CHARLES UNIVERSITY
FACULTY OF SOCIAL SCIENCES
Institute of Economic Studies

Economic determinants of voting behaviour in Czech parliamentary elections in 2021

Master's thesis

Author: Karel Vaněk

Study program: Ekonomie a finance

Supervisor: Mgr. Barbara Pertold-Gebicka, M.A., Ph.D.

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Bibliographic note

Abstract

This thesis examines the voting patterns in the 2021 parliamentary elections in Czech Republic. First using techniques of multivariate analysis as is the principal component analysis, the factor analysis and the t-SNE model, the political positions of political parties participating in the 2021 elections are created using political platforms data from the VAA volebnikalkulačka.cz. Then combining the party positions and election results in every relevant municipality, the consensus position of each relevant municipality was determined. Second, to illustrate the usage of these political positions coefficients, the Weight Least Squares and Spatial Durbin Error models are constructed using variables connected to the cleavages theory, theory of economic voting and theories of regional development.

Keywords

Abstrakt

Tato práce se zabývá volebním chováním v parlamentních volbách v roce 2021 v České republice. Nejprve jsou pomocí technik vícerozměrné analýzy jako jsou analýza hlavních komponent, faktorová analýza a model t-SNE, vytvořeny politické pozice politických stran účastnících se voleb roku 2021, a to na základě dat z VAA databáze volebnikalkulačka.cz. Následně byla kombinací stranických pozic a volebních výsledků v každé relevantní obci stanovena politická pozice každé relevantní obce. Následně, pro ilustraci využití těchto koeficientů politických pozic, jsou zkonstruovány modely Weight Least Squares a Spatial Durbin Error a to s využitím proměnných spojených s teorií štěpení, teorií ekonomického hlasování a teorií regionálního rozvoje.

Keywords

Declaration of Authorship

1. I hereby declare that I have compiled this thesis using the listed literature and resources only.

2. I hereby declare that my thesis has not been used to gain any other academic title.

3. I fully agree to my work being used for study and scientific purposes. .

Prague, April 30, 2024

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Karel Vaněk

Acknowledgments

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Acronyms

EET   Electronic sales registration

MDS   Multidimensional Scaling

MP   Member of parliament

PCA   Principal component analysis

VAA   Voting advice application

VAT   Value added tax

ANO 2011 ANO 2011

ČSSD Česká strana sociálně demokratická

ODS   Občanská demokratická strana

TOP 09 TOP 09

KDU-ČSL Křesťanská demokratická unie - Česká strana lidová

KSČM Komunistická strana Čech a Moravy

SPD   Svoboda a přímá demokracie

STAN Starostové a nezávislí

SDEM Spatial Durbin Error Model

OLS   Ordinary Least Squares

WLS   Weighted Least Squares

VIF   The Variance Inflation Factor

Master's Thesis Proposal

Institute of Economic Studies
Faculty of Social Sciences
Charles University

Proposed Topic:

Economic determinants of voting behaviour in Czech parliamentary elections

Motivation:

The complex intertwined relationship between economic and political reality is concern for both subjects, economics as well as political science. At the centre of this interwinding area is the reality of voting behaviour in the context of most recent economic development. In the coming months and years of macroeconomic uncertainty, it is important to try to understand these kinds of relationships. Since at least the late 1950s the topic attracted significant coverage from wide array of economists who produced a significant amount of academic work.

In the year 1957 Anthony Downs defined the voting mechanism in the democracy as an effort of political parties to formulate policies strictly as a means to gathering votes (Downs, 1957). At the day of the election, in fair and democratic system, voter casts his vote to signal if he supports the current direction of the country and how he or she feels about possible public policies in the forthcoming period. Overall, the classical explanation of the voting behaviour is the presence of social factors as class, religion or society (Stevenson, 2001). In the recent years however, exhausting list of papers indicates that the voters reward the governments on the state of the aggregate economy by casting their votes in line with the economic development. Just as politics influence the economy, does the state of the economy influence politics (Markussen, 2017). Therefore, the elections and the subsequent behaviour of individual parties could be understood as analogous to the entrepreneurs in profit-seeking economy.

It is however important to distinguish what economic factors are suitable for this kind of analysis. Further, there can exist plethora of biases, that can skew the results. Study by Ian G. Anson point out that the subjective economic perceptions are not made up of balanced amalgam of current economic conditions, but more in line with individual perception of one's economic reality. Moreover, the so-called class bias could be encountered. The people tend to favour positive economic, that have positive effect primarily on the very rich "classes" of society (Anson, 2015). The relationship between the economic reality and vote choice is however empirically verified by years of research and thus it makes sense to tackle this issue even in its most broad way imaginable.

Aim of this thesis would be therefore to look at the individual voter data by electoral regions in Czech Republic. The scope would be therefore local and more granular than the aggregate country wide data. I would research not only the relationship between important macroeconomic indicators but also between more microeconomic variables. I hope that this thesis would succeed in answering the question, if the economic reality is important for the voter behaviour in Czech Republic and if there are any regions that are more susceptible to this kind of thinking then others.

Hypotheses:

1. Hypothesis #1: The results of parliamentary elections are determined by economic reality.
2. Hypothesis #2: Negative economic indicators lead to worse election outputs for incumbents.
3. Hypothesis #3: Situation in Czech Republic is in line with the recent developments in this area.

Methodology:

The thesis would have two distinct parts.

In the first part, the political position of each of the 77 Czech counties would be determined based on the parliamentary elections in 2013, 2017 and 2021. This would be achieved by using the answers in VAA voting

applications created by KohoVolit.eu. with a combination of real-life election results. Using these data and principal component analysis, a two-dimensional space would be constructed. Based on this space and based on developments in spatial analysis and coalition formation theory, the political position of each county, taking into account both election results and election programs, would be created. Therefore, each county will have a standardized index for years 2013, 2017 and 2021 taking value between 0 and 1. Each connected to the corresponding dimension on the economic left-right axis (Knutsen 1995). THe salience of this divide is still debated to this day, especially as the left/right distinction is rather dynamic (de Vries, 2013), however in the Czech Republic the current research as well as political parties still operate within these economic boundaries (Chytílek & Eibl, 2011).

The second part would be concerned with econometric model, detailing the relationship between economic reality and the aforementioned indexes, describing the political position of each county. To construct a sufficient econometric model, that would describe in detail the researched relationship one obstacle arises from get go. There are multitude parties, that are competing for the votes in the parliamentary elections, therefore the political space cannot be represented as a two-dimensional space. Secondly, the voter choice is bounded, as there cannot be a greater or lower probability of voting for party than one and zero. Moreover, thirdly, the relationship of the parties to each other is not generally acknowledged and likely varies across voters and elections. Thus, statistical models that impose restrictions on the location of the parties in the electoral space may produce misleading estimates.

To create sufficient econometrical model within these constraints, the more traditional approaches, such as OLS and binomial logit/probit models, can be insufficient. Or rather, it can be used, but a political continuum must be created. For example by mapping the parties by the use of principal component analysis and by using approaches from spatial analysis of electoral platforms. This is the reason for part one of this thesis.

Expected Contribution:

The history of spatial analysis of election results have a long tradition in Czech Republic. There is research providing us with the information that between the years 2006 and 2013 the right-wing parties received greater support in regions with significant development potential, whereas left-wing parties received greater support in areas with limited development potential (Maškarinec, 2017). Moreover, the effect of macro-regions on election results and current status of main political cleavages was also explored (Maškarinec, 2013). There is also research, that explores the rise of new populist parties as primarily taking hold in the socially and economically poorer areas (Lysek, Pánek & Lebeda, 2020). The effect of COVID pandemic on the election is also noticeable, with number of infected negatively correlating to the amount of infected, while the positive correlation was noticed between the number of infected and the election results for the main opposition parties (Válek, 2022). Further, regarding the direct and indirect effects on election the amount of higher educated and entrepreneurs have significant direct effects on election results while public spending or infrastructure have indirect effect (Černý, 2022).

My thesis would explore the effect of economic variables upon election results in much more granular detail. By creating the political positions of each region, the election results of all parties would be taken into account. Further, by working directly with the VAA data, their political positions would be more precisely described and thus the relationship between the dependent and independent variables would be explored in much higher detail. This would help better describe region specific voting patterns and led to further understanding of the underlying mechanisms of today's election results.

Outline:

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e. Data
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g. Conclusion

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Author   **Supervisor**

Chapter 1

Introduction

The complex intertwined relationship between economic and political reality is concern for both subjects, economics as well as political science. At the centre of this interwinding area is the reality of voting behaviour in the context of most recent economic development. In the coming months and years of macroeconomic uncertainty, it is important to try to understand these kinds of relationships. Since at least the late 1950s the topic attracted significant coverage from wide array of economists who produced a significant amount of academic work.

In the year 1957 Anthony Downs defined the voting mechanism in the democracy as an effort of political parties to formulate policies strictly as a means to gathering votes (Downs, 1957). At the day of the election, in fair and democratic system, voter casts his vote to signal if he supports the current direction of the country and how he or she feels about possible public policies in the forthcoming period. Overall, the classical explanation of the voting behaviour is the presence of social factors as class, religion or society (Stevenson, 2001). In the recent years however, exhausting list of papers indicates that the voters reward the governments on the state of the aggregate economy by casting their votes in line with the economic development. Just as politics influence the economy, does the state of the economy influence politics (Markussen, n.d.). Therefore, the elections and the subsequent behaviour of individual parties could be understood as analogous to the entrepreneurs in profit-seeking economy.

It is however important to distinguish what economic factors are suitable for this kind of analysis. Further, there can exist plethora of biases, that can

skew the results. Study by Ian G. Anson points out that balanced amalgam of current economic conditions does not lay at the core of subjective economic perceptions. The subjective economic perceptions are more in line with the individual perception of one's economic reality. Moreover, the so-called class bias could be encountered. The people tend to favour positive economic, that have positive effect primarily on the very rich "classes" of society (Anson & Hellwig, 2015). The relationship between the economic reality and voter's choice is however empirically verified by years of research and thus it makes sense to tackle this issue even in its most broad way imaginable.

Moreover, the ideas pertaining to the effect of cleavages or regional development were also discussed. Cleavages are based on the notions, that the voting behavior is shaped by the underlying divisions within the society. The regional factors influencing voting behavior are intrinsically connected to the development of the regional infrastructure.

Therefore, inspired by these considerations, the idea is to create a new political variable, that would denote the political position of each municipality, region or ORP. Then using methods from spatial econometrics, an illustrative example of the usage of these indexes is created, linking them to the plethora of variables. This may help us achieve a better understanding of the small part of the intertwined relationship between economic and political reality in such a way, that all voters preferences would accounted for while taking into account the spatial characteristics of municipal data.

The thesis have two distinct parts. In the first part, the political position of Czech counties, regions and municipalities is determined based on the parliamentary elections in 2021. This is achieved by using the answers in VAA voting applications created by KohoVolit.eu. Using these data and multivariate statistical techniques as is the principal component analysis, the factor analysis and t-SNE model, the political index would be constructed. Based on this index and based on developments in spatial analysis and coalition formation theory, the political position of each unit would be determined. Therefore, each county, region and municipality would have standardized index for the years 2021. Each connected to one of the principal components.

In the second part, the obtained indexes for each of the Czech municipalities are used as a dependent variable in the econometric model that regresses the aforementioned political positions onto the variety of economic, regional and

cleavage's connected independent variables to find out how the political position of each county are determined by these variables. Due to the characteristics of the data and its issues with spatial auto-correlation and heteroscedasticity two models would be constructed - the Weight Least Squares Model and the Dubin Spatial Error Model. The results indicate, that the salience of education and personal economic situation are the biggest predictors of an political position while the effect of cleavages, infrastructure and demographic are mixed at best.

Part I

Mapping the positions of Political Parties

Chapter 2

Introduction part I

The elections of 2021 provided Czech Republic with rather surprising results. The incumbent ANO 2011 was narrowly defeated by the broad coalition of center-right to center-left parties united mainly by the opposition to the incumbents, eventhough ideological and political positions of the opposition coalition members were all over the place. Political preference surveys, in the weeks before the elections, initially favoured the Piráti–Starostové coalition, in the end SPOLU coalition narrowly won over the incumbent ANO party.

The results as well as the following analysis usually concentrates on the results of those parties and movements who were able to secure places in the after-election political body (be it Senate or Chamber of Deputies). The 2021 elections were however unique in a sense. Every fifth vote, over 1 million votes in total, was allocated to the party that did not secured a single seat.

Thus to better understand the aggregate opinions of voters on the regional basis, the political preferences of Czech regions, municipalities and counties are constructed by using the data from the VAA application and subsequent political positions of all parties, that have taken place in the 2021 elections. VAA aggregates questions and answers by political parties regarding the most salient issues in the upcoming elections. The research question of the first part of the thesis is as follows: What are the differences in the political positions of regions, when taking into account all votes for all political parties, based on their election platforms?

Based on this approach two core hypothesis would be tested:

H1: The positions within the political space, created by the multivariate statistical

techniques would show grouping of the political parties that will be in line with the widely accepted groups from within the political science theory.

H2: The political positions of municipalities, regions and counties influence significant level of variability.

By having constructed this political space, and subtracting these values representing political positions, further research using the position variable as an independent variable can be accomplished.

Chapter 3

Literature review

In this section, literature is reviewed concerning the development and understanding of political positions of political parties and its measurements. Further the eligibility of the primary source of data, the VAAs developed by the kohovolit.eu is discussed. Then the focus is pointed at the existing research in terms of spatial analysis and used techniques to determine the political positions of parties.

3.1 Political party and political space

Political party is the defacto basic unit of our current political space. The Constitution of the Czech Republic defines the political system in Czech Republic as "the political system is based on free and voluntary formation and free competition between political parties respecting fundamental democratic principles and rejecting violence as a means of advancing their interests". In short it is hard to imagine a political system without the existence of political parties (Ware, 1996). One of the main thinkers in the theory of political parties, Giovanni Sartori, defines a political party as a political group which is taking part in the elections and is able to use these elections to secure political places for its candidates (Sartori, 2005). On the other hand, the other most important party theoretician, categorizes political parties into the mass-based and elite-based. The mass-based parties are determined by their strong, pyramid-like, structure with a lot of members, these members identifying with the party ideology rather then with the party leader. The elite-based parties are then focused on the quality of its members, their structure is more flexible and the

members experience much higher degree of freedom (Duverger, 1959). Nowadays, the function of political parties is as follows – they are conductors or critics of the governments, the act as an selection base of official personnel, they help establish and formulate public policies, they are a vehicle of political education and they act as intermediaries between individual and government (Merriam, 1923).

When having defined what the political party is as an entity, now we can focus on the role the political parties have in the political system. To understand the role, attitudes and positions of political parties towards all kinds of issues, the spatial theory of voting is used. For example, it can be useful tool to distinguish between the left/right economic axis. This theory provides a map of ideological space and within this space locates the voters or candidates ideal points offering rigorous description of the political space (Endersby & Hinich, 1992). Overall, there seems to be two main idea-flows in the spatial theorizing – these are the proximity and directional approaches. The proximity theories speculate that voters make decisions on who to vote for based on their perceived proximity of their political position to the party political position, thus the rational voter will always support the party that has the lowest distance to their own preferences. On the other hand, the directional approach is based on the notion that voters support those candidates, that made promises to move the whole party system in a way that will prove to be in line with the voter preferences, ergo the center or neutral points within political space indeed exists. The voters however support those candidates who advocate extreme positions in the same direction from the center as the voter's ideal points (Cho & Endersby, 2003).

The political space itself is naturally dimensional. The political space was interpreted thought the spatial lens ever since the French revolution and the well-known right/left distinction of the revolutionary assembly. When trying to map the political system from the more theoretical position one arrives at the issue of what these dimensions actually stand for. The traditional dimensional distinction is the distinction between the cultural value dimensions and economic value dimension – these can be extended by the usage of for example the new cultural dimension that is based on the notion of the winners and losers of globalization (Van Der Brug & Van Spanje, 2009). The need to use more than one dimension to describe key political differences is very common too, though there is typically much less certainty about the number and substance of any

additional dimensions that might be needed (Benoit & Laver, 2012).

3.2   Estimating party positions

To commence with the empirical analysis and compare various positions the quantitative approach is needed. When presented with the numerical data denoting the political positions, further analysis is possible on much in-depth scale.

The academic literature distinguishes between various approaches that can be used to estimate party positions. There are the approaches that use the coding of party manifestos (Laver & Garry, 2000). There are also the approaches that are based on the questionnaires for the potential voters. These voters than try to position the parties on the selected set of issues (Wagner & Meyer, 2023). The same can be also done by using the lower amount of expert opinions (Armstrong, Stephenson, & Alcantara, 2023). The party positions can be also estimated by using the actual policy output of parties (Pennings & Keman, 2002), but this approach tend to be limited by the reality of the previous elections (i.e. it can be concluded only to those parties that were already elected). The last approach is the usage of the VAA solutions (Schultze, 2014). VAA stands for the Voting Advice Application. VAAs are based on the idea that they match the political offers (defined by the set of questions that is answered by each party) to the political demand of voters (defined by the answers to the same set of questions that the parties answered) (Vassil, 2012). The data from the VAA are precisely those, that are considered one for the most useful when coding the position of political party within political space.

Generally, there can be various problems with the VAA dataset. First, the parties could calculate and position themselves with the average user in mind leading to the liberal bias of the answers (as liberal voters are more prone to use these applications than the conservative ones). Moreover, there can be issue of some parties boycotting the VAAs all together, albeit they tend to be parties with minimal success potential. Alas, the issue of badly designed VAA can also play a role as the creators could be biased towards one or many salient themes, that are relevant at the time of the creation of the VAA but do not say anything specific about the real opinions of the parties (Pianzola, 2014).

3.3   Past relevant research

Usage of VAA data has a long history in the academic circles - it main advantage lays in the ability to visualise, use the aforementioned dimensionality of political space, it can be used to explain voting behavior on the consistent model of self-interest on the basis of unchanging voter preferences (Wheatley, 2012).

As for the combination of dimension reduction techniques and political platforms data there are two main approaches. First group of researchers use the combination of multivariate techniques and intuitive reasoning to find the positions of political parties. These can be the mapping of CEE political preferences on left-right scale (Louwerse, 2009), using the CMP left-right scale from Manifesto Project (Benoit & Laver, 2012) or computerised content analysis (Pennings & Keman, 2002). Second group provide more statistically oriented approach. The combination of dimension reduction statistical technique and VAA data to find the latent dimension were used in case of Greece (Wheatley, Carman, Mendez, & Mitchell, 2014), Scotland (Wheatley, Mendez, & Germann, 2012) or USA, Canada and New Zealand (Van Der Linden & Dufresne, 2017).

