-0,48	0,01	**0,59**
Popular initiative "right to life"	-0,11	0,34	**0,74**
Federal decree on abolishing the cantonal share of profits from banks' stamp duty	-0,02	0,28	**0,76**
Federal decree on the taxation raised from the sale of spirits	-0,07	-0,07	-0,41
Federal decree on the abolition of grants for the self-supply of breadstuffs	0,43	-0,38	**0,5**
Federal decree on the popular initiative to co-ordinate the start of the school year (counter-proposal)	**0,78**	-0,22	0,32
Federal decree on giving small and medium enterprises an advantage in cases of innovations	**0,78**	-0,25	0,16

Amendments to the Swiss Civil Code	**0,51**	**-0,51**	0,11
Popular initiative to ban vivisection	0,07	**0,66**	0,24
Federal decree on joining the United Nations	**0,68**	-0,03	0,43
Popular initiative on culture	0,18	0,16	0,3
Federal decree on the popular initiative on culture (counter-proposal)	**0,62**	0	-0,04
Popular initiative on vocational education	**0,68**	-0,15	0,09
Federal decree on the domestic sugar economy	-0,34	**-0,51**	-0,09
Federal decree on the popular initiative for the protection of tenants (counter-proposal)	0,42	**0,58**	0,38
Popular initiative for a just taxation of truck traffic	**0,62**	0,22	0,24
Amendments to the federal law on asylum	**0,75**	0,16	-0,17
Federal law on the residence and settlement of foreigners	**0,67**	0,14	0,42
Popular initiative for the people's co-determination of military expenditure	-0,36	0,08	0,12
Federal decree on the voting system for popular initiatives	-0,19	0,04	0,29
Federal decree on the Rail 2000 project	**0,56**	0,39	-0,06
Popular initiative for the protection of fens	**0,59**	0,17	0,26
Amendment to the federal law on health insurance	0,45	-0,07	0,41
Federal decree on the constitutional principles behind a coordinated transport policy	0,2	**0,66**	0,4
Popular initiative on lowering the retirement age to 62 for men and 60 for women	**0,84**	-0,02	-0,06
Popular initiative against real estate speculation	0,19	0,47	-0,25
Popular initiative for the shortening of labor time	**0,57**	0,38	0,06
Popular initiative for limiting immigration	**0,85**	0,08	0
Popular initiative for nature-oriented farming and against animal factories	0,34	**0,73**	0,08
Popular initiative for a Switzerland without army and a comprehensive policy of peace	**0,75**	-0,04	0
Popular initiative on introducing 130 and 100 kilometers per hour speed limits	0,27	**-0,78**	-0,16
Popular initiative "Stop the concrete - for a limitation on road making"	-0,05	**0,91**	0,02
Popular initiative for a highway-free countryside between Murten and Yverdon	-0,11	**0,91**	0
Popular initiative for a highway-free Knonauer Amt	-0,02	**0,87**	-0,01
Popular initiative for a highway-free area between Biel and Solothurn/Zuchwil	0,1	**0,85**	0,01
Federal decree on viticulture	-0,29	-0,37	**0,51**
Amendment to the federal law on the organization of the federal judiciary	-0,11	**-0,67**	0,11
Popular initiative to phase out nuclear power	**0,61**	0,27	-0,05
Popular initiative to stop the construction of any new nuclear power plants	**0,52**	0,27	0,28
Federal decree on the constitutional article on energy	**0,69**	0,1	-0,05
Amendment to the federal law on road traffic	-0,06	**-0,78**	0,15

