

MEF UNIVERSITY

**VOTE TRANSITION ANALYSIS
AND COMPARISON OF
TURKISH LOCAL ELECTIONS
IN 2014 AND 2019**

Capstone Project

Ufuk Baydođan

İSTANBUL, 2019

GCPRIS

MEF UNIVERSITY

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Ufuk Baydođan

Advisor: Asst. Prof. Dr. Evren Gney

İSTANBUL, 2019

MEF UNIVERSITY

Name of the project: Vote Transition Analysis and Comparison of Turkish Local Elections in 2014 and 2019

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Date of Thesis Defense: 09/09/2019

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09/09/2019

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EXECUTIVE SUMMARY

VOTE TRANSITION ANALYSIS AND COMPARISON OF TURKISH LOCAL ELECTIONS IN 2014 AND 2019

Ufuk Baydoğan

Advisor: Asst. Prof. Dr. Evren Güney

SEPTEMBER, 2019, 96 pages

Debates around how voters switched their votes relative to previous elections are always the topic after the Election Day. Turkish local election of 2019 was important because of three reasons: first, because it was the first local election after Turkey adapted the new presidential system and the President also participated in the election campaign for his party; second, because İstanbul election, originally run on March 31, was ruled for rerun by Supreme Election Council and the third, because the electoral alliances had significant impact on the results where the votes for The People's Alliance significantly collapsed.

This study presents a comparative analysis of 2014 and 2019 official Turkish Local Election Results as well as 2019 Re-Run Election Results of Istanbul to understand the vote transitions. As the outcomes are considered, there are significant changes in the distribution of voting rates between these elections, especially in critical metropolitans. Using the aggregate level vote counts, the vote transition probabilities between the elections are inferred using ecological inference. Proposed clustering approach on vote transition probabilities show that CHP and IYI Party have benefited from forming Nation's Alliance for most of the cities mainly due to the vote switches from HDP and MHP. For the re-run election case, the slight number of vote difference between the alliances in March has increased significantly. This is mainly because of the contribution of absentees to Nation's Alliance and around %5 of the People's Alliance supporters in March who estimated to vote for Nation's Alliance.

Key Words: Turkish Local Elections, Ecological Inference, Vote Transitions.

ÖZET

2014 VE 2019 TÜRKİYE YEREL SEÇİMLERİ OY GEÇİŞLERİ ANALİZİ VE KARŞILAŞTIRMASI

Ufuk Baydoğan

Tez Danışmanı: Dr. Öğr. Üyesi Evren Güney

EYLÜL, 2019, 96 sayfa

Seçmenlerin oylarını önceki seçimlere göre nasıl değiştirdiği konusundaki tartışmalar, Seçim Günü'nden sonra her zaman konudur. Türkiye'nin 2019'da yaptığı yerel seçim üç nedenden ötürü önemliydi: Birincisi, Türkiye'nin yeni cumhurbaşkanlığı sistemini benimsemesinden sonraki ilk yerel seçimdi ve Cumhurbaşkanı partisinin seçim kampanyasına da katıldı; ikincisi, ilk olarak 31 Mart'ta yapılan İstanbul seçimlerinin, Yüksek Seçim Kurulu tarafından tekrar başlatılmasına hükmedildi ve üçüncü olarak seçim ittifaklarının Cumhuriyet İttifakı'nın oylarının önemli ölçüde düştüğü sonuçlar üzerinde önemli bir etkisi vardı.