The precise point of the political party in the political space is the bliss-point, ie. the point with multiple coordinates on the multiple selected salient political dimensions. There is research providing us with the information that between the years 2006 and 2013 the right-wing parties received greater support in regions with significant development potential, whereas left-wing parties received greater support in areas with limited development potential (Maškarinec, 2017). Moreover, the effect of macro-regions on election results and current status of main political cleavages was also explored (Maškarinec, 2013). There is also research, that explores the rise of new populist parties as primarily taking hold in the socially and economically poorer areas (Lysek, Pánek, & Lebeda, 2021). The effect of COVID pandemic on the election is also noticeable, with number of infected negatively correlating to the amount of infected, while the positive correlation was noticed between the number of infected and the election results for the main opposition parties (Válek, 2022). Further, regarding the direct and indirect effects on election the amount of higher educated and entrepreneurs have significant direct effects on election results while public spending or infrastructure have indirect effect (Černỳ, 2022).

Chapter 4

Methodology

To find the answer to how does the political positions of Czech regions differs and if there indeed exist the groupings in line with common political science knowledge among participating parties, it is important first to quantify the political position of each unit. This can be achieved by using the dimension reduction techniques and set of data, that describes the political positions of all the parties taking place in last elections. By voting for certain party, the voter is revealing his policy preferences. The region is then set of all voters within precise geographical boundaries. Therefore, first the dimension reduction techniques is applied to find underlying latent dimensions for each political party. Then by using the political positions and electoral results of all parties within each region, the aggregated policy preference within certain latent dimension can be determined – the equivalent to the consensus position within all of the voters with political preferences in line with the party they have voted for.

4.1   Used dimension reduction techniques

The academic literature concerning the mapping of political party preferences specify multiple approaches. The dimension reduction techniques have come up with multiple dimensions, that are not directly transferable to classical distinctions (as can be the CAL/TAN distinction). This is however not an issue, as there is still no academic consensus as to how many dimensions exist, what these dimensions are and how they should be reconstructed in the first place (Elff, 2002). Thus, the following statistical methods will be used: the PCA

analysis, the exploratory factor model and the machine learning based t-SNE model (Anowar, Sadaoui, & Selim, 2021).

4.1.1   Principal component analysis

The PCA was first established as a method that finds the lines and planes of closest fit to systems of points in space in early 1900s (Pearson, 1901). Upon Pearsons work, the current foundations of PCA were build, leaning towards more in-depth representation of the geometrical aspects. Nowadays, the PCA is being used in many, completely different, scientific fields with many different names as is the singular value decomposition, the Karhunen-Loéve expansion or as eigenvector analysis and characteristic vector analysis in physical sciences (Wold, Esbensen, & Geladi, 1987).

Currently the distinction between so called linear and nonlinear PCA is the most salient. The difference between the two approaches lays primarily in the ability to transform the observed variables into the principal components by using the nominal and ordinal variables. Moreover this can give the researchers the ability to manage variables based on their inherent measurement levels, for example by interpreting the Likert-type scales as a ordinal variable. (Linting, Meulman, Groenen, & van der Koojj, 2007). The other important usage of the nonlinear PCA is in its ability to identify specific set of features based on specific criteria. The example of nonlinear PCA can be the hierarchical approach as proposed by Scholz and Vigario or the method for the SPPS program as divised by the Lintig and van der Kooijl (Linting & van der Kooij, 2012; Scholz & Vigário, 2002).

In economics and econometrics the PCA can be used for the variety of tasks. It can be used to give further insight into monetary policy and finding that estimated factors do provide a useful parsimonious summary of the information used in designing monetary policy (Favero, Marcellino, & Neglia, 2005). PCA can be also used to analyse the monthly returns of hedge funds, banks, brokers/dealers and insurance companies and its systematic risks (Billio, Getmansky, Lo, & Pelizzon, 2012). Further it is being used to interpret the high-dimensional factor analysis by removing the noise components (Fan, Liao, & Wang, 2016). It is a method that is being implored in various environments that can benefit from the dimension reduction ability.

When trying to estimate the positions of the political parties the PCA together

with any set of data on political platforms (be it VAA, the party manifestos, the expert surveys or any other approach) is being used rather often. The combination of PCA and party manifestos is used to find out the differences between each aforementioned sources of data, the study find out that the indicators derived from the media converge with traditionally used measurements from party manifestos, mass surveys and expert judgments, but that salience indicators measure different underlying constructs (Helbling & Tresch, 2011). PCA can be also used to find out which issues in the political space have highest salience for the mainstream and niche parties. The structure of political conflict in Eastern versus Western Europe could not be more different, the logic with which parties compete in their respective systems is the same (Rovny & Edwards, 2012). Further the PCA can be also used to find out how many salient dimensions there really are in the political space, with four being the most close to the truth (Albright, 2008). I have also used the concept of PCA to map position of political parties and then create game theoretic concepts to try to forecast governing coalitions based on the party platforms (Vaněk, 2021). To conclude, the PCA, in its linear and nonlinear variant, is dimensionality reduction method that increases ones ability to interpret information while it minimize the loss of information (Joliffe & Morgan, 1992). It has history of usage in all kinds of subjects. In economics and econometrics it is used to solve rather complex issues. Regarding the position of the political parties, the usage of PCA is also well documented with all kinds of source data.

The dataset from the VAA for each political party is in a sense an example of multidimensional space denoting the multidimensional coordinates of the parties , this multidimensional space can be then reduced to the 2-dimensional space and thus be made more accessible to any kind of analysis.

At the beginning the VAA dataset, consisting of yes and no answers by all of the political parties except one, was standardized through scaling by using using the mean value and the standard deviation. This standardized matrix X with rows equivalent to number of political parties and the columns equivalent to the number of variables (the VAA answers) is then used to construct the covariance matrix, given as:

$$C = \frac{(X^T) * X}{n - 1} \tag{4.1}$$

Then eigenvectors matrix V was constructed using the notion of covariance

matrix being the multiple of the matrix C. The full-set of eigenvectors up to the number of columns are then the principal components. The principal components that have the higher amount of explained variance, as ranked by the value of eigenvectors by their eigenvalues, are then used to map the relative positions of all of the political parties. To select the correct principal components the additional analysis is concluded to look at which variables contribute to each principal component. This is achieved by counting the quality of representation as the squared coordinates of the principal components divided by the total quality of representation of the component.

4.1.2   Exploratory factor model

Factor analysis is a statistical technique employed to characterize the variability among observed, correlated variables by identifying a smaller number of unobserved variables – so called individual factors. They are the underlying latent variables, representing the variables as linear combinations of aforementioned potential factors along with "error" terms, making factor analysis a specific instance of errors-in-variables models. These factors account for the shared variations in the observed variables. Thus, the model represents the observed variables. The factor analysis is usually employed to reduce the amount of dimensions in the dataset, it puts the variables into similar clusters (Gorsuch, 2014).

The main distinction between the Principal component analysis and the factor analysis lays in the notion that the factors represent the original variables through linear combination of the factors whereas in the principal component analysis the principal components are linear combination of the original variables of the dataset. Further, the principal component analysis is mainly concerned with the total variance, the factors on the other hand deal mainly with covariance and correlations among the variables (Rencher & Christensen, 2012).

The method used to find the factors is based on the Maximum Likelihood Method. Iterative eigenvalue decomposition of a correlation matrix is performed, updating communalities on the diagonal until the sum of diagonal elements stabilizes. This in order to aim to estimate communalities for each variable based on the first n factors.

Important thing to consider is the satisfactory result of the Heywood and Ultra-Heywood case. If the test confirms any of these two occurrences, the

iterative method converges to unique variance values. Basically, it occurs when the amount of factors extracted is too huge or the sample size too small.

Further, the important distinction is the selection of the sufficient amount of factors. The method used in this thesis is the usage of scree plot of the eigenvalues. When the scree plot rapidly fails and than remains still at very low value, then the points before the fall is considered.

4.1.3   t-SNE

Unlike the PCA and Explanatory Factor Analysis, the t-SNE is part of the non-parametric approaches towards the dimension reduction. The non-parametric methods provides mapping of the given data points without an explicit mapping prescription. The main advantage of the t-SNE lays in the fact that the underlying structures may become more visible while sacrificing repeatability and being less modifiable after the analysis is concluded nad it is impossible to add additional dimension once the analysis is due, as the results would be different in each run (Gisbrecht, Schulz, & Hammer, 2015).

Firstly, the distance matrix is be constructed and the similarity score is calculated. Then taken into account selected perplexity (for two models, one with very low and one with very high perplexity) which states how many nearest neighbours are taken into account when the embedding in the low-dimensional space is created. Then the RTSNE function from the R package *Rtsne* is used to create the t-SNE low dimensional embedding (Krijthe, van der Maaten, & Krijthe, 2018).

4.2   The Consensus position – Measuring the position of a region

When having the dimension reduction in place the political position of the region is the last problem that needs to be solved. This is due to the need of describing the position of a region as one numerical in a way that can be used for a further analysis. For this the game theoristic approach can be used.

More precisely the modified concept of consensus position can be applicable here. The original idea of the consensus position is based on the notion of the consensus of the winning coalition. It is calculated as a position in which all

the positions of all governing parties are taken into account, based on their
weighted position in the political space. For the winning coalition following
stands true:

$$x_i^* = \frac{\sum_{i=1}^{n}(w_i)*(x_i)}{\sum i} \tag{4.2}$$

Where w stands for the weight of each member of the governing coalition, based
on the number of seats won, x is the precise coalition party and i stands for the
overall sum of all parties taking place in the coalition. The consensus position
is then, in the context of cooperative games, underlined by the need of all of
the coalition members to have sufficient amount of power in the government
(Gamson, 1961).

The modified version of this approach can be made under the assumption, that
the overall average political position of a region, in case of national election,
can be equal to the hypothetical coalition of all of the parties taking place in
the elections weighted by the number of eligible votes by the each of the parties
taking place in the election. Then the consensus position of this hypothetical
coalition denotes the overall position of the region. The modified equation
stands then as follows:

$$x_i^* = \frac{\sum_{i=1}^{n}(w_a)*(x_a a)}{\sum a} \tag{4.3}$$

Where w stands for the weight of each party taking place in the elections, based
on the number of seats won, x is the precise party taking place in the election
and a stands for the overall number of all parties taking place in the election.

Chapter 5

Political and historical context

In this section, important empirical background to the thesis topic is provided. Firstly, the historical context is discussed, then the focus is put on describing the Czech political system, how elections are organized and transferred into seats in the Parliament. The question of how can party be registered for elections and how many parties took place in the 2021 elections is answered. Finally, the main political parties taking place in the elections are be described.

5.1 Historical context

The Czechoslovak Republic, established in October 1918 in the aftermath of to the dissolution of the longstanding Habsburg Monarchy after the end of World War One, is the direct predecessor to the contemporary Czech Republic. Characterized by a representative democracy and parliamentary structure, Czechoslovakia embodied a robust democratic ethos from its inception - by its representative democracy with parliamentary system and strong democratic tradition (Marková, 2016). All the traditional signs of democracy were present during the so called "first republic". The citizens were able to use and live through complete set of human rights and freedoms. The citizens were equal before the law, the power was distributed in line with other democracies of the times with separation of power between legislature, judicature and executive within system that was pluralistic and build upon strong republican foundations (Balík, 2011).

It had still its limitations of course and during the tenure of the so called "second republic" have almost entirely lost the aforementioned democratically ethos

(Rataj, 2005). Still, the continuity of representative rule, the style of government of the elites vis-à-vis the counter-elites and the degree of formal/informal protection for religious, ethnic or linguistic minorities are among the reasons that interwar Czechoslovakia was able to endure as a functioning democracy up until the Munich Agreement (Braghiroli, 2007).

After the Second World War and one partly free elections, Czechoslovakia was an one-party government ruled by Communist Party of Czechoslovakia (Charvát & Rákosník, 2010). Under the communist regime only one list of candidates, so called National Front, was permitted. The principle of National Front balloting, in practice in 1948 although, not codified until 1954, leaved the voter with practically no alternatives. Only the politicians approved by Czech communist party were approved, National Front itself subordinate to Czechoslovak Communist Party.

Following the onset of the Velvet Revolution, a transformative shift in the political landscape unfolded. The era of communist one party rule was no more. Instead the reinstated multiparty system witnessed the inaugural free elections with diverse party representation. First of them taking place on the 8th and 9th of June 1990. Subsequently, the division of Czechoslovakia into the Czech Republic and Slovakia in 1993 delineated the inception of the contemporary Czech political framework. After the transition the Czech Republic was able to develop a stable political system and institutions, as well as a clear separation between the individual institutions, being considered as a classical example of classical consolidated democracy (Mansfeldová & Guasti, 2010),

5.2   Czech Political System

Nowadays, the political system of Czech Republic is based on the characteristics of Czech Republic itself. The Czech Republic is a unitary state and parliamentary republic with a multi-party system, where executive authority is vested in the president and government. The government is led by the prime minister, legislative functions are carried out by a bicameral parliament, and judicial oversight is managed by a four-judge court system alongside a Constitutional Court.

National elections for a new Chamber of Deputies (the topic of this thesis) should take place once every 4 years. The voters vote within two days, rather

unique situation in developed democracy, as usually elections take place only during one day. In the 2021 parliamentary elections, when attending the voting booth, the voter selects his preferred party by selecting the party list and giving preferential votes to certain politicians on the party list. To calculate the minimum number of votes to get a seat in the elections, the Imperiali quota was used. This quota is based on the idea, that the least amount of votes needed to get a seat is equal to the total number of votes divided by the total seats (200 seats in the case of Chamber of Deputies) plus two. To get the amount of seats per party, the D'Hondt method was used. After the election, when all the votes were counted, for each party quotient is calculated. The party that has the highest quotient will win one seat. Then next quotient is calculated and again party on the top will win one seat. The main advantage of the method is that it reduces, at least compared to ideal proportional representation, the political fragmentation for smaller electoral district sizes.

Based on the law, the political parties or political movements (the basic organizational structures taking place in the Czech elections) can be founded by at least three state citizens of the Czech Republic over the age of 18. These individuals must submit a written proposal for registration and movement by mail or in person at the Registry Office of the Ministry of the Interior. If this party or movement want to take part in the elections, it must register with the Ministry of Interior.

In the Chamber of Deputies elections of 2021, there was 22 political subjects competing for the electoral votes. These subjects can be categorized (by their own admission) as 11 political parties, 9 political movements and 2 election coalitions. The election coalitions were the right-wing conservative SPOLU coalition (coalition of right-wing conservative ODS, the right-wing liberal TOP 09 and christian rightist KDU-ČSL) and centrist Piráti a Starostové (coalition of liberal Pirate party and technocratic Starostové a nezávislí). Additional coalition was the national-conservative Trikolóra SS (being coalition of parties Trikolóra, Svobodní and Strana soukromníků), however to pass the minimum requirements for coalitions of 7%. vote share, these parties decided to create new party all together to get around this requirement (rule which was abolished before the elections nevertheless). The incumbent was the political movement ANO led by former prime minister Andrej Babiš who was in governing coalition with social democratic ČSSD in the previous period, quietly supported by post-communist KSČM. The nationalistic forces were present due to the SPD

party. The last relevant subject was the movement Přísaha, led by former anticorruption detective Robert Šlachta on a anticorruption platform (Hušek & Smolík, 2019).

Chapter 6

Data

For the first part of the thesis, two main data sources are being used. First, are the results for the Czech Chamber of Deputies in the 2021 election. Second, are the VAA data for the aforementioned election.

6.1 Election results in the 2021 elections

The data for the results of the Chamber of Deputies elections were collected on the real-time basis by the Czech Statistical Bureau. The observed data are on the regional basis as the research question in place is concerned by the differences on the regional level.

The data presented in this text are the latest confirmed election results. Overall 5 375 090 eligible votes were collected. The votes were collected based on the electoral districts in each of the 72 regions divided by the 22 parties taking place in the election. Further votes were also collected on the ORP and municipal level leading to three distinct approaches. For a clarity sake the description of data would focus mainly on the regional level. However it is important to note, that the analysis itself was condusted on all three levels – regional, ORP and municipal.

The graphs above show that Prague being by far the biggest region pooled significantly more votes than any other region (it is important to note, that all voters living abroad are by design counted as voting in Prague). Moreover the parties that crossed the minimum threshold of 5% are also noticeable. For the devising of the overall position of the region, one thing is important to note.

Over 1 million votes were not counted towards the Chamber of Deputies because they were distributed to those parties, that do not crossed the needed threshold and thus would play significant role in devising the real political position of the regions.

Figure 6.1: Results in the 2021 parliamentary elections

(a) Results by regions

(b) Results by parties

6.2   Data from the 2021 VAA

The VAA data used in the thesis were created by the www.volebnikalkulacka.cz right before the 2021 elections. The questions are created by the experts from the Volební Kalkulačka organization. Overall the VAA dataset includes 116 questions ranging from all relevant policy areas including human rights, economy, international politics etc with focus on contemporary issues of the year 2021. The questions created needs to fulfil certain VAA criteria - the Volební Kalkulačka organization specifies that the questions are only concerned by that which is changeable by the politicians to be. The questions have only yes or no answers and they are neutral by design and clearly understandable (the questions are short and concise). The selection of question is in line with all the important election stakeholders, there are themes connected to the issues that are salient for all voter groups.

Table 6.1: VAA 2021 summary

Party	VAA	Votes
ANO 2011	114	1458140
ČSSD	116	250397
KSČM	102	193817
Piráti a STAN	103	839776
SPD	113	513910
Spolu	111	1493905
Přísaha	103	251562
Trikolóra SS	116	148463
Zelení	102	53343
ANS	111	5167
APB	92	11531
Koruna Česká	104	8635
Levice	116	639
Moravané	102	14285
MZH	97	1648
Nevolte Urza.cz	104	6775
Otevř. Česko	116	21804
PB	0	586
Prameny	114	8599
Senioři 21	110	3698
Švýc.dem.	93	16823
Volný blok	115	71587

Source: www.volebnikalkulacka.cz, ČSÚ

Additionally, there are a few questions that are not salient but still interesting within the overall contemporary public discussions in Czech Republic.