Table A.2: Factor scores for the period 1991-2000

Vote	Factor 1	Factor 2	Factor 3
Federal decree on lowering the voting age to 18	0,04	**0,74**	-0,04
Popular initiative on promoting public transport	0,48	0,08	-0,15
Federal decree on reorganizing the federal finances	0,08	**0,62**	0,26
Amendment to the military penal code	0	0,35	0,44
Popular initiative for a financially bearable health insurance	-0,17	**0,73**	0,21
Popular initiative for the drastic and stepwise limitation of animal experiments	-0,38	0,49	-0,26
Federal decree on joining the Bretton Woods system	0,12	**0,76**	-0,07
Federal law on contributing to the Bretton Woods system	0,17	**0,72**	0,09
Federal law on water protection	0,23	**0,67**	0,2
Federal decree on the popular initiative against the malpractice of gene technology on humans (counter-proposal)	0,32	**0,61**	0,2
Federal decree on creating a civilian service alternative to military service	0,46	**0,6**	0,02
Amendments to the Swiss Penal Code and the Military Penal Code on sexual integrity	**0,86**	-0,05	-0,08
Popular initiative for the recovery of our waters	**0,86**	-0,07	-0,1
Federal decree on building a transalpine rail route	-0,14	**0,58**	0,09
Federal law on the standing orders of the Federal Assembly	**0,62**	0,42	-0,12
Amendment to the stamp duty law	**0,69**	0,32	-0,18
Federal law on farmland	**0,82**	0,23	-0,14
Federal law on the expenses of members of the Federal Assembly	**0,65**	-0,04	0,12
Federal law on the salaries of members of the Federal Assembly	**0,64**	-0,07	-0,23
Federal decree on the European Economic Area	**0,84**	-0,34	-0,26
Federal law to raise fuel taxes	-0,17	**0,69**	-0,11
Federal decree on lifting the ban on gambling establishments	-0,15	**0,63**	**0,52**
Popular initiative on banning animal testing	0,35	-0,01	0,04
Popular initiative "40 military training areas are enough-environment projection at military"	0,4	0,2	**-0,67**
Popular initiative for a Switzerland without new warplanes	0,43	0,17	**-0,68**
Federal decree on the misuse of weaponry	0,06	0,47	-0,17
Federal decree on whether Laufen should be part of the Basel-Landschaft canton	**0,64**	0,25	-0,1
Popular initiative on creating a new Swiss National Day on 1 August	0,36	0,15	0,39
Federal decree on a temporary halt to increase in the cost of health insurance	0,4	0,02	0,34
Federal decree on unemployment insurance	**0,56**	-0,22	-0,29
Federal decree on the financial order	-0,05	**0,7**	0,02
Federal decree on recovering money owed to the federal government	-0,08	**0,69**	0,03
Federal decree on measures for preserving social insurance	0,35	**0,52**	0,4
Federal decree on special excise taxes	0,35	0,48	0,46
Popular initiative on the reduction of alcohol problems	**0,55**	0,41	0,46

Popular initiative on the reduction of tobacco problems	**0,53**	0,33	**0,51**
Federal decree on roadbuilding	-0,04	**0,88**	0,14
Federal decree on continuing existing truck tolls	-0,1	**0,87**	0,24
Federal decree on varying tolls based on engine power or mileage	-0,13	**0,8**	0,35
Popular initiative for the protection of the alpine region from traffic	-0,31	**0,75**	0,08
Amendment to the aeronautical law	**0,6**	-0,13	-0,01
Federal decree on the constitutional article on the promotion of culture	**0,72**	0,23	-0,42
Federal decree on facilitated naturalization for foreign youth	**0,87**	0,02	-0,05
Federal law on Swiss troops in peacekeeping operations	**0,89**	-0,01	-0,02
Federal decree on abolishing price reductions on breadstuffs	**0,57**	0,48	0,33
Amendments to the Swiss Penal Code and the Military Penal Code	**0,73**	0,37	0
Federal law on health insurance	-0,3	0,34	**0,56**
Popular initiative for a healthy health insurance	0,29	0,04	**-0,72**
Federal law on foreigners	**0,57**	-0,09	**-0,58**
Federal decree on the popular initiative for an environmentally sound and efficient peasant farming (counter-proposal)	0,44	-0,07	0,44
Federal decree on dairy farming	0,34	**-0,67**	-0,03
Amendment to the farming law	0,32	**-0,69**	0,01
Federal decree on spending	0,33	**-0,7**	0,07
Amendment to the federal law on aged and bereaved insurance	0,18	0,26	**-0,73**
Popular initiative to extend aged and bereaved and invalidity insurance	0,14	0,1	**0,8**
Amendment to the federal law on purchasing land through agents abroad	**0,76**	-0,27	-0,23
Amendment to the constitutional article on languages	0,36	0,46	0,33
Federal decree on whether municipality of Vellerat (then part of the canton of Bern) should become part of the canton of Jura	0,08	0,46	0,35
Federal decree on abolishing the cantons' responsibilities for providing army equipment	**0,65**	0,33	0,26
Federal decree on abolishing the federal requirement to purchase distilling equipment	0,47	0,12	0,06
Federal decree on abolishing federal financing of parking areas at rail stations	**0,58**	0,04	-0,27
Federal decree on the popular initiative "peasants and consumers-for a nature-oriented farming" (counter-proposal)	0,14	**0,73**	0,04
Federal law on governmental and administrative organization	**0,8**	-0,02	-0,3
Popular initiative against illegal immigration	0,14	0,23	**0,64**
Amendment to the federal law on labor in trade and industry	**-0,76**	0,17	0,23
Popular initiative "EU accession talks in front of the people"	0,4	0,43	0,38
Popular initiative for a ban on arms exports	0,42	0,22	**-0,57**
Federal decree on ending the federal monopoly on producing and selling gunpowder	**-0,6**	0,12	-0,17

Federal decree on financing unemployment insurance	-0,31	0,26	**0,71**
Popular initiative "youth without drugs"	-0,31	-0,45	-0,09
Federal decree on a balanced budget	**-0,53**	**0,6**	0,17
Popular initiative for the protection of life and environment against genetic engineering	0	0,38	**-0,51**
Popular initiative "Switzerland without secret police"	0,03	0,25	**0,77**
Federal law on truck tolls based on engine size	-0,16	**0,75**	-0,2
Popular initiative for well-priced foodstuffs and ecological farms	0,36	**0,71**	-0,14
Popular initiative "10th revision of the Aged and Bereaved Insurance without raising the retirement age"	0,29	0,02	**-0,84**
Federal decree on building and financing public transport infrastructure	-0,2	**0,62**	0,15
Federal decree for a temporary article in the Swiss Federal Constitution on grain	0,15	**0,52**	**0,51**
Popular initiative for a prudential drug policy	**0,59**	0,47	0,02
Amendment to the federal law on labor in trade and industry	0,41	0,46	-0,32
Federal decree on changes to the eligibility for membership of the Federal Council	0,3	0,4	**0,55**
Federal decree on constitutional regulations on organ transplantation	**0,65**	0,01	0,05
Popular initiative "house ownership for everyone"	-0,09	-0,12	0,28
Amendment to the federal law on spatial planning	0,39	-0,45	-0,11
Federal decree on a new Swiss Federal Constitution	**0,82**	-0,02	-0,31
Federal law on asylum	0,27	**0,7**	0,23
Federal decree on asylum and foreigners	-0,15	0,47	**0,62**
Federal decree on the medical prescription of heroin	-0,05	0,46	**0,61**
Federal law on disability	0,37	-0,13	0,11
Federal law on maternity insurance	**0,7**	-0,23	**-0,57**
Federal decree on reforming the judiciary	0,11	**0,76**	-0,04
Popular initiative for speeding up direct democracy	**-0,56**	**0,56**	0,04
Popular initiative for a just representation of women in federal authorities	**0,64**	0,36	0,2
Popular initiative for the protection of men against manipulations in procreation technology	-0,2	0,19	-0,04
Popular initiative on halving motorized road traffic	0,49	0,11	-0,47
Federal decree authorizing sectoral agreements between Switzerland and the European Union	**0,81**	-0,15	-0,01
Popular initiative on promoting solar energy	0,14	**0,73**	0,08
Federal decree on the popular initiative on promoting solar energy (counter-proposal)	0,16	**0,6**	-0,17
Federal decree on the popular initiative on energy efficiency (counter-proposal)	0,35	**0,5**	-0,06
Popular initiative for regulating immigration	-0,09	0,29	**-0,54**
Popular initiative "more rights for people thanks to referendums with counter-proposals"	**-0,75**	0,2	0,18
Popular initiative against raising the female retirement age	0	0,28	**0,8**
Popular initiative for a flexible retirement age for men and women from 62 years on	-0,22	0,04	**-0,5**