The questionnaire was sent to all parties which provided the answers. The lowest amount of answers was provided by the Pravý Blok party, which did not answered any questions. This is however not a grave issue, as this party collected only 586 votes in total and having relevant party list in only one district altogether, making it almost non relevant entity. The second lowest is the Aliance pro budoucnost party with 92 answers. Overall the response rate of the VAA was high, highest than the similar VAAs conducted before the elections in 2013 and 2017. On average 102 questions out of 116 was answered.

In line with the standard usage of VAA application the perspective voters can fill the VAA to find out their preferred party. This is not part of the analysis and as such is not analysed in the thesis.

Data were then transformed into the binary variables. In line with the yes or no answers provided by the parties, the answer "Yes" corresponded to the value of 1 and value "No" corresponded to the value of 0. When no answer was collected, the value of 0,5 was used, based on the preposition that these questions are not relevant for the parties and therefore the parties are indifferent if they are for or against that type of issue.

The VAA data are used to establish the relative positions of the political parties and as such the underlying patterns are taken advantage of. When constructing simple correlation matrix, the first patterns are be noticeable.

When running the initial analysis the first patterns within the dataset emerges. Following correlation matrix describes the relative (dissimilarities) in questions answered between the parties. Correlation matrix is a table which is created form the correlation coefficients between all variables. The value of one corresponds to the strong relationship whereas zero is equal to neutral relationship and minus one to negative relationship. Striking is the somewhat recidivist Nevolte Urza.cz party that have strong dissimilarity scores with almost each of the other parties and as such can be considered rather radical.

Further when using the hierarchical clustering method for the analysis of the data the distinction between the traditional mainstream parties that had history of being part of the political Establishment and part of the chamber of deputies and the rest of the parties which tend to be smaller and much more extreme in

Figure 6.2: Structure of answers in the data set of 2021

Count of Values for Each Party
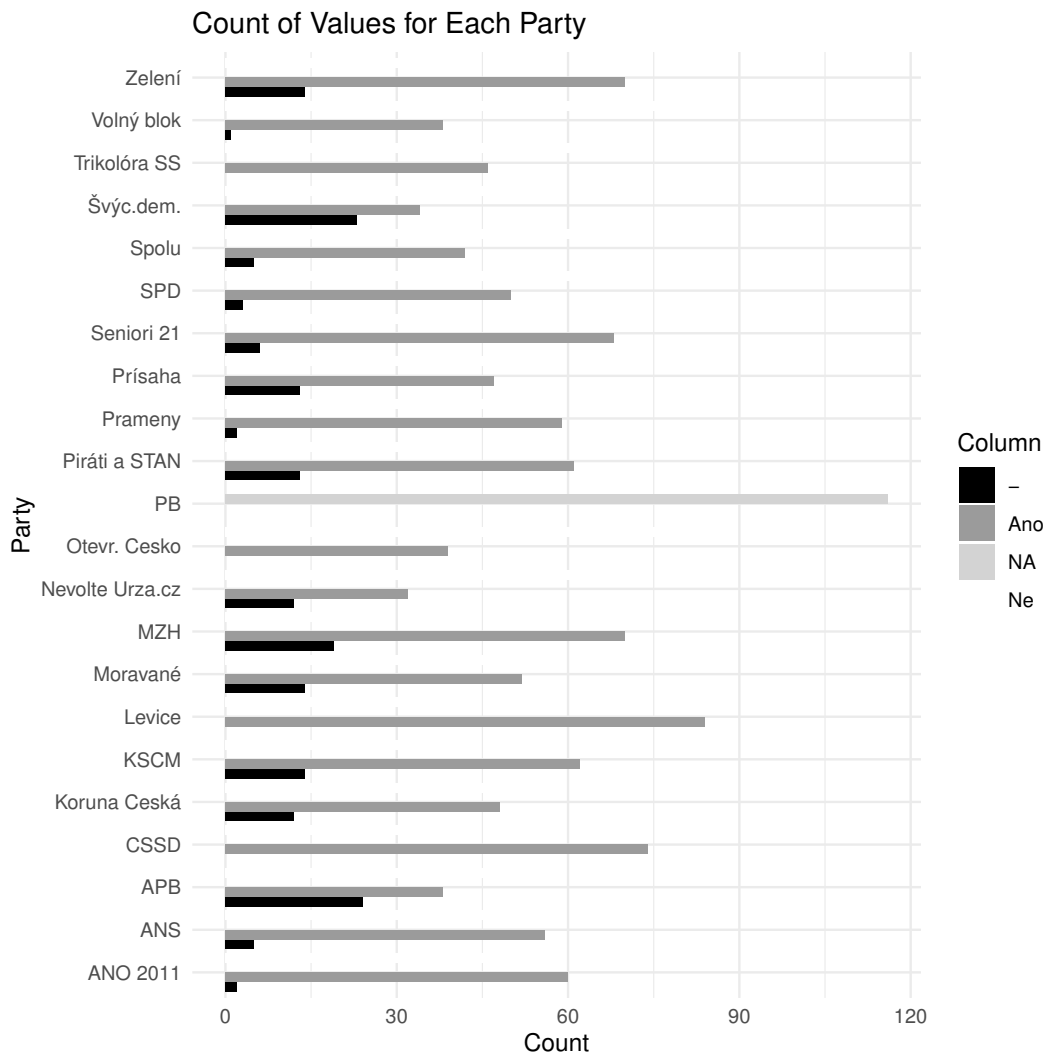
its positions. Only distinction is the SPD party that is nowadays traditional part of the political sphere but from the political space point of view is in line with the other group of small non-mainstream parties.

Figure 6.3: Correlation matrixes for the VAA 2021 data

(a) General Correlation Matrix

(b) Hierarchical clustering correlation matrix

Chapter 7

Parties, regions and results

The following section describes the main practical part of the first part of the thesis. The chosen approach, described in previous methodology section is applied. Thus multiple methods were employed to map the positions of the political parties. The standard PCA analysis, the principal factor model and the t-SNE analysis. Following section describes the process.

7.1 PCA Analysis

The principal component analysis was achieved using the FactoMineR package for R (Lê, Josse, & Husson, 2008). First the eigenvalues were computed to find-out the amount of variance explained.

Figure 7.1: Explained Variance
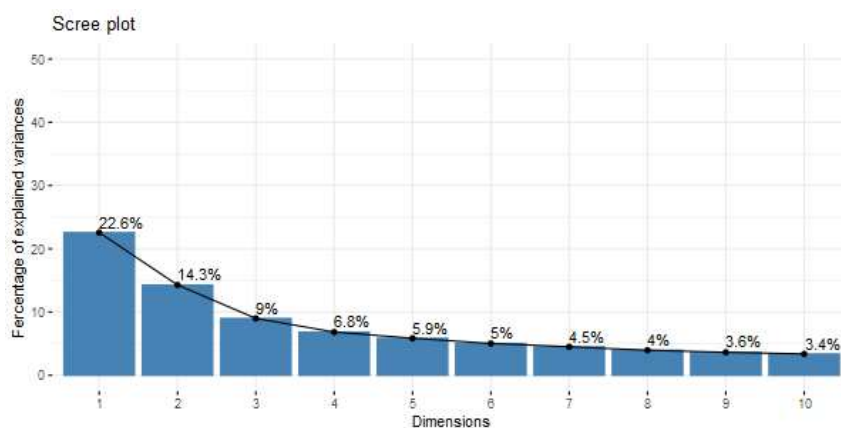
The results were far from satisfactory as only 22,6 percent of the variance was explained by the first principal factor. To explain the overall variance twenty

different principal components are needed. This can be at least partly explained by the fact that the questions from the VAA are all over the place – from economic questions to questions about space exploration.

When looking at what variables contributed to the first principal component dimension one can find over 53 variables that can be considered substantial, ranging from EU integration through education towards the fiscal policies. Parties who scored high within this principal component support higher EU integration, are in favour of more active fiscal role of the state and are inclined towards increased spending towards education.

Figure 7.2: Contributions of variables to PC1

(a) Contributions of variables to PC1   (b) Hierarchical clustering correlation matrix PC1
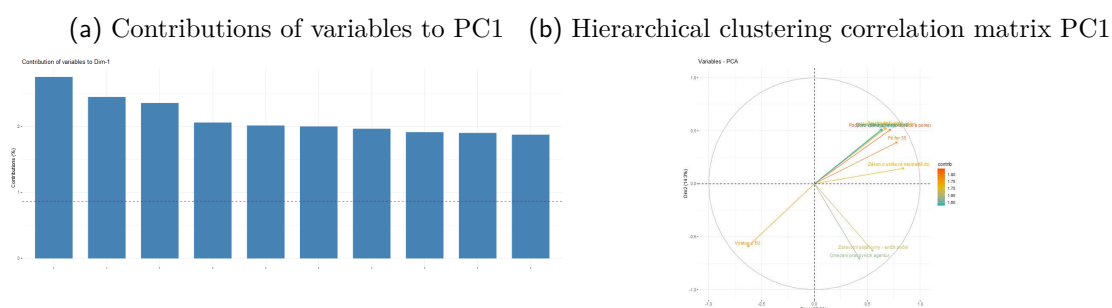
The created political space then illustrates rather well-known picture. On the horizontal axis, the traditionally left wing parties occupy one side whereas the other side is occupied by the populist parties with the traditional right wing parties still tilted more towards the traditional left-wing parties than towards the populist parties.

Interesting is the position of the ANO 2011 party, as it is in close proximity of its former coalition partner ČSSD and its supporting partner KSČM, in the context when lots of political analyst predicted that the closest natural ally of ANO 2011 is the ODS party aggregated within SPOLU coalition. Regarding the local clustering of the parties, the picture is also familiar as populist parties, nationalist parties, left-wing parties and right-wing parties are clustered together. Regarding the contribution towards the PC1 and PC2 from the POV of the parties, only two parties have lower amount of contribution – the Senioři21 and Přísaha party. This however does have to be a problem as these parties can be considered non-ideological as one has strong anti-corruption platform and the second has strong pensioner focus and as such does not play a significant role within the left/right distinction.

Figure 7.3: Positions of the parties according to PC1 and PC2
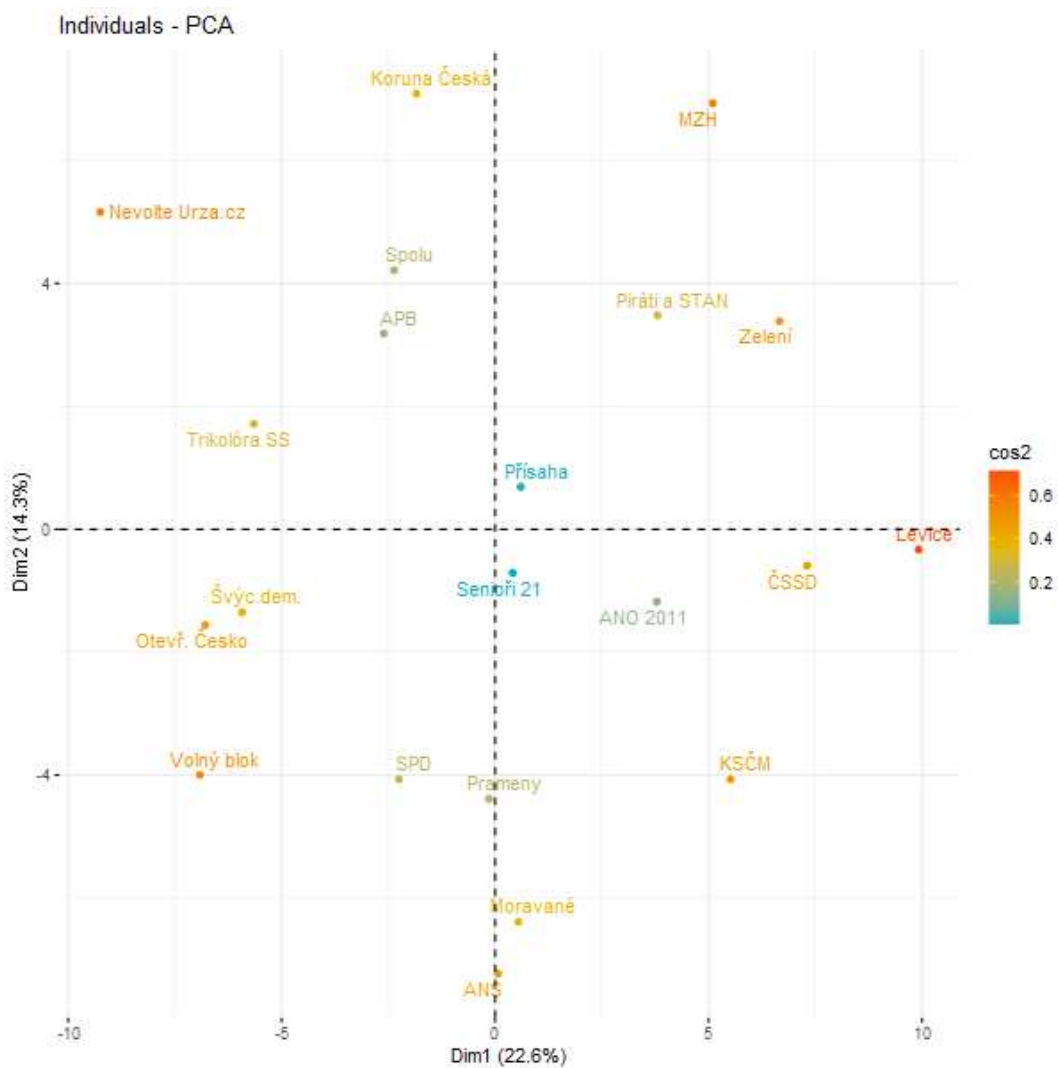
Thus, based on the explained variance, the issues and variables contributing to it and the resulting political space, the PC1 was selected as the coefficient for the overall political position of the region. Its underlying theme being the relationship towards subsidies, EU and overall amount of economical interventions. This resulting coefficient was then multiplied by -1 to be in line with the traditional conventions. Therefore traditional left-wing parties are on the left of the scale and traditional right wing parties are to the right with populist and nationalist parties even further to the right.

Based on this positioning several clusters can be distinguished. There are two outliers – on the far left there is a place occupied by the Levice party, past beyond the far-right position of the scale lies the satirical URZA party. The economically speaking a truly far-left/far-right distinction. The position

Figure 7.4: Selected coefficient scale
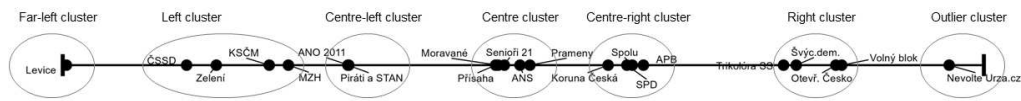
occupying the centre left is somewhat unusual pairing of ANO 2011 and Piráti-Starostové coalition - in the actual political space the sworn enemies. However when looking at the underlying themes of the PCA1, the close position of these two parties is not surprising as both can have more economically interventionist policies then the rest of the political space. Second rather unusual pairing is found in the centre-right cluster where the SPD and SPOLU lay. Again two parties, that are in stark opposition while both have strong economically nonintervention's roots and thus their similar pairing cannot also be considered surprising.

Figure 7.5: Principal Component 1 Results

(a) PC1 results on the regional basis   (b) PC1 results on the municipal basis
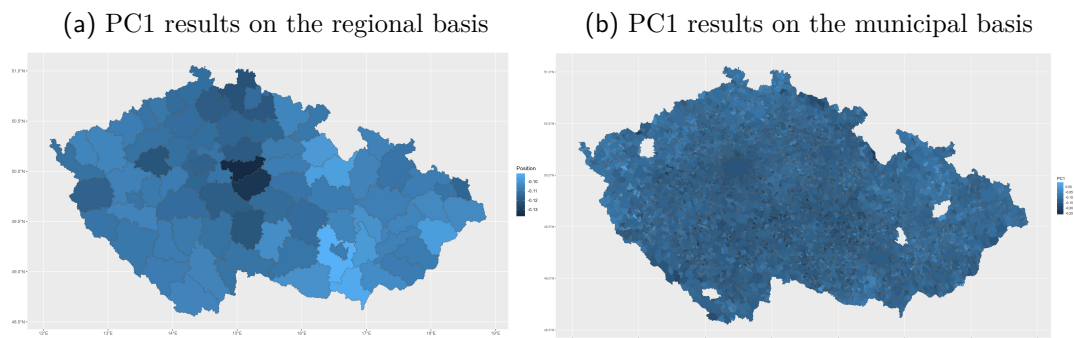
Then based on the scores for the each of every party taking place in the 2021 parliamentary elections the consensus positions were created for each region based on the amount of votes each party secured which led to each region having a score coefficient corresponding to how left-wing/right-wing each region voted. The differences are rather subtle, but clear distinctions can be distinguished. The interpretation of PCA2 is rather complicates as no unified narrative about underlying themes emerges and thus the PCA2 would not be elaborated upon further.

7.2   Principal factor model

First to create the principal factor model, the parallel analysis was created, in order to find-out how many of underlying factors should be used. This method compares the eigenvalues generated from the VAAs data and then compares them with the random data of the same sample size generated through Monte-Carlo simulation. Based on the results three factors should be retained and as such the following analysis would be working with three factors. The following factor analysis is accomplished by the Minimum Residuals through the psych R package (Revelle & Revelle, 2015).

Figure 7.6: Parallel analysis
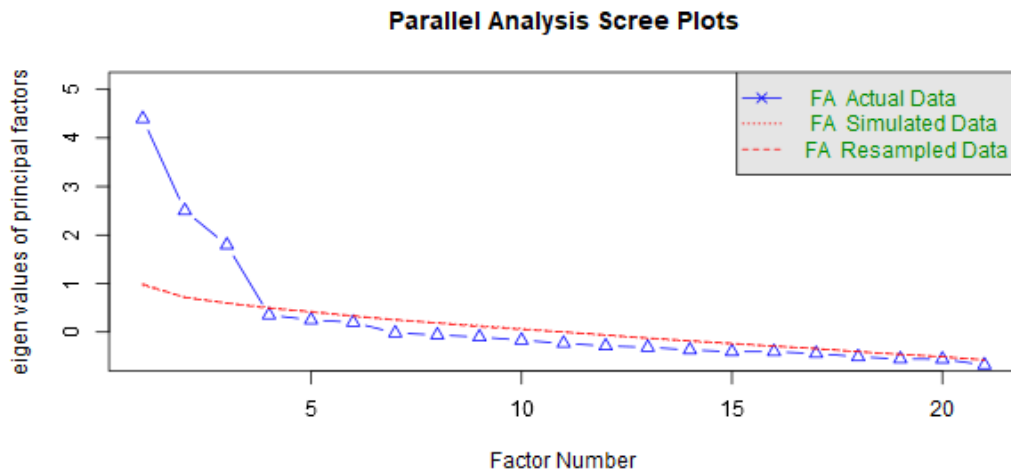
The three factors are connected to the parties as follows. The first factor MR1 have high scores for the traditionally populist and anti-system parties, the SPD being the largest of them and low to negative values for left-wing parties. The second factor MR2 is on the other hand rather high for the left-wing parties as is Levice, KSČM and ČSSD and has highly unusually low value for the libertarian Urza.cz party suggesting that it is indeed connected to the economic issues. The explanation of the third factor is more complex, the highest values are associated with the subsequent winners of the election - the PirStan coalition and the Spolu coalition. Therefore it can be speculated that the distinction between the MR1 and MR2 can be due the first factor being more in line with the cultural value dimension with the conservative and ultraconservative parties on one side (which can explain rather high values for KSČM and ČSSD which are economically left wing but can have conservative cultural undertones) and

the MR2 being more in the economical plane which could explain why is the economically libertarian Urza.cz party so far away.

Thus only two factors are being used for the further analysis with the corresponding scales showed in the following figure. The MR3 cannot be used, as the values of the factors hint towards the latent variable that is not in line with any classical distinction between political preferences and as such adds unnecessary additional complexity.

Figure 7.7: Results of the factor analysis
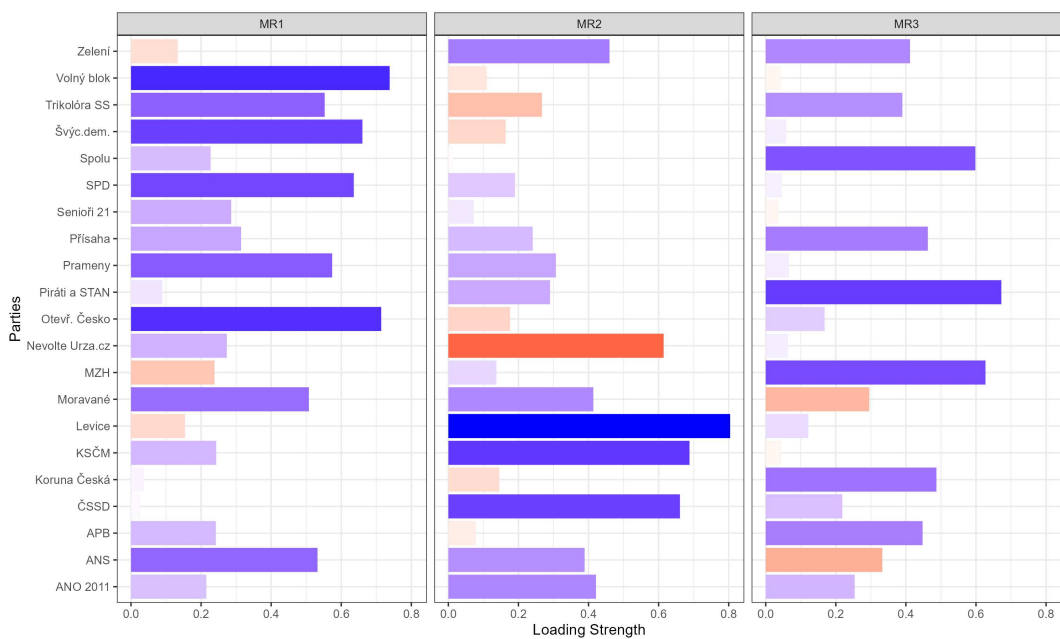
The results paints a similar picture as in the PCA analysis. The Kolín region is again rather pronounced. Further the Šluknov region and the Moravia macro-region also have distinctive values from the central Czech regions.

Again as in the case with the PCA2, no unifying narrative emerges for the MR3, that helps us conduct relevant analysis and as such no further elaboration about MR3 is included.

Figure 7.8: Latent factors results on regional level

(a) Regional map according to MR1   (b) Regional map according to MR2
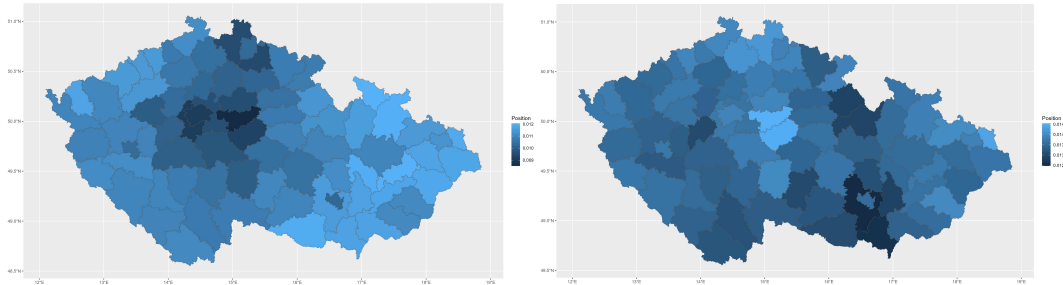
Figure 7.9: Latent factors results on municipal level

(a) Municipal map according to MR1   (b) Municipal map according to MR2
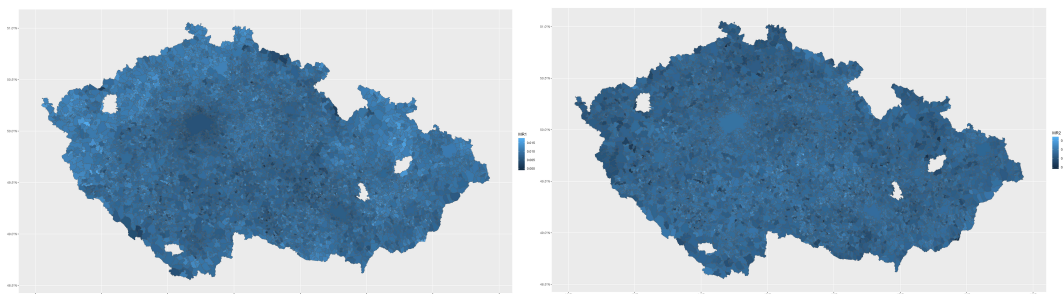
7.3   t-SNE

The final measure to reduce the amount of dimensions of the VAA dataset was the t-SNE analysis. The core variable within the t-SNE measure is the perplexity - the lower the perplexity the more dominant is the local variance, i.e. the more pronounced would be the groupings. Two main t-SNE models were created with the possible lowest and highest perplexity to look at the local and global groupings of data.

The local grouping of data neatly distinguishes between various party subgroups with economically left-wing cluster of ČSSD, Levice, KSČM and Zelení, the cluster of subsequent winners of Spolu and Piráti a Starostové which is rather surprisingly accompanied by opposition ANO 2011 and various small parties. Third cluster are the populist right-wing parties as Volný Blok and Otevřené Česko. Separate group is made by the SPD and Prameny parties which are little bit more less extremely right wing. Last cluster are the nationalistic parties with more pronounced social policies of ANS, Senioři21 and Moravané.

Figure 7.10: t-SNE political positions

(a) t-SNE positions high perplexity   (b) t-SNE positions low perplexity
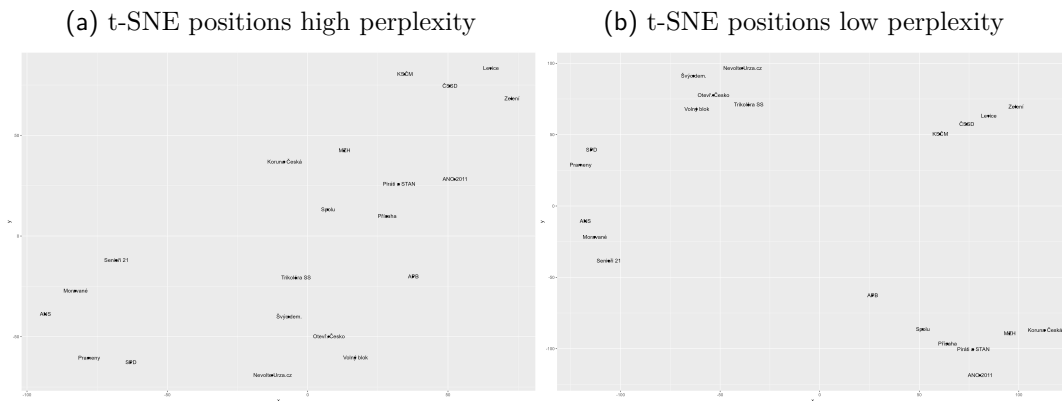
The global clustering is more in line with the common sense as the proximity of mainstream parties and the distance of populist and anti-system parties is much more visible. On one side of the spectrum lies the left wing parties with the nationalist parties on the other side. The clustering is still rather visible, but the distances and relationships are much more complex. Still the aforementioned distinction between the mainstream parties and the anti-establishment ones is the most salient distinction. The mainstream parties themselves are much more similar than those who oppose them with SPD being the only outlier cementing its position as a fellow proponent of the anti-establishment parties.

Figure 7.11: t-SNE results on regional level

(a) Regional map according to t-SNE1   (b) Regional map according to t-SNE2
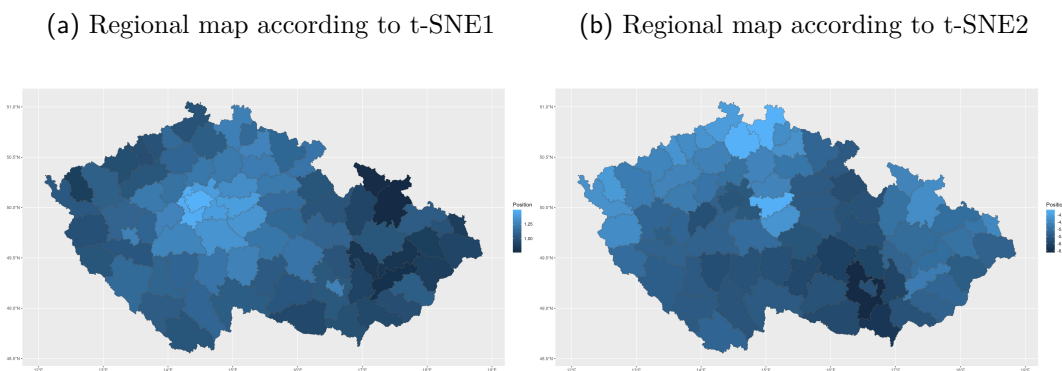
However, the issue with the t-SNE measure is that the distance do not have to mean anything as the one perplexity value that ideally captures distance between all of the clusters simply do not have to exist (Wattenberg, Viégas, & Johnson, 2016).

Figure 7.12: t-SNE results on municipal level

(a) Municipal map according to t-SNE1   (b) Municipal map according to t-SNE2
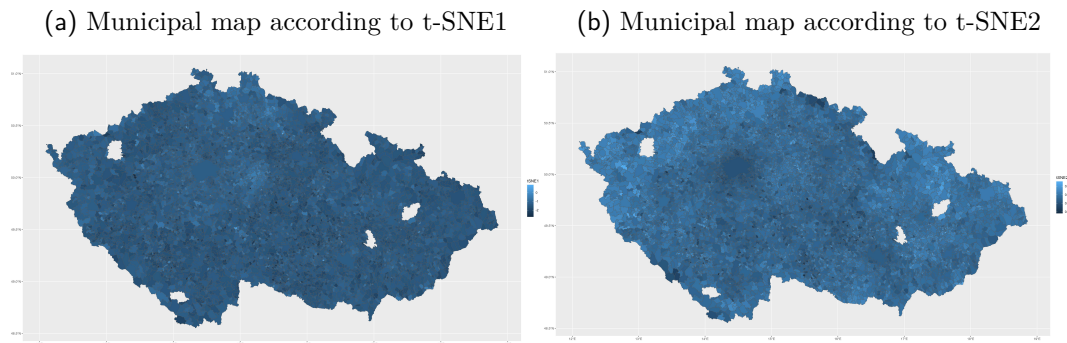
7.4   Interpretation of the results

When looking on the aggregated results on the regional level however, some important information may be lost. For coherent interpretation a more granular view is needed. The division under the traditional region division is the ORP subdivision. All regions have usually three two four ORP but there are also those, who have only one. When plotting results for all used multivariate techniques onto the ORP space (taking into account the election results on the ORP basis), more granular view appear.

The visual distinction between the center regions - Prague and surrounding ORPs comes to be even more visible for all used techniques, when looking at the results trough the lens of the more granular regional division. What is significant is the visibility of border regions which before may have come under the radar. Interestingly, the t-SNE1 shows strikingly different results than the rest albeit the difference of the central regions in contrast to those with higher distance from Prague remains. Overall the results point at the unsurprising different voting patterns between the peripheral regions and those regions which consists of urban centers.

The interpretation of the voting patterns without taking into account underlying forces is difficult. Still, few interesting patterns emerge. The different voting patterns of formerly German inhabited regions are still visible, even more than 80 years after the force expulsion and resettlement. The phantom border (Šimon, 2015) is still visible. Role of KDU-ČSL which is historically much stronger in Moravia does make a less significant impact then anticipated, primarily due to being in coalition with ODS and TOP 09 within SPOLU – the strong regional results of TOP 09 and KDU-ČSL were smoothed up by more overarching

Figure 7.13: Results compared for the ORP division
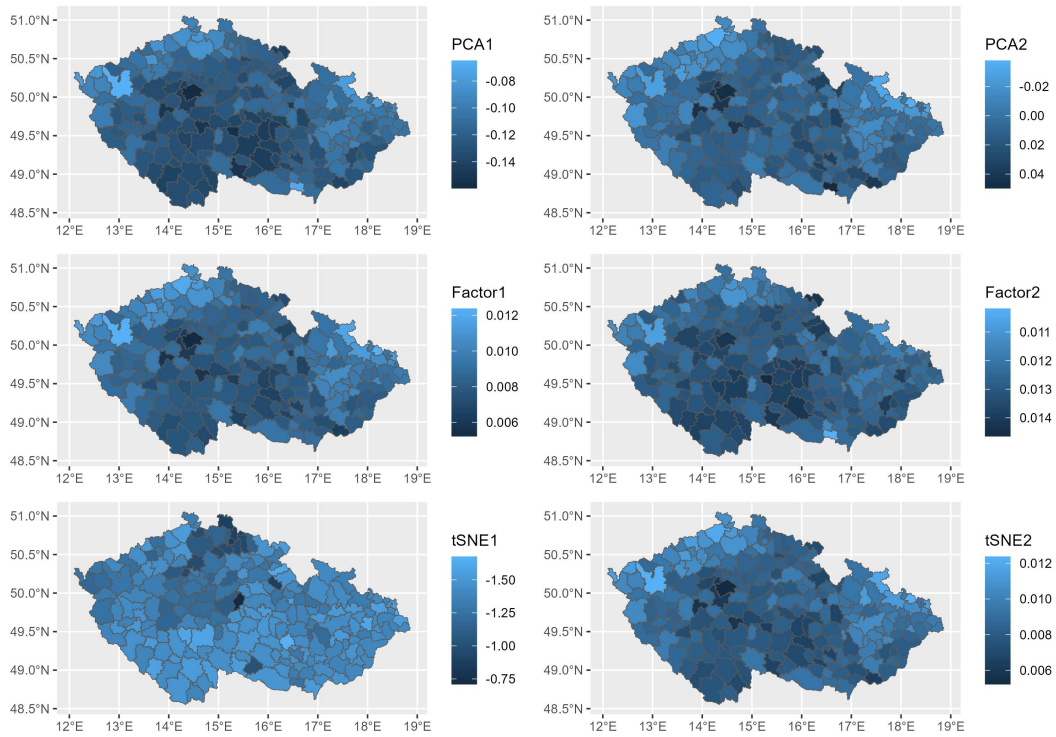
historical results of ODS. There are still regions where the low amount of SPOLU votes influenced the overall position (for example Karlovy Vary as one of the outliers, which is however more influenced by the overall lower amount of votes for parties connected to the Left and Far-Left clusters from PCA1).

Viewing the results through the ORP aggregation helps us to get better understanding than on more macro level through regions or more micro level through municipalities. Nevertheless the regional and spatial variability is neatly visible with the clusters of similar positions all over the country.

Chapter 8

Conclusion

Three dimensionality reduction techniques were used - the PCA analysis, the exploratory factor model and the machine learning based t-SNE model.

The patterns coming from all of the reduction techniques paint a similar picture with narrow differences. The t-SNE and PCA model come up with significantly different values for the Kolín and Kutná Hora regions. The t-SNE further distinguished the well-known Lipsetian cleavage between the center (Prague) and periphery (the border regions), which can be also visible in the other methods but not as saliently. The PCA results have the distinction between Moravia and macro-regions more pronounced than the periphery/center conflict. However, It can be certain to conclude, that the conflict between periphery/center and urban/rural areas, at least from the point of view of election results, is still rather salient.

Overall the PCA results suffers from rather small explained variance, as only approx. 20% of variance is explained by the first principal components, while the other 19 needed principal components explains the rest. The factor analysis on the other hand needed only three factors to sufficiently describe the dataset. Problem with the t-SNE approach is in the repeatability of the results and as such it is not suited for followup research. It however acts as an useful tool to research the policy differences between parties on much greater gradient. The subsequent t-SNE maps are also useful to see more clearly the different political and voting patterns.

Part II

Economics and voting behavior

Chapter 9

Introduction part II

To illustrate the results from the Part I of the thesis, second part is devoted to the analysis of the constructed indexes through the usage of various approaches from economic of voting, cleavage theory, regional development and voting, and spatial analysis.

The issue of varying election results is indeed a salient one. After the elections, the media and public space is usually driven by the following sentiments: What have driven these differences in election results across country? And how is it possible that these differences occurred in the first place? To understand the answers to these questions, the idea of what drives the voting decisions would be explored.

In the media as well as in the public space, multiple explanations for the distribution of political preferences are present. Some put forward the idea that the educated are fighting against the uneducated masses. Others point out to cultural differences between the former border regions of Sudety and Czech heartlands. The understanding of voting patterns includes explanations ranging form cultural through socioeconomic. In the core of the issue stands the individual political preferences of the voters. Again, this can be further emphasized by the public discourse - the center versus periphery, the rich versus the poor regions, the urban versus rural populous - the well known categories of Lipsetian cleveages.