Popular initiative on economizing on military and defense-for more peace and seminal jobs	**0,59**	-0,07	**-0,65**
Popular initiative for lower hospital expenses	0,42	-0,14	**-0,77**
Federal law on federal employees	0,37	-0,18	**-0,78**

Table A.3: Factor scores for the period 2001-2010

Vote	**Factor 1**	**Factor 2**	**Factor 3**
Popular initiative on joining the European Union	-0,28	-0,2	**0,7**
Popular initiative on lowering medicine prices	0,23	0,14	**0,63**
Popular initiative on lowering the urban speed limit to 30 km/h	**0,72**	**0,52**	-0,13
Amendment to the federal law on the Swiss army I	**0,67**	-0,16	0,32
Amendment to the federal law on the Swiss army II	0,14	-0,06	0,3
Federal decree on abolishing the requirement for a permit to establish a diocese	**0,73**	-0,15	0,27
Federal decree on expenditure	0,07	0,42	**0,53**
Popular initiative for an assured Aged and Bereaved insurance - tax on energy instead of work	0,06	**0,54**	0,16
Popular initiative for an authentic security policy and a Switzerland without army	0,17	**-0,64**	0,13
Popular initiative "Solidarity creates security: for a voluntary civilian peace service"	0,4	**0,7**	0,09
Popular initiative for a capital gains tax	0,4	**0,76**	0,08
Popular initiative on joining the United Nations	**0,87**	0,22	0,15
Popular initiative to reduce working hours	0,31	**0,79**	0,06
Amendment to the penal code regarding abortion	**0,67**	0,17	0,15
Popular initiative for mother and child	**-0,6**	-0,03	-0,21
Popular initiative on adding surplus gold reserves to the country's pension fund	-0,06	**-0,54**	0,46
Federal decree on the popular initiative on adding surplus gold reserves to the country's pension fund (counter-proposal)	0,45	0,27	0,27
Federal law on the electricity market	**-0,64**	-0,11	-0,03
Popular initiative against misuse of asylum rights	0,14	**-0,7**	0,15
Federal law on compulsory unemployment insurance and compensation for insolvencies	**-0,65**	-0,43	0,04
Federal decree on reforming the referendum process	0,24	-0,11	0,37
Federal decree on changing the cantonal contribution to financing hospital medication	0,44	0,05	0,03
Federal law on the Swiss army	0	0,23	**0,6**
Federal law on civil defense	0,2	**0,65**	0,36
Popular initiative "yes to fair rents"	0,1	**0,76**	0,22
Popular initiative for one Sunday a season free from motor vehicles-a test for four years	0,18	**0,85**	0,13
Popular initiative "health has to be affordable"	**0,7**	0,1	0,12
Popular rights for equal rights for the disabled	0,21	**0,83**	0,06
Popular initiative "electricity without nuclear power"	**0,73**	0,07	0,05
Popular initiative for prolonging the ban on new nuclear power stations	0,08	**0,88**	0