This is in line with the voting patterns across the developed democracies. The voting differences between former East and West Germany, the differences

between urban centers and rural arrears in Great Britain and France or the
different aggregate voting results in the central USA and coastal states.

The research question would be thus as follows: Why are there differences in
the voting patterns on the regional level?

Having created the political positions of each of relevant Czech municipalities in
the Chamber of Deputies elections of 2021, the issue of the regional variations
would be explored by using the economics of voting and following hypotheses:

*H1: Factors connected to the Lipsetian cleavages best predicts municipal political
positions.*

*H2: The regional characteristics connected to public finances, infrastructure and
demographic predicts municipal political positions.*

*H3: The economical reality as perceived by the municipal inhabitants predicts
municipal political positions.*

These hypothesis would be tested by using the MOS dataset published by
the Czech Statistical Bureau and advanced regression analysis. By testing
these hypotheses, the overall understanding of political preferences and voting
patterns on regional bases would be enhanced.

Chapter 10

Literature review

When trying to explain the electoral behavior, three main approaches are used. The sociological model sees voting as a individual act affected by the personality of voter, the psychosocial model which puts in the center of our understanding the personal party identification and the economic theories of democracy which are based on the notion that voters are rational being, that make their decision in order to maximize their utility (da Silva Antunes, 2010). Thus the process of evaluating party platforms and voting based on their contents would firmly belong to the economic school of democracy, as economic opportunities and risks for the individual are the core issue (Brooks, Manza, & Bolzendahl, 2003).

Further research that links utility, economic approaches and voting patterns (and which can be used to understand the regional voting patterns and political positions) can be generally divided into three broadly defined groups. There are the theoretical papers focusing on the issue of individual decisions and party preferences – the rational choice theories of voting. The second approach are the theories of economic voting. These theories link the performance of the economy with the changes in the attitudes towards the incumbents. The worse the perceived economic performance, the higher probability that the economical reasoning voter will vote for a different party. If the economic performance is good however, then the probability of voting for incumbent increases. The utility is maximized in a situation when the incumbent party and ideology either looses or retains power based on the economic performance. Third loose group of approach are the various approaches, which try to explain the election results or political preferences based on socioeconomic factors. The utility is maximized

by voting in line with ones ideology. The polarization along ideological cleavages reinforces that ideological voting (Lachat, 2008).

10.1 Rational choice theories of voting

Even before explaining for which parties would the voters vote, the economic theories of voting deal with the voting participation itself. Generally, there several streams economic voter participation theories (Dhillon & Peralta, 2002). There are the instrumental theories, that deal with the notion of driving forces of rational voter calculation being the free-riding problem and competition. The game theoretic models, voters act as fully rational beings, taking into account the candidates platforms and expected utility deriving from these platforms. Lastly, the evolutionary models take a perspective of the parties – voters are too inconsequential to make changes and thus the ability of individual parties to motivate the voting behavior takes the central stage.

Game theoretic approaches, taking into account the electoral platforms, however extend over the voter participation discussions towards the voting for concrete political parties with defined political positions (McKelvey & Patty, 2006). Within the game theoretic approaches, two models stand in the forefront.

Within the expected utility model, the main idea is the utility. The individual calculates his utility which he can obtain if his preferred party wins the elections. He weights his utility against the cost associated with even going to the pooling booth. Moreover, the voter takes into account how important his vote is in the whole ordeal. This relationship can be illustrated on the following equation:

$$R = B * P - C + D \tag{10.1}$$

Where B is the utility from victory, the P is the probability of voters vote being important, the C are the costs implied and the D are the direct benefits from the act of voting itself. The turnout is thus intrinsically connected to the importance of elections. The reasonable level of turnout is achieved most often also due to the feedback mechanism under rather wide range of conditions. (Edlin, Gelman, & Kaplan, 2007).

Second is the minmax model. This model is based on the notion of regret. The voter compares all possibilities under uncertainty and selects the one which will

give him the lowest level of negative consequences. From the prospective of voting participation then, the voter would choose to vote when the idea of not voting would be similar to experiencing death. The equation for this model stands as follows:

$$R = P * (B + E + R!) - C + D \tag{10.2}$$

Where the P stands again for the probability of vote making any difference, the B stands for utility from the victory, the E stands for elation and $R!$ for remorse. The C and D are the same as in the previous model, the cost and direct benefit respectively. Thu criticism of this model is then based on the similarity to the previous one.

As at the core of these approaches is the focus on individual utility functions and the spatial distance between the personal political position and the party political position, the usage of these models is usually based on the thorough sampling of voter preferences and thus is outside of the scope of this thesis.

10.2   Theories of economic voting

The theories of economic voting put in to the focus the economic situation in the country. Their beginnings start in the early 20th century with the effort to link the business cycle and the election outcomes. However the true start of theories of economic voting is connected to the after-war economical boom (Anderson, 2007). The idea is, that when economy is in the upswing, the voters would notice that and in effect reward the incumbent party by casting their votes for them (Lewis-Beck & Stegmaier, 2015). The political economics uses the concept of political accountability. Repeated elections have the potential to mitigate the commitment problems of politicians and voters (Duggan & Martinelli, 2017). This means that politicians indeed respond to the political incentives of elections and voters vote in line with this notion. There exits however series of limits on political accountability. For example the incumbents incentives are driven by the information about the ideological type of incumbent and not its actual policy. It is thus crucial, when trying to understand the voting patterns of voters, to look at the political platforms and its underlying ideologies than the actual outputs and the normative desirability of outcomes (Ashworth, 2012). The responsiveness of government or politicians is pressing

issue also because in place with high-responsiveness and electoral accountability, the government tends to function better (Brenner, Lipsky, & Zoizner, 2014)). Which leads to the increase of incumbents chances of reelection. The issue of economic issues is emblematic mainly to the Western Europe, but its salience is increasing all over current democracies (Sthanumoorthy & Eapen, 2004). There are studies looking at how the political business cycle, which tends to increase spending as the elections are approaching, help the incumbent party to get reelected (Brender & Drazen, 2008). Moreover, evidence points out to general election outcomes being influenced by the complex interaction between government policies in the social sector and the development process of said policies. (Mukherjee & Chakraborty, 2017). The relationship between economy and voting remains at the stable level even where the economy is going through short term fluctuations (Talving, 2018).

The empirical research supporting the notions of the economic theory of voting found proofs in case of Turkey, where the lost votes for the ruling AKP in 2009 local elections could be connected to the poor local economic conditions (Akarca, 2010) . The voter perception about economy was also found to influence the presidential elections in the US, where the effects are strongly related to the incumbency of the running candidate (Lewis-Beck & Stegmaier, 2015; Nadeau & Lewis-Beck, 2001). The effects of economic voting however diminishes slightly when the EU is framed by the political actors as being the culprit behind the economy as shown on the presence of national economic vote in Southern Europe (Lobo & Lewis-Beck, 2012). There are also broader empirical studies supporting the reward-punishment approach towards the incumbent political chances, the impact of quality of institutions on the economic votes or the relevance of overall political sophistication present in the system (Voigt & Blume, 2015).

Competing with the classical idea of economic voting are the theories that put into the center the rising inequality which would make voters consider not only the economic growth and economic performance but also the overall distribution of this economic improvement (Linn & Nagler, 2017). Others outright criticize the economic voter model for simply asking too much from the voters themselves. Moreover most citizens lack the necessary information and impartiality to accurately assess the government's performance (Anderson, 2007).

10.3 Cleavage theory of voting

In contrast to the previous two approaches, which are strongly based in the economic theory of voting, the cleavage approach takes its ground also from the sociological approach. The decision of the voter to vote for certain party is based on two arguments – the overarching social structure and the quality of the institutions of a political system (Goldberg & Sciarini, 2014).

Cleavage theory divides voters into various voting blocks based on their social and economic characteristics. These voting blocks define lines separating people into distinct groups. Lipset and Rokkan in their famous essay introducing the cleavage theory came up with four main cleavages. The first is the cleavage between the urban and rural population, those living in the cities and those living in the countryside. Second cleavage is between the workers and owners, third between religious and secular population and fourth between the centre and periphery (Lipset & Rokkan, 1967).

There are three attributes that should be fulfilled in order for a cleavage to be salient. The cleavage needs to be politically relevant, the conflict between the groups needs to be present to some degree and the political system needs to underline the cleavage conflict (Bartolini & Mair, 2007). Many authors add and subtract various cleavages based on the specificity of each democratic system. The relevance of social cleavage was for example observed in the USA (Brooks, Nieuwbeerta, & Manza, 2006), in Russia (Korgunyuk, 2015) or in Switzerland (Gorsuch, 2014). The intra-country cleavage relevance was obtained in the case of German election. The results indicate that the religious cleavage and the post-materialism cleavage are indeed salient. The impact of of the capital-labour cleavage however vanished (Magin, Freitag, & Vatter, 2009). The relevance of cleavages was also confirmed for the division and stratification of the Slovak society. The salient cleavages in Slovakia are the cultural and ethnic cleavage and centre periphery cleavage (Szabó & Tátrai, 2016).

The existence and salience of cleavages is very debated topic. The focus on relatively homogeneous Western Europe thus makes the cleavage idea too deterministic (Bornschier, 2009). But even within the Western European space, the idea of relevant cleavages is being contested. The behavior and size of working-class and religious citizens groups from 1975 to 2002 show big drops in how much these groups support aligned political parties while these groups are getting smaller. The traditional voting frameworks are going through

change (Best, 2011). Overall the cleavage research is commonly criticised for the outdated class distinction, the simplistic approach or flawed statistical approach with limited evidence (Brooks & Manza, 1997),

Therefore to explore the applicability of these theories in the Czech Republic, the underlying powers of the municipal political positions would be examined using the economic theory of democracy and the cleveage theory.

10.4   Voting patterns as a function of development

Last stream of relevant literature looks at the voting patterns and political attitudes and behaviors in the context of regional development. The voting results of political parties, the electorate susceptibility towards populist or anti system messaging is driven by the local development. The regional determinants as is local public spending on culture, broader welfare and local unemployment, can be seen as having equally important role as an macro-economical factors (van Leeuwen & Vega, 2021). Thus, the spatial distribution of votes is associated with regional differences within (among other factors) the aforementioned categories (Faggian, Modica, Modrego, & Urso, 2021). Areas that were subject to rapid deindustrialization or were historically agricultural have in the current environment much lower levels of development than those without this history. Subsequently these regions tend to have different voting patterns (Rodríguez-Pose, 2018).

Thus looking at the amount of cultural, economical, educational or institutional development may help predict voting patterns. The places that are undeveloped, places that "don't matter" voice distrust in national political institution and vote more probably for anti-system or populist parties. This is the case in Italy where education, age and income determine vote on the regional basis (de Renzis & Sforzi, 2022). At the European Union scale, voting against the EU could be seen as stemming from regional economic downturns, reduced employment opportunities, and a less educated populace. (Dijkstra, Poelman, & Rodríguez-Pose, 2020). The low regional development and vote for far-right parties was found in Slovakia (Rehák, Rafaj, & Černěnko, 2021) or in the Germany (Greve, Fritsch, & Wyrwich, 2023).

Chapter 11

Methodology

The following section describes the main methodological part of this thesis. The chosen methodology is described including the underlying assumptions.

To explore the relationship between economic variables, cleavages and regional development and the political positions coefficients crated in the part one, two approaches would be used. A baseline OLS model and the more complex Spatial Durbin Error model.

11.1 Linear regression Model

The initial model used would link the voting patterns on the municipal level with the regional, economic and cleavage variables through basic linear regression characterized with the following general equation.

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \tag{11.1}$$

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i + \hat{\epsilon}_i \tag{11.2}$$

More specific, it includes the dependent variable $Coeff_r$, the intercept β_0, the error term ϵ, and the plethora of independent variables connected to the aforementioned three group of influences – the economic situation, the cleavages and the regional development. These independent variables have corresponding coefficients of $\beta_1, ..., \beta_2 0$. The subscript $_r$ denotes the one of 6 258 municipalities

whose data are used in the analysis. The coefficients are then estimated using minimizing the residual sum of squares.

$$RSS = \sum(y - \hat{y})^2 = \sum y^2 - a\sum y - b\sum xy \tag{11.3}$$

The OLS coefficients are *certeris paribus*, when holding other variables constant, the change on independent variable results in a change in the dependent variable. The Breusch-Pagan test for Heteroskedasticity rejected the null hypothesis and thus we assume non-constant variance, the heteroscedasticity.

Thus, to deal with the violation of the MLR.5 from the Gauss.Markov theorem, we need to use the Wighted Least Squares (WLS) method (Wooldridge, 1996) as the other assumptions are indeed satisfied. This is moreover supported by the fact that each municipality varies in the size, so the subsequent weights assigned to appropriate municipalities would differ based on the size of the municipality. The residual graphs describing the structure of OLS data are bellow.

Figure 11.1: Residual plots

(a) Principal Component 1   (b) Latent factor 1
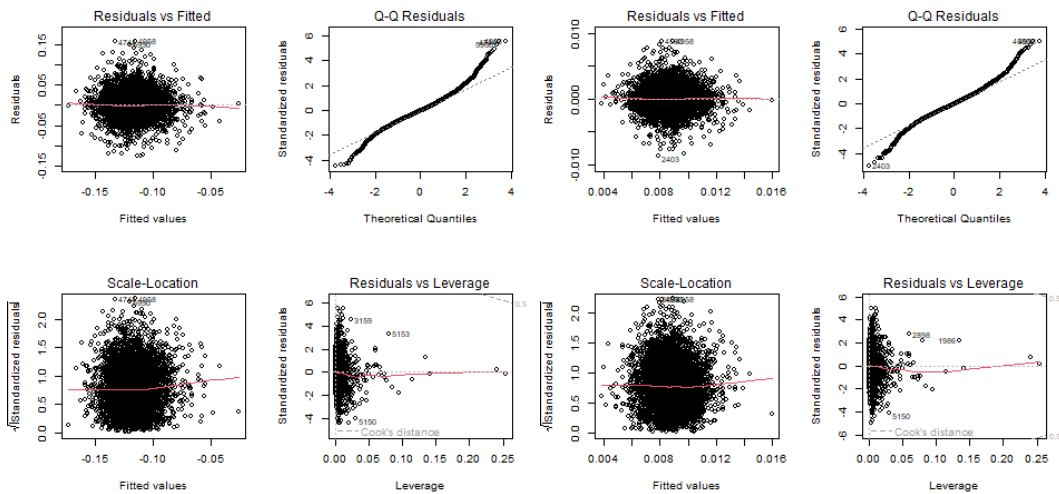
The WLS regression helps to correct for the MLR.5 violation by correcting for the non-constant variance (Wooldridge, 1996).

$$WSS = \sum w(y - \hat{y})^2 \tag{11.4}$$

Each observation is weighted by the reciprocal of its estimated variance in a way,

that those with higher estimated variance are weighted lower that those with the lower estimates. The main difference lays in the incorporation of weights for the residuals.

11.2   Spatial Durbin Error model

The data on the regional level and the corresponding election results traditionally evidence spatial auto-correlation.

To deal with the spatially with regard to the error term, the Spatial Durbin Error model can be used (Černỳ, 2022). The original Durbin model came to be as a generalization of the the spatial error model under a non-linear parametric restriction (Koley & Bera, 2024). The Durbin Error Model can be understood as an application which involves employing machine learning techniques to estimate a mixed regressive-auto-regressive model, incorporating spatially lagged explanatory variables within its specification (Anselin, 2013).

To test data for a spatial auto-correlation in the error term the Moran's I test can be used (Anselin, 2013). The Moran's I test is denoted by following equation:

$$I = \frac{\sum_i \sum_j w_{ij}(x_i - \bar{x})}{(\sum_i \sum_j w_{ij}) * \sum_i (x_i - \bar{x})^2} \tag{11.5}$$

If the I is equal to zero, then there is no auto-correlation. Otherwise the correlation is either negative or positive, based on if the I is higher or lower than zero.

The Moran I test on the spatial correlation of the dependent variable was successful. The value of Moran I statistics, being significantly higher then 0 and with p-value being sufficiently small, suggests that nearby locations tend to have similar values for the political positions. The local Moran's I scores and Local Moran Clusters can be seen below.

To test for both spatial dependence and heteroscedasticity, the Lagrange Multiplier Approach can be used (Anselin, 2013).

Is the spatial auto-correlation is indeed present, the OLS can be biased and several OLS assumptions may not be satisfied. We have both spatially endogenous interactions and spatial interactions in the error term as well as exogenous

Figure 11.2: Moran's I Plot
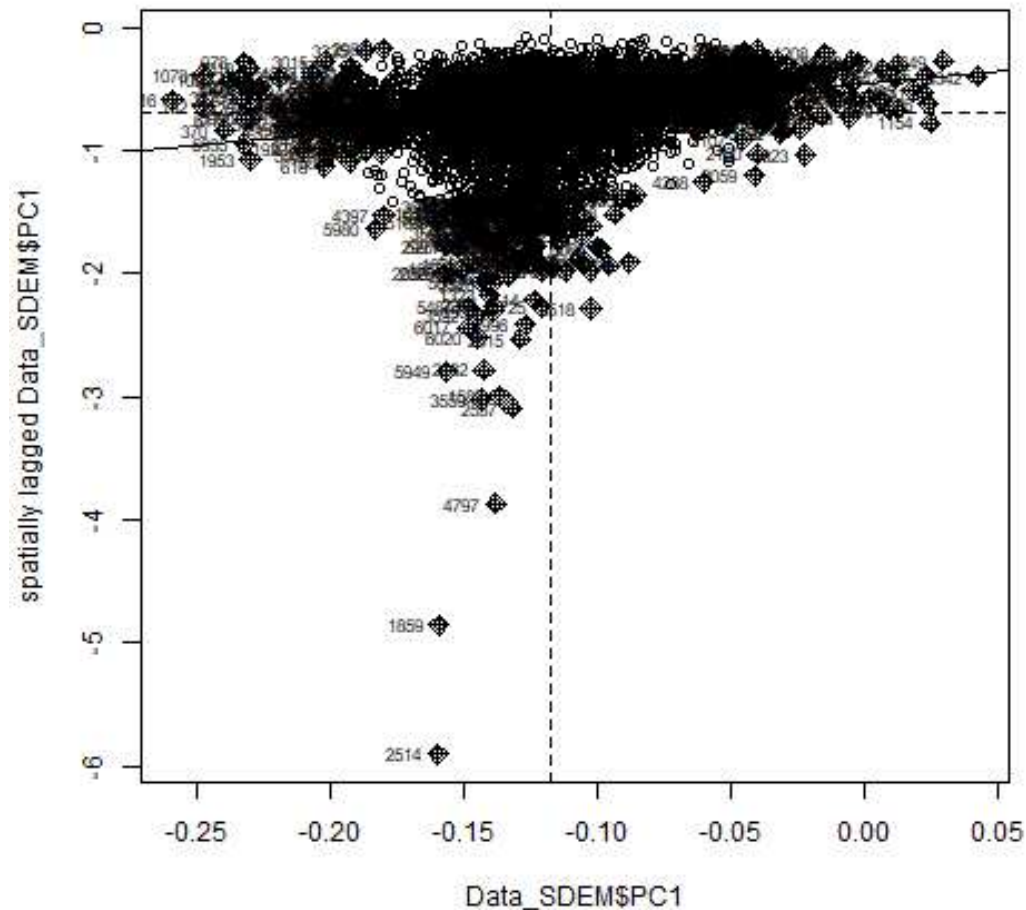
interaction. To incorporate the spatial correlation into the regression, The Spatial Durbin Model would be constructed. This model is an extension of the traditional linear regression model, used in case of persistent spatial correlations. It is commonly used in spatial econometrics to analyze spatially correlated data and account for spatial auto-correlation in regression analyses. It serves as the simplified version of a model incorporating cross-sectional dependence in the errors, yet it can also function as the foundational model within a broader framework of model selection (Mur & Angulo, 2005).