Popular initiative for a sufficient provision of vocational education	0,12	**0,85**	-0,03
Federal decree on the popular initiative for safe and efficient motorways (counter-proposal)	-0,37	**-0,61**	0,42
Amendment to the Obligations law	**-0,57**	0,1	-0,03
Popular initiative "life-long custody for non-curable, extremely dangerous sexual and violent criminals"	0,16	-0,22	-0,12
Amendment to the federal law on Aged and Bereaved insurance	**0,57**	-0,06	0,36
Federal decree on financing the Aged and Bereaved insurance	0,23	**-0,72**	0,23
Federal law that would affect taxation for married couples, families, private housing and stamp duty	0,25	**-0,54**	0,18
Federal decree on ordinary and facilitated naturalization (2nd generation)	**0,8**	0,48	-0,18
Federal decree on ordinary and facilitated naturalization (3rd generation)	**0,79**	0,48	-0,22
Popular initiative "postal services for all"	**0,68**	**0,61**	-0,23
Federal law on compensating members of the armed forces for loss of earnings	-0,08	**0,75**	-0,28
Federal decree on rebalancing the financial duties of the Federation and the Cantons	**0,64**	-0,02	0,09
Federal decree on the constitutional reordering of the budget	0,26	-0,13	0,01
Federal law on stem cell research	**0,71**	0,19	-0,07
Federal decree on Switzerland joining the Schengen Area	**0,65**	-0,07	**0,5**
Federal decree on whether registered partnerships for same-sex couples should be introduced	**0,91**	0,24	0,03
Federal decree on extending the agreement on free movement of people to new members of the European Union	**0,91**	0,08	0,07
Federal decree on the popular initiative for food from an agriculture free of genetic modification (counter-proposal)	0,42	-0,39	0,49
Federal labor law related to the opening times of shops in public transport hubs	-0,11	**0,55**	-0,25
Amendment to the constitutional article on education	**0,6**	-0,06	-0,06
Popular initiative on diverting profits from the Swiss National Bank into the national pension fund	**-0,52**	**-0,68**	0,24
Federal law on foreigners	**-0,53**	**-0,69**	0,16
Amendments to the federal law on asylum	-0,13	**0,74**	0,14
Federal law on assistance to Poland and other poorer EU countries	**0,86**	0,15	0,14
Amendment to the family allowances law	0,3	**0,58**	0,01
Popular initiative for a social unified health insurance	0,26	**0,83**	-0,2
Amendment to the disability insurance law	-0,13	**-0,8**	0,09
Popular initiative against fighter aircraft noise in tourism areas	0,35	**0,61**	0
Federal law on the corporate tax reform	0	**-0,6**	-0,11
Popular initiative for democratic naturalization	-0,4	**-0,65**	0,41
Popular initiative against publicly funded information campaigns by the government	**-0,73**	**-0,52**	0,24
Amendment to the constitutional article on health insurance	**-0,72**	-0,37	0,21

Popular initiative for the elimination of the statute of limitations with respect to pornographic crimes against children	-0,15	0,01	**0,73**
Popular initiative for a flexible retirement age	0,2	-0,12	**0,68**
Popular initiative for the restriction of the right of associations to appeal against building projects	**-0,6**	0	0,28
Popular initiative for a sensible cannabis policy with effective protection of the youth	-0,01	**0,85**	-0,05
Amendment to the federal law on narcotics	-0,13	-0,39	-0,19
Federal decree on approving the renewal of the EU-Switzerland bilateral agreement on free mobility	**0,87**	0,09	-0,04
Constitutional article "Future with complementary medicine"	0,47	-0,22	0,24
Federal decree on the introduction of biometric passports	**0,5**	0,47	-0,25
Federal decree on a limited increase of the value added tax to continue financing the disability insurance	**0,75**	-0,01	0,05
Federal decree on accepting the decision not to introduce the generic popular initiative	**0,7**	0,46	0,02
Federal decree on aviation fuel taxation	**0,64**	-0,23	0,24
Popular initiative "ban on exporting war supplies"	0,41	**0,64**	0,08
Popular initiative against the construction of minarets	**-0,81**	-0,29	0,01
Amendment to the constitutional article on research on humans	0,01	0,03	**0,76**
Popular initiative on providing enhanced legal protection for animals	0,05	**-0,64**	0,07
Amendment to the federal law on Aged and Bereaved insurance	**0,79**	0,21	-0,01
Amendment to the federal law on unemployment benefits	-0,06	**-0,83**	0,17
Popular initiative for the deportation of foreign criminals	**0,53**	0	0,25
Federal decree on the popular initiative for the deportation of foreign criminals (counter-proposal)	0,1	**0,68**	0,14
Popular initiative for fair taxes	**-0,82**	-0,32	0,04

Table A.4: Factor scores for the period 2011-2017

Vote	**Factor 1**	**Factor 2**	**Factor 3**
Popular initiative for the protection against gun violence	0,49	**0,67**	0,06
Popular initiative "an end to the limitless construction of second homes"	0,31	0,04	**0,57**
Popular initiative for tax-supported building society savings to buy living space for self-use and to finance energy saving and environmental measures	**0,84**	0,07	-0,01
Popular initiative "six weeks of vacation for everyone"	0,4	**0,53**	-0,17
Federal decree on using the state earnings from gambling for the public interest	**0,69**	0,27	-0,3
Federal law on the fixed book price agreement	0,44	-0,02	**-0,62**
Popular initiative on assistance with savings for home buyers	**-0,55**	-0,06	**0,53**
Popular initiative on reinforcing popular rights in foreign policy	-0,17	**-0,71**	0
Amendment to the federal law on healthcare	0,26	0,04	**-0,53**