If the changes in region are only local (as are the clusters in case of election results), that is if the changes in region affect only set of neighbours, the specific Spatial Durbin Error Model is used. With the following general equation:

Figure 11.3: Moran's I Results

(a) Local Moran's I   (b) Local Moran Clusters
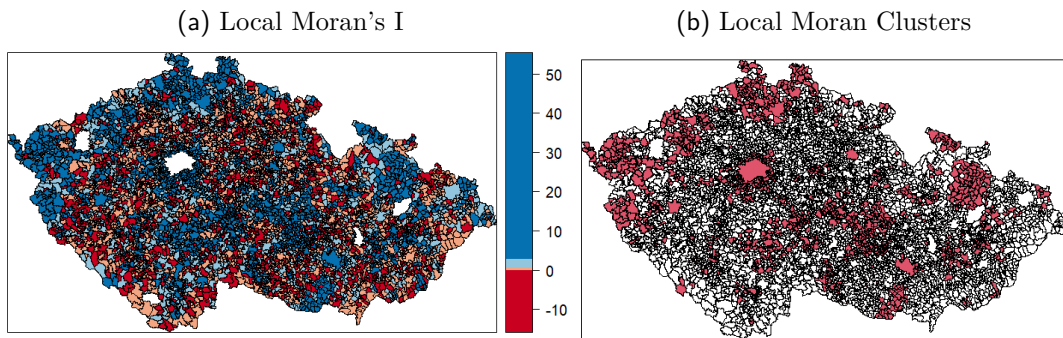
$$y = X\beta + WX\theta + uu = Wu\lambda + \epsilon \qquad (11.6)$$

Where $y = y = (y_1, y_2, \ldots, y_n)'$, $\epsilon = (\epsilon_1, \epsilon_2, \ldots, \epsilon_n)'$ have $\epsilon_i \sim N(0, \theta^2)$ and X, Z belongs to the nxp and nxq matrices respectively. The formula includes the spatially lagged dependent variable and spatially lagged explanatory variables.

To construct the Durbin Error Model, using the spdep package from R (Bivand et al., 2005), the Spatial Weight Matrix (SWM) needs to be constructed first. Generally, the SWM is an spatial representation of the spatial structure within the dataset. It is an NxN matrix, where N is the amount of features in the data. The SWM was created using the basic binary coding taking into account the links either as absent or neighbours.

Chapter 12

Socioeconomic situation in Czech Republic in year 2021

12.1 Economic situation

The Czech Republic is export-oriented economy focused mainly on manufacturing, services and innovation with a robust welfare state (Aspalter, Jinsoo, & Sojeung, 2009). In 2021 the pandemics still loomed large in the Czech economic development, the subsequent worldwide component shortages, stemming from the COVID restrictions, led to decreased industrial production. This was true also in the second part of the year when the restrictions were becoming lifted. As Czech Republic have significant focus on manufacturing, these component restrictions had an effect on the whole production chain decreasing the overall activity of Czech Economy (ČNB, 2022). The issue connected to the component shortages was the low supply of computer chips. This shortage virtually paralyzed the worldwide automotive sector, which in Czech Republic is seen as the biggest industrial sector (CzechInvest, 2021). The production and distribution of electricity, gas, heat and air-conditioned air fell more modestly, and mining and quarrying in Q3 2021 only corrected the decline of the previous year. The industry as a whole contributed more than quarter of gross value added (Ministerstvo Průmyslu, 2022).

Regarding the foreign trade, the problems within the automotive sector manifested in the overall decrease in exports. Further the deficit in trade in oil and natural gas was the main driver of foreign trade deficit. The trade deficit was recorded for the first time in eleven years. (Ministerstvo Průmyslu, 2022).

The Czech strategy, spearheaded by the Czech National Bank, was based on providing exceptional support and stimulus to the corporate, household and financial sectors in form of combination of monetary, macroprudential and microprudential measures easing the negative impacts of the COVID pandemics on the Czech economy (Mora & Galuščák, 2022).

The unemployment in Czech Republic is continually on rather low levels. That was true also during the pandemics as the overall unemployment peeked at 3,3% in the first quarter of 2021. Comparatively, the same was true for the compensation of employees. Their growth has also slowed down, but it began its recovery to pre-pandemic levels in the latter half of 2021 (IMF, 2022).

Overall, the Czech Republic experienced a period of economic downturn which is however important to understand within the broader environment of worldwide economic downturn connected to the COVID pandemics. The negative implications of the pandemic, purely in the economic terms, were however not as strong as in the similar economies.

12.2   Situation regarding the traditional cleavages

As mentioned in the literature review, the traditional old-school cleavages are the urban/rural, the religious/secular, the centre/periphery and the economic cleavage.

The urban and rural distinction is more complex then ever. The city of current time is rather heterogeneous space. It is a mix of different cases of spatial structures – cities and its parts can be distinguished between historical city centers, housing estates and residential suburban areas among many other (Hudeček, Hnilička, Dlouhý, Leňo Cutáková, & Leňo, 2019). The definition of the rural area is no more complex. Generally there are two ways to define rural area. Rural is that which is not urban or rural is can be defined as area with low population density and characterized with activities he end purpose of which consists in exploiting natural resources (as is agriculture for example) (Chromy, Jancak, Marada, & Havlicek, 2011). The urban and rural areas in Czech Republic have similarities in terms of mortality, average living floor area per completed dwelling, healthcare indicators and average old-age inhabitants. The core differences are in the economic characteristics and labour market indicators (Pechrová & Šimpach, 2013).

In case of religion, the public perception is that the Czech Republic is very secular country to begin with. Still, the christian KDU-ČSL party partly exploiting the secular/religious cleavage is a sample of Czech politics and has a tradition of being a junior government partner for both right-wing and left-wing cabinets (Evans & Whitefield, 1998). The individual religiosity in the Czech context is more driven by individual socialization within ones church (with varying degrees between churches) than by underlying socioeconomic factors (Hamplová & Nešpor, 2009). The contemporary catholic church however is rather visible in the public political discussion, especially regarding the cultural issues, becoming vocal and important conservative voices in public discourse (Slačálek, 2021).

Peripheries refers to areas with social, economic, and demographic disadvantages combined with physical geographic barriers within the region (Havlíček, Chromỳ, Jančák, & Marada, 2005). The new peripheries are created as an extend more from other peripheries than through new ones being created. (Kebza & do Carmo Perotto, 2020). People living within Czech periphery regions, based positive experiences of the past regime and feelings nostalgia, frustration and anger, are main susceptible towards the messaging of populist and radical parties (Šaradín & Bieleszová, 2023).

Regarding the economical cleavage, the party system in the Czech Republic, country that was historically one of the most developed in the region with a low rural population and high levels of economic development, copies this cleavage with the historical two-block distinction between ODS, the main party from the right, and the ČSSD being the main party of the left. However the salience of this cleavage have diminished somehow with the post 2013 political development, which saw the establishment of new dominant party, ANO 2011 (Evans & Whitefield, 1998).

Chapter 13

Data

The data were collected from various public sources. As the analysis is concerned with the intersection of economical, socioeconomic and regional variables the initial data source is the MOS database. The MOS database contains statistical data for city and municipal statistics. The data are grouped into separate annual files and present data for municipalities from 2000 to the present. The data always refer to the current municipal area valid in the respective year. It includes general characteristics, education, healthcare, demographics, housing, spa facilities, land types, social indicators, economic entities, tourism, municipal finances, census data from 1991, 2001, 2011, and 2021, unemployment rates, and civic amenities data from 2016.

Second source of data is the Czech population census of 2021. The census was conducted towards 27.March 2021 and it was the historically first census being conducted online. 10 524 167 inhabitants in the Czech Republic were counted. Their average age was 42.7 years and 50.7% of those counted were women and

Table 13.1: Variable categories and sources

Variable category	Source
Cleavage	Czech census 2021, ČSÚ, MPSV
Education	Czech census 2021
Poverty	mapazadlužení.cz
Demography	Czech census 2021
Infrastructure	MOS 2021
Municipal finance	MOS 2021
Covid	MH
Election	ČSÚ

49.3% were men. The data were sub-grouped into various sources based on the main theme including education, religion and economic activity.

Additional data obtained were the detailed employment from MPSV, the foreclosures statistics by municipalities published by the mapazadluzeni.cz, the Covid19 statistics published by the ministry of healthcare and municipalities economic variables from public finance database. The collected data and variables categories are presented in the table above.

Two issues were needed to be solved. First the army regions, which have very limited statistics in all of subject arrears were excluded from the analysis. Further, Prague as a capital city with its own further administrative divisions was approached as an one object instead. It is also important to note, that the use indexes for the political positions, created in the first part of this theses, do not include the results of Cibilka.net party as this party had no noticeable program. Subsequently its election results were negligible without affecting the overall positions as this party collected under 600 votes which is under 0,001 % of legible voters overall.

13.1 Descriptive statistics

Descriptive statistics reveal the diverse range of values observed within each variable, with notable variations in means, standard deviations, and ranges. For instance, while the mean turnout for elections stands at 0.672, indicating relatively high participation rates, variables such as periphery.c exhibit substantial variability, with a wide standard deviation of 0.341. Additionally, we observe disparities in infrastructure availability, with some regions demonstrating a high presence of cultural centers and educational institutions, while others exhibit limited access to hospitals and ecological amenities. Moreover, the dataset encompasses demographic factors such as gender representation and marital status, shedding light on the social composition of the Czech Republic.

Variables related to demographic events such as births ("dem.born"), deaths ("dem.died"), and migration ("dem.emigrated" and "dem.imigrated") exhibit lower means and standard deviations, indicating lower variability in these demographic processes across the dataset. Additionally, descriptive statistics reveal characteristics of economic variables, such as municipal income ("mun.income") and taxes ("mun.taxes"). The mean municipal income is 25.029, with a standard

deviation of 16.271, indicating considerable variability in income levels among municipalities. Similarly, the mean municipal taxes are 3.305, with a standard deviation of 0.535, suggesting variability in tax revenue generation across regions. These descriptive statistics provide valuable insights into the distribution and variability of key variables, laying the foundation for further spatial econometric analysis of voting patterns and their determinants.

Table 13.2: Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
religion.c	6,254	0.238	0.135	0.014	0.837
class.c	6,254	0.015	0.015	0.000	0.273
urban.c	6,254	0.866	0.341	0	1
periphery.c	6,254	0.026	0.110	0.0001	3.258
edu.terciary	6,254	0.117	0.052	0.000	0.409
edu.secundary	6,254	0.673	0.053	0.336	0.870
edu.primary	6,254	0.137	0.038	0.000	0.440
pov.foreclosures	6,254	0.056	0.043	0.000	0.517
pov.debt.relief	6,254	0.011	0.010	0.000	0.130
dem.women	6,254	0.494	0.027	0.068	0.667
dem.born	6,254	0.011	0.007	0.000	0.071
dem.died	6,254	0.013	0.008	0.000	0.105
dem.emigrated	6,254	0.025	0.015	0.000	0.195
dem.imigrated	6,254	0.034	0.022	0.000	0.307
inf.cultural.centre	6,254	0.692	0.462	0	1
inf.hospital	6,254	0.048	0.213	0	1
inf.education.institution	6,254	0.555	0.497	0	1
inf.ecology	6,254	1.753	3.590	0.007	77.690
mun.income	6,254	25.029	16.271	3.330	539.892
mun.taxes	6,254	3.305	0.535	0.598	11.766
mun.capital	6,254	1.435	6.517	−0.300	245.024
mun.subsidies	6,254	7.104	12.478	0.326	221.554
dem.minorities	6,254	0.028	0.026	0.000	0.315
dem.married	6,254	0.419	0.049	0.114	0.750
perc.covid	6,254	0.165	0.043	0.000	0.527
turnout	6,254	0.672	0.102	0.000	2.692
log.inf.ecology	6,254	−0.269	1.264	−4.991	4.353
log.income.mun	6,254	3.140	0.343	1.203	6.291
log.periphery.c	6,254	−5.141	1.442	−9.657	1.181

Figure 13.1: Correlation Plot of Variable
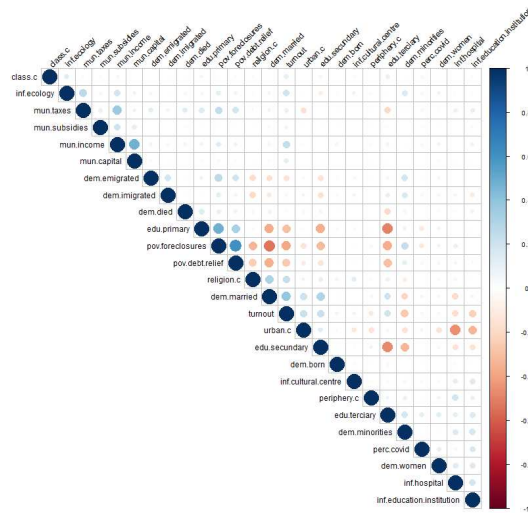
When constructing the correlation matrix few variables tend to hint on rather substantial correlation. However, when The Variance Inflation Factor (VIF) is constructed not a one variable have VIF higher than 5. VIF measures the level of multicollinearity among predictor variables and as a rule of thumb, any variable with value above 5 is considered a highly correlated.

13.2   Spatial distribution of variables

When looking at the four cleavages some spatial developments are visible. The most distinct is the east/west distribution of religion as most of the religious people live in the Moravia region. The urban and rural distinction is naturally following the centrality of cities with more rural areas around. The most striking is the class cleavage as these values are very similar over all of the Czech Republic. The periphery cleavage points at the border regions as being those with the most peripheral status.

Regarding the data on foreclosures and debt, the distinction between those negatively influenced by these effects copies the former Sudety regions in line with the phantom border phenomena. Moreover, the centrality of Prague and other bog cities is also significantly pronounced. Regarding the municipal finances, the distinction is not that striking at all, the spatial difference between the border regions and the center is lost.

Regarding the demographic variables again some spatial clustering is noticeable. The minorities are strong in the Český Těšín region which historically has a high

proportion of Polish nationals. Other arrears with higher amount of minorities is the north of the country and of course the big cities like Prague and Brno. Regarding the people emigrated and people born no significant spatial clustering is visible on the visualisation.

Most Infrastructure variables are dummy variables denoting if the region have cultural institution, hospital or education institution. The ecology variable is connected to the ecology coefficient denoting the amount of nature in a municipality. This variable was transferred to a logarithmic variable for the regression analysis. Regarding the infrastructure variables, the striking about cultural variable is the effect of big cities nearby. This is especially visible in the proximity of the capital city Prague. Further, cluster without any cultural variable are visible in the border regions, especially within those border regions, that are adjacent to the Germany. The ecological variable have opposite relation towards the border regions than any social and economical ones. The border regions fare much better in this sense then the regions in the center. Unsurprisingly there is a strong correlation between the municipalities with high ecological variable and municipalities within mountainous regions illustrated by the highest scores being in Krkonoše, Krušné hory, Šumava and Rychlebské hory.

Chapter 14

Analysis and results

Based on the results of the Part One, two created variables for political positions
were used as a dependent variables. The PC1 with its simply to distinguished
clusters ranging from Far-left cluster through the Centre cluster up to the outlier
Far-right cluster with its underlying core themes associated being the relationship
towards subsidies, EU and overall amount of economical interventions with the
spatial distinction between the centre and periphery or Czechia and Moravia
region. The second variable chosen for the analysis of underlying factors is
the first latent variable from the Principal factor analysis denoted as MR1.
The MR1 neatly distinguishes between the parties with more conservative-right
wing approaches and more liberally-left wing approach. Thus based on political
position as an dependent variable and various municipal characteristics as
independent variables two distinct econometric methods would be used – the
WLS regression with regards to the existing heteroskedasticity and the Spatial
Durbin Error model due to the existing spatial auto-correlation.

14.1   The Weighted Least Squares

For model PC1, the R-squared value is approx. 0.185, indicating that approximately
18.5% of the variance in the dependent variable is explained by the model. The
adjusted R-squared is slightly lower at 0.181, reflecting the inclusion of additional
explanatory variables in the model. The residual standard error, representing
the variability of the data points around the regression line, is 1.336. The
F-statistic, which assesses the overall significance of the regression model stands

at 56.378. This indicates a significant relationship between the independent and dependent variables.

In contrast, for model MR1, the R-squared value is notably higher at 0.301. This indicates that approximately 30.1% of the variance in the dependent variable is explained by the model. The adjusted R-squared is also higher at 0.298, suggesting a better fit of the model to the data compared to PC1. The residual standard error is slightly lower at 1.325, indicating less variability in the data points around the regression line compared to PC1. Moreover, the F-statistic is substantially higher at 107.025, indicating a more significant relationship between the independent and dependent variables compared to PC1.

Thus, regarding the WLS model, the MR1 outperforms PC1 in terms of model fit, explanatory power, and overall statistical significance, highlighting its effectiveness in capturing the underlying patterns of the dataset.