Federal decree on the popular initiative on promoting music lessons for youth (counter-proposal)	-0,21	-0,29	0,09
Popular initiative on secure housing in old age	0,43	0,41	0,07
Popular initiative on a smoking ban	**0,5**	0,2	-0,07
Amendment to the federal law on animal diseases	0,42	**0,65**	-0,33
Federal decree on family policy	-0,03	0,15	**0,67**
Popular initiative against rip-off salaries	0,38	-0,35	**0,53**
Amendment to the federal law on spatial planning	**0,75**	0,49	-0,24
Popular initiative on the direct election of the Federal Council	**-0,73**	-0,21	0,14
Urgent modification of the federal law on asylum	-0,09	**-0,66**	-0,03
Popular initiative on the abolition of compulsory military service	**0,76**	0,43	0
Amendment to the federal law on epidemics	-0,19	0,34	-0,17
Amendment to the federal law on labor in trade and industry	0,42	**0,6**	-0,39
Popular initiative on fair wages	-0,25	**0,51**	0,21
Popular initiative on tax credits for stay-at-home parents	**0,74**	-0,28	0,2
Amendment to the federal law on road taxation	-0,32	**-0,75**	0,06
Federal decree on the popular initiative on financing and developing the railway infrastructure (counter-proposal)	**-0,59**	**-0,6**	0,29
Popular initiative on abortion	-0,31	**-0,87**	0,09
Popular initiative against mass immigration	0,46	**0,64**	-0,21
Federal decree on the popular initiative on primary health care (counter-proposal)	**0,86**	0,06	0,18
Popular initiative on a lifetime ban on convicted pedophiles working with children	**-0,77**	-0,42	0,12
Popular initiative on minimum wages	0,41	0,47	0,04
Federal law on the procurement of the JAS 39 Gripen fighter aircraft	0,49	-0,48	**-0,55**
Popular initiative on the value added tax for the hospitality industry	**0,86**	0,21	-0,1
Popular initiative for a unified health insurance fund	0,21	-0,44	-0,3
Popular initiative for the abolition of the flat tax	0,03	-0,23	**0,8**
Popular initiative "Stop overpopulation (ECOPOP)"	-0,16	**-0,81**	0,25
Popular initiative on gold reserves	-0,08	**-0,83**	0,08
Popular initiative for the exemption of family allowances from income tax	0,03	0,17	**0,51**
Popular initiative on a non-renewable energy tax	0,44	-0,18	-0,32
Federal decree on the constitutional article on reproductive medicine	0,45	-0,02	**0,68**
Popular initiative on scholarships	**0,82**	0,28	-0,01
Popular initiative on inheritance taxes	**0,51**	**0,61**	-0,1
Amendment to the federal law on radio and television	**0,51**	**0,62**	-0,35
Popular initiative for the couple and the family - No to the penalty of marriage	**0,71**	-0,08	0,38
Popular initiative for the actual deportation of foreign criminals (implementation initiative)	**-0,61**	-0,4	0,06
Popular initiative "No speculation on food"	-0,21	**-0,91**	-0,1
Amendment to the federal law on road transit in the Alpine region	0,03	**-0,6**	-0,22

Popular initiative for the public service	0,31	**-0,52**	0,35
Popular initiative for a basic income	**0,77**	0,13	0,29
Popular initiative for fair transport financing	0,22	**0,82**	0,15
Amendment to the federal law on medically assisted reproduction	-0,19	**-0,71**	0,01
Amendments to the federal law on asylum	0,47	**0,61**	-0,39
Popular initiative for a green economy	**0,79**	0,37	0,15
Popular initiative on the retirement system	**0,86**	0,04	0,01
Federal law on intelligence	-0,03	0,36	-0,43
Popular initiative for the programmed phase-out of nuclear energy	**0,75**	0,4	0,07
Federal decree on the simplified naturalization of third-generation immigrants	**0,51**	**0,76**	-0,09
Federal decree on establishing a fund for national roads and urban traffic	-0,02	0,49	**-0,52**
Federal law on the corporate tax reform	-0,03	0,26	**-0,74**
Federal law on energy	**0,52**	**0,65**	-0,2

Appendix B – Results of Dunn's tests
"Left-Right" dimension

Table B.1: Results of Dunn's tests on median income on the "Left-Right" dimension

Median income (1981-1990)

	Left	**Not Significant**
Not Significant	-3.84 p < 0.001	
Right	2.36 p = 0.009	6.97 p < 0.001

Median "Left" = 32'500

Median "Not Significant" = 34'000

Median "Right" = 32'250

Median income (1991-2000)

	Left	**Not Significant**
Not Significant	-10.21 p < 0.001	
Right	-9.69 p < 0.001	-1.37 p = 0.09

Median "Left" = 44'350

Median "Not Significant" = 48'050

Median "Right" = 48'500

Median income (2001-2010)

	Left	**Not Significant**
Not Significant	-0.87 p = 0.57	
Right	-0.75 p = 0.34	-0.02 p = 0.49

Median "Left" = 54'967

Median "Not Significant" = 56'000

Median "Right" = 55'925

Median income (2011-2017)

	Left	**Not Significant**
Not Significant	4.24 p < 0.001	
Right	7.91 p < 0.001	5.23 p < 0.001

Median "Left" = 61'800

Median "Not Significant" = 59'550

Median "Right" = 56'600

Table B.2: Results of Dunn's tests on the Gini coefficient of the income distribution on the "Left-Right" dimension

Gini coefficient of the income distribution (1981-1990)

	Left	**Not Significant**
Not Significant	1.96 p = 0.02	
Right	7.70 p < 0.001	7.91 p < 0.001

Median "Left" = 0.317

Median "Not Significant" = 0.308

Median "Right" = 0.290

Gini coefficient of the income distribution (1991-2000)

	Left	**Not Significant**
Not Significant	4.85 p < 0.001	
Right	3.09 p = 0.002	-1.14 p = 0.13

Median "Left" = 0.329

Median "Not Significant" = 0.316

Median "Right" = 0.318

Gini coefficient of the income distribution (2001-2010)

	Left	**Not Significant**
Not Significant	3.34 p = 0.001	
Right	2.39 p = 0.01	-0.49 p = 0.31

Median "Left" = 0.316

Median "Not Significant" = 0.310

Median "Right" = 0.310

Gini coefficient of the income distribution (2011-2017)

	Left	**Not Significant**
Not Significant	8.56 p < 0.001	
Right	10.15 p < 0.001	3.64 p < 0.001

Median "Left" = 0.360

Median "Not Significant" = 0.336

Median "Right" = 0.328

"Liberal-Conservative" dimension

Table B.3: Results of Dunn's tests on median income on the "Liberal-Conservative" dimension

Median income (1981-1990)

	Conservative	**Not Significant**
Not Significant	-9.29 p < 0.001	
Liberal	-9.39 p < 0.001	2.96 p = 0.002

Median "Conservative" = 30'775

Median "Not Significant" = 33'600

Median "Liberal" = 34'850

Median income (1991-2000)

	Conservative	**Not Significant**
Not Significant	-4.65 p < 0.001	
Liberal	-9.66 p < 0.001	7.55 p < 0.001

Median "Conservative" = 45'650

Median "Not Significant" = 47'125

Median "Liberal" = 50'050

Median income (2001-2010)

	Conservative	**Not Significant**
Not Significant	-9.58 p < 0.001	
Liberal	-18.11 p < 0.001	13.51 p < 0.001

Median "Conservative" = 52'200

Median "Not Significant" = 55'800

Median "Liberal" = 62'500

Median income (2011-2017)

	Conservative	**Not Significant**
Not Significant	-9.77 p < 0.001	
Liberal	-17.59 p < 0.001	12.73 p < 0.001