Figure 14.1: WLS for PC1 results
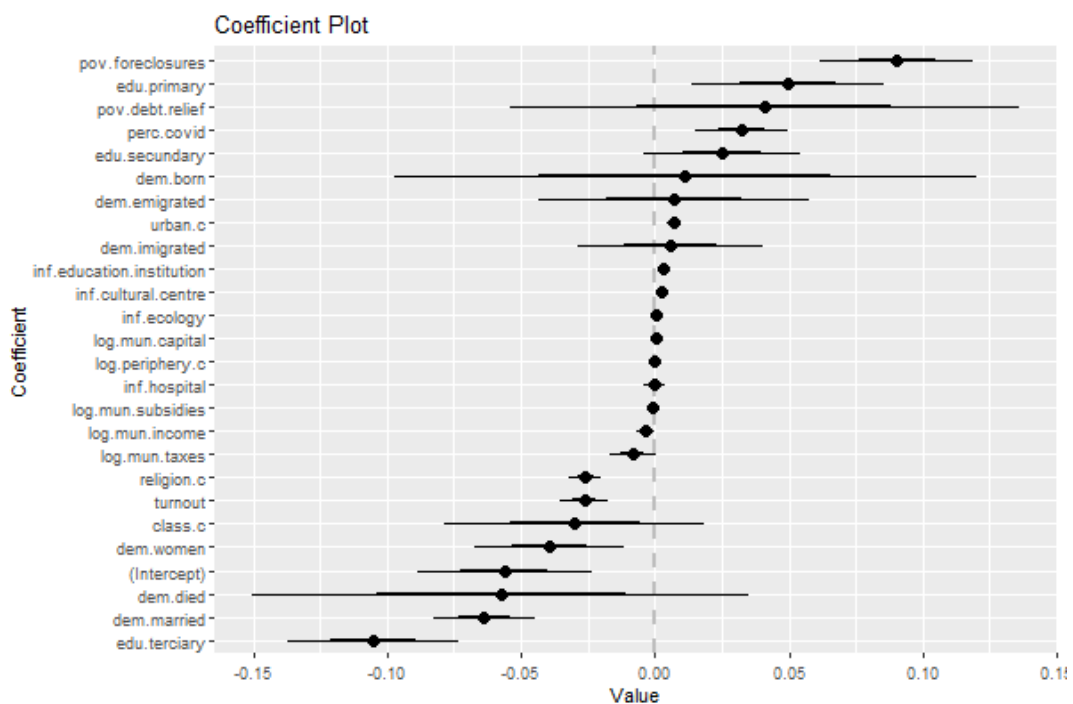
The results of the WLS in regard to the PC1 dependent variable points towards the economical issues and education as being the main drivers of election decision. The precise interpretation is difficult as the political coefficient denoting the political positions is aggregate in nature and influenced by the extreme parties. The difference between the anti-system extremes and traditional parties is much

more salient then the difference between traditional parties and movements.
The position of incumbent ANO party, for example, is much more aligned to
their arch-rivals from the SPOLU coalition then towards the anti-lockdown
Otevřené Česko. Moreover, because the underlying factor explains only part of
the VAA data, the groupings may look counter-intuitive from the perspective of
the voters themselves as the voter groups for KSČM and Zelení would be rather
different, even-thought they scored within one cluster in PCA1. Nevertheless,
the municipalities that scored high on the PCA1 coefficient and thus voted more
in-line with more anti-system parties are the areas which have higher amount of
primary education and financial debt relief and foreclosures. The municipalities
which scored more negatively on the PCA1 coefficient then are those where the
aggregate education is higher. What is also important finding is relatively small
relevance of the traditional cleavages and municipal development with regards
to booth infrastructure and municipal finances.

Figure 14.2: WLS for MR1 results
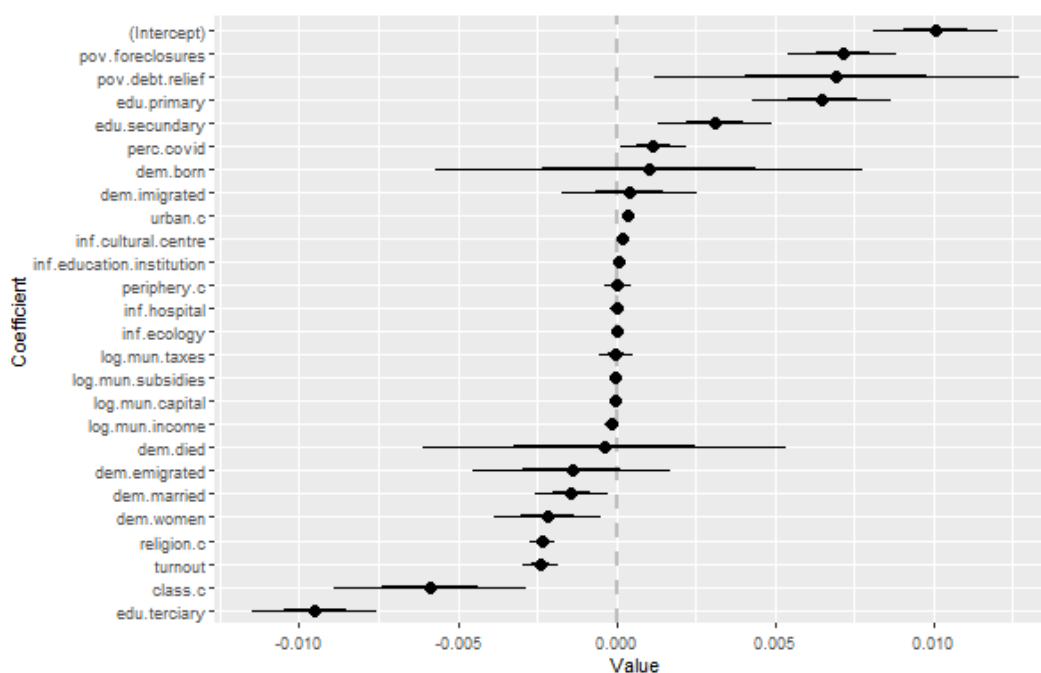
The results for the MR1 are rather similar. The only difference is that the MR1
WLS would point to increased relevance of the two traditional cleavages as
booth religion and class have higher effect while maintaining high significance.
Again, the positions aligned with the most anti-system parties are connected
to the foreclosures, debt relief and lower education with the opposite effect of
higher education.

Overall the results are mixed for the continuing relevance of the traditional cleavage groups. The PCA WLS found no significant effect of traditional cleavages on the voting patterns while the MR WLS points at effects of religion and class cleavage, however still at significantly lower volumes then the main drivers of the voting patterns - the economical hardship and the education. The effects of infrastructure and public finance seems to be negligible. The WLS results are not surprising and can be thought of as being in line with the classical preconceptions about the Czech political landscape. The regions hammered by low education and bad economical situation tend to vote for more anti-system parties whereas the regions with high education tend to vote for more traditional parties or parties more on the left. The precise interpretation of the political parties needs to be taken with a grain of salt, thanks to the aggregated nature of the indexes. The interesting is the virtual irrelevance of the urban/rural cleavage as this cleavage have also lot of traction in contemporary medial landscape. It might be interpreted in line with the other variables. The difference is not between the village and the city but between poverty and abundance, between educated and uneducated.

Table 14.1: WLS Regressions results

	Dependent variable:	
	PC1	MR1
	(1)	(2)
religion.c	−0.026***	−0.002***
	(0.003)	(0.0002)
class.c	−0.030	−0.006***
	(0.024)	(0.002)
urban.c	0.007***	0.0004***
	(0.001)	(0.0001)
log.periphery.c	−0.0001	
	(0.0003)	
periphery.c		0.00003
		(0.0002)
edu.terciary	−0.105***	−0.010***
	(0.016)	(0.001)
edu.secundary	0.025*	0.003***
	(0.015)	(0.001)
edu.primary	0.050***	0.006***
	(0.018)	(0.001)
pov.foreclosures	0.090***	0.007***
	(0.014)	(0.001)
pov.debt.relief	0.041	0.007**
	(0.047)	(0.003)
dem.women	−0.039***	−0.002**
	(0.014)	(0.001)
dem.born	0.011	0.001
	(0.054)	(0.003)
dem.died	−0.057	−0.0004
	(0.046)	(0.003)
dem.emigrated	0.007	−0.001
	(0.025)	(0.002)
dem.imigrated	0.006	0.0004
	(0.017)	(0.001)
inf.cultural.centre	0.003***	0.0002***
	(0.001)	(0.00005)
inf.hospital	−0.0002	0.00003
	(0.002)	(0.0001)
inf.education.institution	0.003***	0.0001**
	(0.001)	(0.0001)
inf.ecology	0.001***	0.00003***
	(0.0001)	(0.00001)
log.mun.income	−0.004**	−0.0001
	(0.002)	(0.0001)
log.mun.taxes	−0.008*	−0.00001
	(0.004)	(0.0003)
log.mun.capital	0.0003	−0.00002
	(0.001)	(0.00004)
log.mun.subsidies	−0.001	−0.00002
	(0.0005)	(0.00003)
dem.married	−0.064***	−0.001**
	(0.009)	(0.001)
perc.covid	0.032***	0.001**
	(0.009)	(0.001)
turnout	−0.026***	−0.002***
	(0.004)	(0.0003)
Constant	−0.056***	0.010***
	(0.016)	(0.001)
Observations	6,254	6,254
R^2	0.185	0.301
Adjusted R^2	0.181	0.298
Residual Std. Error (df = 6228)	1.336	1.325
F Statistic (df = 25; 6228)	56.378***	107.025***

Note:	*p<0.1; **p<0.05; ***p<0.01

14.2   Durbin Spatial Error Method

Underlying the importance of spatial auto correlation in the source data is the usage of Durbin Spatial Error Model.

Because booth models were applied on the dataset consisting of all the relevant municipalities, both models, PC1 and MR1, were applied to the same dataset comprising 6,254 observations. From the point of view of log likelyhood the MR1 outpreforms the PC1. The MR1 31,29 over PC1 13,75 suggests better fit of the model to the data, indicating its superior performance in capturing the underlying patterns and structure of the data. The sigma squared value again signifies the better fit for the MR1 model, because the sigma squared of MR1 is much lower than the value for PC1. Lastly the Wald Test and LR Test statistics for PC1 and MR1 are significantly higher for MR1 compared to PC1. This again suggests that MR1 provides a better overall fit to the data compared to PC1, as indicated by the larger test statistics. MR1 demonstrates a superior ability to capture the underlying patterns in the data and provides a more accurate representation of the dataset compared to PC1

The SDEM for the PC1 variable still holds the primacy of the Tertiary education variable. The lagged variables however become more pronounced by the inclusion of the spatial lag. The overall fit of the model, as measured by the Akaike Information Criterion, hints at the Spatial Model having higher goodness of fit then the baseline WLS model. The story however remains very similar for all of the variables. The importance of the traditional cleavages remains questionable. The slightly increased importance of the infrastructure variables can be noted.

The emigration and immigration once again provide very little effect onto the political position variable. The same holds true for the demographic variable connected to the amount of people born within municipality. Only three variables seems to somehow affect the dependent variable. These are the amount of deaths, the percentage of married inhabitants and amount of women within municipality. All of these variables have a negative effect in case of PC1. In case of MR1 the effect is more limited, even when taking into account different initial values of the indexes. Overall, it is safe to conclude that the effect of demographic powers towards the political positioning of the municipality is limited bordering to virtually nonexistent.

Regarding the traditional infrastructure variables (that is without the spatial

lag), the results are very limited booth based on the overall effect and significance of the variables. Very similar results can also be observed with regards to the municipal public finances. All four variables have also limited effect in their traditional form.

The Covid deaths and average turnout again differ between the MR1 and PC1 as the Covid perception acts more stronger within PC1 then MR1. Regarding the poverty metrices, the foreclosures and debt relief have similar effects within MR1 while the difference in the velocity of the effect is higher within PC1 then within MR1.

When taking into account also the lagged variable, the interpretation of results does not changes significantly. The public finance and demoghraphy remains limited still. The infrastructure have higher effect within the laggs, but still does not have substantial effect. The effects of foreclosures and education looms the highest as the most important variables.

Table 14.2: SDEM Regressions results

	Dependent variable:	
	PC1	MR1
	(1)	(2)
religion.c	−0.046*** (0.004)	−0.004*** (0.0003)
class.c	−0.050** (0.023)	−0.007*** (0.001)
urban.c	0.006*** (0.001)	0.0003*** (0.0001)
periphery.c	−0.002 (0.003)	−0.00003 (0.0002)
edu.terciary	−0.082*** (0.016)	−0.008*** (0.001)
edu.secundary	0.029** (0.014)	0.003*** (0.001)
edu.primary	0.032* (0.017)	0.005*** (0.001)
pov.foreclosures	0.068*** (0.014)	0.005*** (0.001)
pov.debt.relief	−0.002 (0.045)	0.004 (0.003)
dem.women	−0.042*** (0.013)	−0.003*** (0.001)
dem.born	0.004 (0.052)	0.001 (0.003)
dem.died	−0.068 (0.044)	−0.002 (0.003)
dem.emigrated	0.002 (0.024)	−0.002 (0.001)
dem.imigrated	0.018 (0.017)	0.001 (0.001)
inf.cultural.centre	0.001* (0.001)	0.0001*** (0.00005)
inf.hospital	−0.003 (0.002)	−0.0001 (0.0001)
inf.education.institution	0.00000 (0.001)	−0.0001 (0.0001)
inf.ecology	0.0001 (0.0001)	0.00000 (0.00001)
mun.income	0.00003 (0.00003)	0.00000 (0.00000)
mun.taxes	−0.001 (0.001)	0.00003 (0.00005)
mun.capital	−0.0001 (0.0001)	−0.00001* (0.00000)
mun.subsidies	−0.00000 (0.00003)	−0.00000 (0.00000)
dem.married	−0.062*** (0.009)	−0.002*** (0.001)
perc.covid	0.012 (0.008)	0.0003 (0.001)
turnout	−0.026*** (0.005)	−0.002*** (0.0003)
lag.(Intercept)	0.007 (0.007)	−0.0002 (0.0004)
lag.religion.c	0.006*** (0.001)	0.0004*** (0.0001)
lag.class.c	−0.004 (0.011)	0.0001 (0.001)
lag.urban.c	0.002*** (0.001)	0.0001*** (0.00003)
lag.periphery.c	−0.0003 (0.001)	−0.00003 (0.0001)
lag.edu.terciary	−0.012* (0.007)	−0.0004 (0.0004)
lag.edu.secundary	−0.003 (0.006)	0.0002 (0.0004)
lag.edu.primary	0.002 (0.008)	0.0002 (0.0005)
lag.pov.foreclosures	0.009 (0.006)	0.001*** (0.0004)
lag.pov.debt.relief	0.043** (0.022)	0.003** (0.001)
lag.dem.women	−0.004 (0.006)	0.00000 (0.0004)
lag.dem.born	−0.012 (0.026)	−0.001 (0.002)
lag.dem.died	0.004 (0.021)	0.002* (0.001)
lag.dem.emigrated	−0.008 (0.012)	−0.0003 (0.001)
lag.dem.imigrated	−0.002 (0.008)	−0.0003 (0.0005)
lag.inf.cultural.centre	0.001* (0.0003)	0.0001** (0.00002)
lag.inf.hospital	0.002*** (0.001)	0.0001** (0.00005)
lag.inf.education.institution	0.002*** (0.0003)	0.0001*** (0.00002)
lag.inf.ecology	0.0002*** (0.00004)	0.00001*** (0.00000)
lag.mun.income	−0.00002* (0.00001)	−0.00000 (0.00000)
lag.mun.taxes	−0.001*** (0.0003)	−0.0001*** (0.00002)
lag.mun.capital	0.00000 (0.00003)	−0.00000 (0.00000)
lag.mun.subsidies	−0.00001 (0.00001)	−0.00000 (0.00000)
lag.dem.married	−0.004 (0.004)	0.0002 (0.0003)
lag.perc.covid	0.013*** (0.003)	0.001*** (0.0002)
lag.turnout	−0.001 (0.002)	−0.0001 (0.0001)
Constant	−0.066*** (0.015)	0.011*** (0.001)
Observations	6,254	6,254
Log Likelihood	13,750.540	31,288.050
σ^2	0.001	0.00000
Akaike Inf. Crit.	−27,393.090	−62,468.100
Wald Test (df = 1)	328.568***	511.147***
LR Test (df = 1)	296.566***	447.590***
Note:		*p<0.1; **p<0.05; ***p<0.01

Chapter 15

Conclusion

Firstly, the indexes representing political positions were created using multivariate techniques. The PCA, factor analysis and t-SNE methods were employed. The results varied in spatial distribution as well as in the overall explained variance. The interpretation of some indexes was rather difficult and as such two indexes were selected as having the most explanatory power. These were the PC1 index and the MR1 index.

The political positions created in the Part One of the thesis were analysed by the WLS and SDEM models. The results confirm the expectations. The cleavages indeed didn't matter while the primacy of aggregate positions of municipalities was occupied by the education (tertiary education as one of the strongest determinants) and personal economic positions (as described by the percentage amount of debt relief and foreclosures).

This is in line with plethora of other research, which tends to be limited only on selected parties or ideological positions. Mapping the political positions of the whole population brings more granularity into the research. However, the answer are almost entirely the same.

Further research could focus on more in-depth analysis of the underlying political positions. By that, I mean the more precise mapping using more advanced computational techniques which would be able to catch higher volume of variance. It is important to note, that again the results would probably look rather similar.

Moreover, the created indexes on political parties positions could be further used for more specific research, for example by looking at specific municipal

characteristics the connections towards elected officials on the municipal level or other economic variables, that are hard to come by nowadays.