Median "Conservative" = 54'200

Median "Not Significant" = 59'150

Median "Liberal" = 68'400

Table B.4: Results of Dunn's tests on the Gini coefficient of the income distribution on the "Liberal-Conservative" dimension

Gini coefficient of the income distribution (1981-1990)

	Conservative	**Not Significant**
Not Significant	-7.20 p < 0.001	
Liberal	-12.48 p < 0.001	9.17 p < 0.001

Median "Conservative" = 0.279

Median "Not Significant" = 0.304

Median "Liberal" = 0.335

Gini coefficient of the income distribution (1991-2000)

	Conservative	**Not Significant**
Not Significant	-9.45 p < 0.001	
Liberal	-11.55 p < 0.001	5.03 p < 0.001

Median "Conservative" = 0.304

Median "Not Significant" = 0.322

Median "Liberal" = 0.338

Gini coefficient of the income distribution (2001-2010)

	Conservative	**Not Significant**
Not Significant	-7.55 p < 0.001	
Liberal	-10.93 p < 0.001	6.36 p < 0.001

Median "Conservative" = 0.297

Median "Not Significant" = 0.311

Median "Liberal" = 0.331

Gini coefficient of the income distribution (2011-2017)

	Conservative	**Not Significant**
Not Significant	-8.27 p < 0.001	
Liberal	-14.19 p < 0.001	9.89 p < 0.001

Median "Conservative" = 0.317

Median "Not Significant" = 0.337

Median "Liberal" = 0.371

"Ecological-Technocratic" dimension

Table B.5: Results of Dunn's tests on median income on the "Ecological-Technocratic" dimension

Median income (1981-1990)

	Ecological	**Not Significant**
Not Significant	5.57 p < 0.001	
Technocratic	3.59 p < 0.001	-1.21 p = 0.11

Median "Ecological" = 34'700

Median "Not Significant" = 33'050

Median "Technocratic" = 33'117

Median income (1991-2000)

	Ecological	**Not Significant**
Not Significant	0.71 p = 0.24	
Technocratic	3.34 p < 0.001	3.37 p = 0.001

Median "Ecological" = 48'000

Median "Not Significant" = 47'400

Median "Technocratic" = 45'938

Median income (2001-2010)

	Ecological	**Not Significant**
Not Significant	3.52 p < 0.001	
Technocratic	7.52 p < 0.001	5.90 p < 0.001

Median "Ecological" = 58'000

Median "Not Significant" = 55'925

Median "Technocratic" = 53'150

Median income (2011-2017)

	Ecological	**Not Significant**
Not Significant	-2.01 p = 0.03	
Technocratic	-2.64 p = 0.01	-1.20 p = 0.12

Median "Ecological" = 58'400

Median "Not Significant" = 59'400

Median "Technocratic" = 60'300

Table B.6: Results of Dunn's tests on the Gini coefficient of the income distribution on the "Ecological-Technocratic" dimension

Gini coefficient of the income distribution (1981-1990)

	Ecological	**Not Significant**
Not Significant	3.97 p < 0.001	
Technocratic	-0.25 p = 0.40	-4.26 p < 0.001

Median "Ecological" = 0.311

Median "Not Significant" = 0.302

Median "Technocratic" = 0.315

Gini coefficient of the income distribution (1991-2000)

	Ecological	**Not Significant**
Not Significant	11.34 p < 0.001	
Technocratic	6.87 p < 0.001	-2.46 p = 0.007

Median "Ecological" = 0.343

Median "Not Significant" = 0.313

Median "Technocratic" = 0.318

Gini coefficient of the income distribution (2001-2010)

	Ecological	**Not Significant**
Not Significant	5.85 p < 0.001	
Technocratic	4.90 p < 0.001	0.43 p = 0.33

Median "Ecological" = 0.323

Median "Not Significant" = 0.308

Median "Technocratic" = 0.307

Gini coefficient of the income distribution (2011-2017)

	Ecological	**Not Significant**
Not Significant	-4.40 p < 0.001	
Technocratic	-13.02 p < 0.001	-11.74 p < 0.001

Median "Ecological" = 0.327

Median "Not Significant" = 0.333

Median "Technocratic" = 0.373