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Appendix A

VAA questions and answers

Question	ANO 2011	CSSD	KSČM	Piráti a STAN	SPD	Spolu	Přísaha	Trikolóra SS	Zelení	ANS	APB	Koruna Česká	Levice	Moravané	MZH	Nevolte Urza.cz	Otevř. Česko	Prameny	Senioři 21	Švýc.dem.	Volný blok
Taxation of empty flats	No	Yes	Yes	No	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No
Relaxation of housing construction conditions	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	-	Yes	Yes	No	Yes	Yes
Regulation of rents in flats	No	Yes	Yes	No	No	No	No	No	No	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Tenants by ethnicity	No	No	No	No	No	No	No	Yes	No	Yes	No	No	No	-	No	Yes	Yes	No	Yes	-	Yes
Max. price - sale of flats	No	No	No	-	No	No	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	Yes	No	No
Covid tests paid for by insurance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	-	Yes	Yes	Yes	No	Yes	Yes	No	-	Yes
Covid tests covered by the budget	Yes	No	Yes	Yes	No	Yes	-	No	-	Yes	No	Yes	Yes	-	Yes	No	No	Yes	Yes	-	Yes
Police tougher on covid measures	Yes	Yes	No	No	No	No	No	No	-	No	No	No	Yes	No	No	No	No	No	No	No	No
Mandatory vaccination against covid-19	No	No	No	No	No	No	No	No	-	No	No	No	Yes	No	Yes	No	No	No	No	No	No
National referendum	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Register of lobbyists	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	No	-	-	Yes
Bill - petition	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	-	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes
Highways - land expropriation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
High speed trains priority	No	Yes	Yes	Yes	Yes	No	-	No	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No
Raise the retirement age	No	No	No	No	No	No	No	No	No	No	-	-	No	No	No	-	No	No	No	-	No
New dams	Yes	Yes	-	No	Yes	No	Yes	No	No	No	Yes	No	No	-	No	No	Yes	No	-	Yes	No
Preservation of biofuel components	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No
Fit for 55	Yes	Yes	-	Yes	No	No	No	No	Yes	No	-	-	Yes	No	Yes	No	No	No	No	No	No
Back up PETs and cans	Yes	Yes	Yes	Yes	-	-	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	-	Yes	Yes	No	No	No
Support for organic farming only	No	No	-	No	No	Yes	No	No	No	Yes	Yes	No	Yes	No	Yes	No	No	Yes	No	No	No
Property tax volume	No	Yes	No	Yes	No	No	No	No	Yes	No	No	Yes	Yes	No	Yes	No	No	No	No	No	No
EET repeal	No	No	No	-	Yes	Yes	Yes	No	No	Yes	Yes	-	No	Yes	-	Yes	Yes	Yes	No	No	Yes
Digital services tax	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Government - mobile internet prices	Yes	Yes	Yes	-	No	No	Yes	No	-	Yes	-	No	Yes	Yes	-	No	No	Yes	Yes	No	-
Privatisation of Budvar	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No
Privatisation of Thermal	No	No	No	-	-	-	-	Yes	-	No	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No
Tax progression of employees	No	Yes	Yes	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	-	No	No	Yes	No	No	No
Balanced budget within 4 years	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Increase in tax on alcohol	Yes	No	-	Yes	No	No	No	No	-	Yes	No	No	Yes	Yes	No	No	Yes	No	Yes	No	No
Reduction of VAT on housing construction	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	No
End of coal mining and burning before 2038	Yes	Yes	No	Yes	No	-	No	No	Yes	No	No	No	Yes	No	Yes	No	No	No	No	No	No
State support for Dukovany	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Support for renewables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	No
Carbon neutrality law by 2050	Yes	Yes	No	Yes	No	No	No	No	Yes	No	-	No	Yes	-	Yes	No	No	No	-	No	No
Cannabis cultivation legal	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	No	-	Yes
Higher penalties for rape	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
Lower impact on punishment for existing impunity	No	No	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No
Law against punishing children	No	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No
Fines according to driver's income	No	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes	No	No	No
Judges for life	Yes	Yes	Yes	Yes	-	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No
Allowance for legal counsel	No	Yes	Yes	-	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	-	No	Yes	Yes	No	-	Yes
Restrictions on access to social media	No	No	No	-	No	No	No	Yes	No	No	No	No	No	No	Yes	Yes	No	No	Yes	-	No
Liability of social networking sites	No	Yes	-	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No	No	No	Yes	-	No
Fake News - obligation to remove	No	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No
Less money for public service broadcasting	Yes	No	-	No	Yes	No	No	Yes	No	Yes	-	No	No	No	No	Yes	Yes	No	Yes	Yes	No
Nutrition Score	Yes	Yes	No	Yes	Yes	No	-	No	-	-	Yes	No	Yes	No	Yes	No	Yes	Yes	No	No	No
Strengthening state food inspection bodies	Yes	Yes	Yes	Yes	No	Yes	-	No	Yes	Yes	Yes	-	Yes	Yes	No	Yes	Yes	No	No	No	No
Making part-time work more profitable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No
Reducing the tax burden on labour	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minimum wage tied to average wage	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Reduction of working hours across the board	No	Yes	Yes	No	Yes	No	No	No	Yes	Yes	No	No	Yes	Yes	-	No	No	No	No	No	No
Greater powers for workplace inspections	No	Yes	Yes	No	No	No	-	No	Yes	Yes	No	No	Yes	Yes	No	No	No	No	Yes	No	No
Restrictions on employment agencies	Yes	Yes	Yes	-	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	No	No
Same-sex couples: adoption of children	-	Yes	-	Yes	No	-	-	No	Yes	No	-	No	Yes	Yes	Yes	No	No	No	No	No	No
Same-sex couples: marriage	-	Yes	-	Yes	No	-	-	No	Yes	No	-	No	Yes	Yes	Yes	No	No	No	No	No	No
Reduction of parental leave	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
Local jurisdiction of bailiffs	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	-	No	No	Yes	Yes	Yes	No	Yes
1 debtor = 1 bailiff	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No
Social housing	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No
Active search for people in need	No	Yes	Yes	No	No	No	No	No	Yes	Yes	No	Yes	Yes	No	-	No	No	Yes	No	No	No
Binding calculation of maintenance payments	No	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No
Decentralisation of the Czech Republic	Yes	No	-	-	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No
Colonisation of Mars	Yes	No	Yes	Yes	No	Yes	-	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No
Online elections	No	No	No	Yes	No	Yes	No	No	No	No	-	No	-	Yes	No	Yes	No	No	No	No	No
Promoting technical education	Yes	No	Yes	-	Yes	No	No	Yes	No	No	No	No	No	No	Yes	No	No	Yes	No	Yes	Yes
Non-differentiation of pupils in primary schools	Yes	Yes	Yes	-	Yes	No	No	No	No	Yes	No	No	Yes	-	No	No	No	No	No	No	No
Tuition fees at universities	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Inclusive education system	Yes	Yes	No	Yes	No	No	No	No	Yes	No	-	Yes	Yes	Yes	No	No	No	No	No	No	No
Support for teachers in poorer regions	No	Yes	No	-	Yes	Yes	Yes	No	Yes	No	-	No	Yes	Yes	No	No	No	Yes	No	No	No
Output from the EU	No	No	-	No	Yes	No	No	Yes	No	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Introduction of the euro	Yes	Yes	No	Yes	No	No	No	No	Yes	No	-	No	No	No	No	No	No	No	No	No	No
Exit from NATO	No	No	Yes	No	Yes	No	No	No	No	Yes	No	No	Yes	No	No	-	Yes	Yes	Yes	Yes	Yes
Czech Republic at the heart of the EU	No	Yes	No	Yes	No	No	No	No	No	No	-	Yes	No	Yes	No	-	Yes	No	-	No	No
Support for foreign cooperation and aid	Yes	Yes	Yes	Yes	No	-	Yes	No	Yes	No	-	No	Yes	-	Yes	No	No	Yes	No	No	No
Consideration for developing countries	No	Yes	Yes	Yes	No	Yes	No	No	Yes	No	-	No	Yes	-	Yes	No	No	No	No	No	No
Easier asylum in the Czech Republic	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes	No	-	No	No	Yes	Yes	No	No
Czech Republic in Schengen	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	No
More money for the army	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes
Genetic modification of embryos	No	No	No	No	No	No	No	-	No	No	No	No	No	No	-	Yes	No	No	No	No	No
Choosing the sex of the child	No	No	No	No	No	No	No	-	No	No	No	No	No	No	No	Yes	No	No	No	No	No
Palliative and hospice care	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	-	Yes	Yes	Yes	No	No	Yes	Yes	-	No
Foreign doctors and nurses	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	-	No
Hospital beds	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	-	No	No	Yes	Yes	No	No
Healthcare financing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	Yes	No	No
Medicines co-payments harmonisation	Yes	-	No	Yes	No	No	No	No	Yes	Yes	No	No	Yes	No	No	No	No	No	Yes	No	No
Subsidies for health care outside large cities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	No
Discounts on health insurance	No	No	-	No	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Allowing euthanasia	No	No	No	No	No	-	No	No	-	No	No	No	Yes	No	Yes	Yes	No	Yes	No	No	No
Health insurance companies - reduce the number	Yes	Yes	Yes	No	No	No	-	No	No	Yes	No	No	Yes	Yes	No	No	No	No	Yes	No	No
Increase payments for state insured	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes	No	-	Yes	No	Yes	No	No	Yes	No	No	Yes
Valorisation of payments for state insurers	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	-	No	Yes	Yes	Yes	No	No	Yes
Introduction of private health insurance	No	No	No	No	No	Yes	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes
Introduction of personalised healthcare	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	Yes
Centralisation of specialised medical care	No	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	Yes	No	No
Patient co-payments for medical care	No	No	No	No	No	No	No	No	No	No	Yes	No	No	-	No	No	No	No	No	No	No
Science and research in international cooperation	No	No	No	Yes	No	No	Yes	No	No	No	-	Yes	No	-	Yes	No	No	No	No	No	No
Promoting telemedicine	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	-	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No
Promotion of prevention by health insurance companies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	No
Reintroduction of regulatory fees	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	Yes	No	No
Salaries of medical staff	Yes	Yes	Yes	Yes	Yes	Yes	-	Yes	Yes	No	-	Yes	Yes	-	Yes	-	Yes	-	Yes	-	No
More publicly owned hospitals	No	Yes	Yes	No	No	No	No	No	-	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No	No
Obligation for medical graduates to work in the Czech Republic	No	No	Yes	No	Yes	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No
Privatisation of hospitals	No	No	No	No	No	No	No	No	No	Yes	-	No	No	No	No	No	No	No	No	No	No
Against discrimination against female doctors	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	-	Yes	No	Yes	Yes	No	No	Yes	No	-	No	No
School canteens - composition of meals	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes	No	No	No
Health insurance - health care utilization statement	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	-	No	No	Yes	Yes	Yes	Yes	Yes
Higher VAT on junk food	No	No	-	-	No	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	No	No	-	No
Advertising on medicines paid for by insurance	No	No	No	No	No	Yes	No	No	-	-	No	Yes	No	Yes	Yes	-	No	No	No	-	No
More contracts with psychologists	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	No	Yes	Yes	Yes	-	No	No	Yes	No	No	No
Health data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes
Mental illness - community care	Yes	No	No	Yes	Yes	No	-	Yes	Yes	-	-	Yes	-	Yes	-	No	Yes	Yes	No	-	No
Glyphosate ban	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No
Legislation for self-driving cars	No	No	No	Yes	No	No	No	No	-	-	Yes	No	No	-	No	Yes	No	No	No	No	No
Stop automated control systems	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	-	-	No	Yes	No	No	No	No
Ban on autonomous weapons	No	Yes	Yes	Yes	-	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	-	Yes
Ban on automatic facial recognition	Yes	No	-	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	-	Yes	Yes	No	Yes	Yes	Yes

Appendix B

Spatial distribution of variables
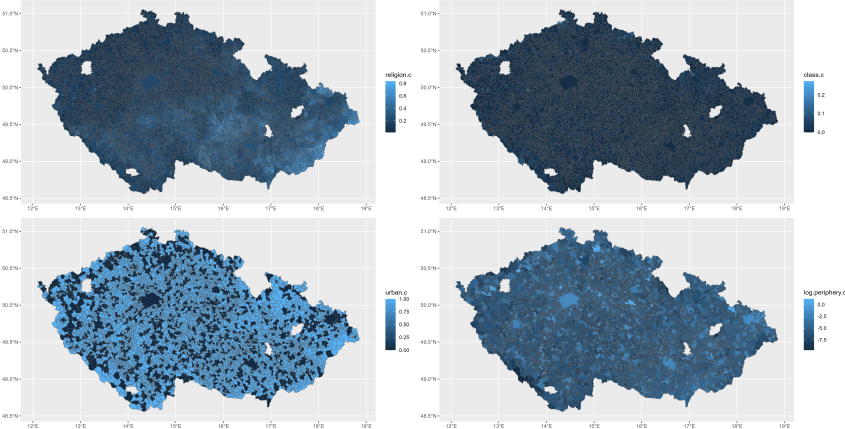
Figure B.1: Spatial distribution – Cleavages

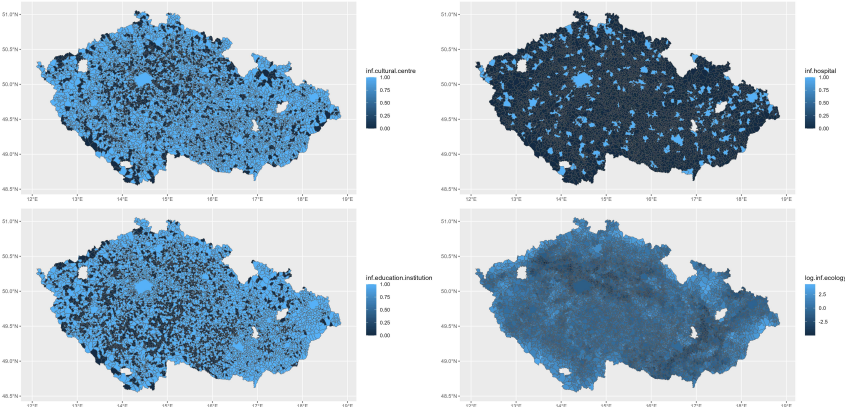Figure B.2: Spatial distribution – Infrostractur
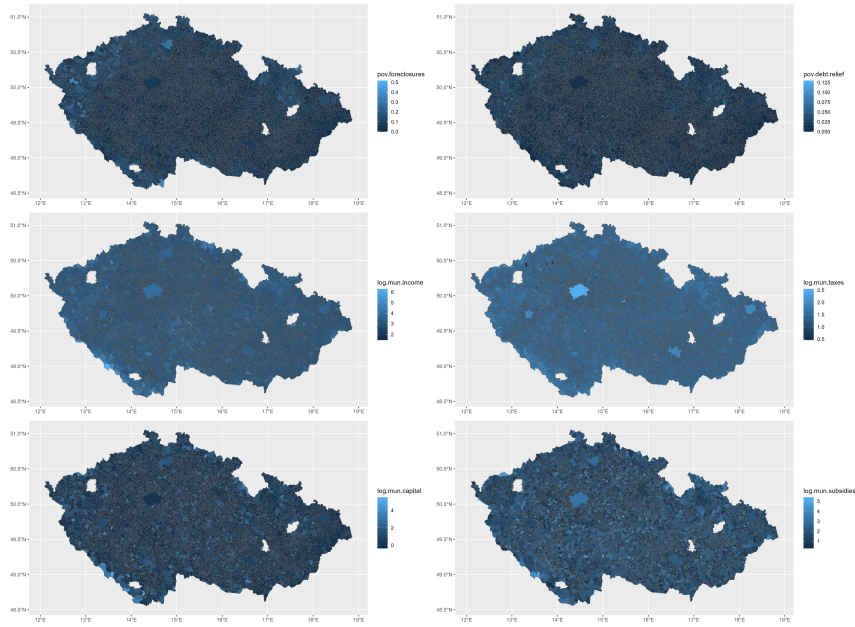
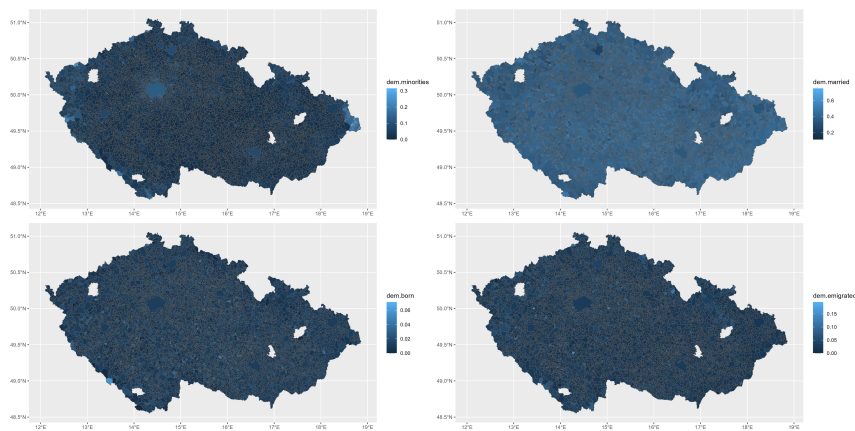Figure B.3: Spatial distribution – Economics and Finance

Figure B.4: Spatial distribution – Demographic

Appendix C

Calculated indexes

Political Party	PC1	PC2	MR1	MR2	t-SNE1	t-SNE2
ANO	-3.84503	-1.18741	0.214935	0.421236	-52.3771	-28.169
ANS	-0.40504	-7.27621	0.532259	0.388914	93.59067	38.85705
APB	2.661232	3.242995	0.242145	-0.07809	-37.5187	20.20661
ČSSD	-7.32802	-0.39811	0.025218	0.660872	-50.5564	-74.4405
KSČM	-5.69512	-3.96676	0.036035	-0.14531	8.363048	-36.8227
Levice	-9.97406	-0.08886	0.243115	0.688069	-34.5534	-80.3784
Monarchiste.cz	2.072864	7.159613	-0.15428	0.804115	-65.1672	-83.2879
Moravané	-0.70751	-6.37802	0.507588	0.413709	82.84011	27.27161
MZH	-4.87085	7.067993	-0.2383	0.137124	-12.9816	-42.4352
OtČe	6.623386	-1.91688	0.713989	-0.17614	-7.43396	49.98674
PRAMENY	-0.02286	-4.46682	0.57409	0.306983	78.01296	60.61247
SENIOŘI	-0.41152	-0.71129	0.285978	0.072529	68.2768	12.06797
SPD	2.103887	-4.17479	0.63588	0.190055	63.11108	62.83777
SPOLU	2.395498	3.862075	0.227406	-0.01292	-7.12969	-13.1183
TSS	5.692459	1.427009	0.552737	-0.2672	4.282211	20.76365
Volný blok	6.733754	-4.24966	0.738078	-0.10933	-16.9141	60.45755
Zelení	-6.53941	3.588747	-0.13359	0.459849	-72.6388	-68.1859
Švýcar. demokr.	5.937205	-1.45994	0.660393	-0.16374	6.776199	40.13406
PŘÍSAHA	-0.69981	0.627178	0.314215	0.240691	-28.1794	-9.7839
Nevolte Urza.cz	9.60223	5.233821	0.273415	-0.61428	12.65388	69.20594
Piráti+STAN	-3.7348	3.354006	0.089344	0.29024	-32.4565	-25.7796