Bu çalışma, 2014 ve 2019 resmi Türkiye Yerel Seçim Sonuçları ve İstanbul'un 2019 Yenilenen Seçim Sonuçları üzerinde oy geçişlerini anlamak için karşılaştırmalı bir analiz sunmaktadır. Sonuçlar göz önüne alındığında, bu seçimler arasında, özellikle kritik metropollerde, oy oranları dağılımında önemli değişiklikler olduğunu ortaya çıkmıştır. Seçimler arasındaki oy geçiş olasılıkları toplam oy sayıları üzerinden ekolojik çıkarım kullanılarak tahmin edilmiştir. Tahmini oy geçiş olasılıkları üzerine önerilen kümeleme yaklaşımı, CHP ve İYİ Parti'nin çoğu şehir için HDP ve MHP seçmenlerinin oy geçişleri sayesinde Millet İttifakı ile fayda sağladığını göstermektedir. Tekrarlanan İstanbul seçiminde, ittifaklar arasındaki oy farkı Mart'ta yapılan seçime kıyasla önemli ölçüde artmıştır. Bunun temel nedeni, Mart'ta oy kullanmayan belli bir kesmin Millet İttifakı adına oy vermek üzere sandığa gitmesi ve ilk seçimde Cumhuriyet İttifakı destekçisi olmuş seçmenin %5 oranında Millet İttifakı'na olan geçişidir.

Anahtar Kelimeler: Türkiye Yerel Seçimleri, Ekolojik Çıkarım, Oy Geçişleri

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1. INTRODUCTION

Turkish local election of 2019 was important because of three reasons: first, because it was the first local election after Turkey adapted the new presidential system and the President also participated in the election campaign for his party; second, because İstanbul election, originally run on March 31, was ruled for rerun by Supreme Election Council and the third, because the electoral alliances had significant impact on the results where the votes for The People's Alliance significantly collapsed.

Debates around how voters switched their votes relative to previous elections are always the topic after the Election Day. Understanding the vote transitions are easier when individual-level votes are known as in some states of United States (Ambadjes, 2014). However, this information is unavailable in most of the elections. For the cases where individual vote information is not available, researchers have focused on the survey results to understand the vote transition behavior of the individuals. Although this approach is adapted by many studies, it is prone to mislead since how you perform sampling may affect the findings significantly. Because of the potential problems with the aforementioned approaches, researchers focus on how vote transition between political parties or alliances can be quantified using aggregate data (Andreadis & Chadjipadelis, 2009). In many elections, the most detailed level of available information is the neighborhood based aggregate vote counts/shares. Given the aggregate level vote information, the ultimate aim of these approaches to estimate the conditional probability, p_{jl} , of individual's choosing the l^{th} option in the second election given that s/he has chosen the j^{th} option in the first one. In other words, p_{jl} is the voter transition rate from political party j of the first election to political party l of the second election. This problem is also known as the ecological inference problem in social sciences, where the information about the individual behavior is to be extracted using the information reported at an aggregate level (Freedman et al., 1998). Formally, ecological inference is defined as the process of using aggregate (i.e., "ecological") data to understand discrete individual-level relationships of interest when there is a lack of individual level information (King, 2013). Since it is claimed that the longer the period between two elections, the harder to measure the real amount of vote transitions. It is preferred to compare the elections for which the time period between them is shorter. 31

March 2019 Istanbul Local Elections and its rerun version on 23 June 2019 are good candidates for such an analysis.

This study focuses on the comparative analysis of 2014 and 2019 official Turkish Local Election Results as well as 2019 Re-Run Election Results of Istanbul to understand the vote transitions. As the outcomes are considered, there are significant changes in the distribution of voting rates between these elections, especially in critical metropolitans. Therefore, main focus is on the voting behavior of metropolitans instead of cities, districts or town municipalities. In order to characterize the vote transition behavior for each metropolitan, Bayesian and frequentist inference for ecological inference approach proposed by Rosen et al. (2001) is used on the neighborhood level aggregate vote counts. After the vote transition probabilities are obtained, hierarchical clustering is used to identify the metropolitans with similar vote transition behavior for the comparison of the election results of 2014 and 2019.

Clustering analyses reveal the group of metropolitans where certain political parties benefited from forming alliances. It is observed that in one of the largest cluster including the most crowded cities such as Ankara, İstanbul and İzmir, MHP's votes have been distributed between Nation's and People's Alliance due to IYI Party and IYI Party's votes have contributed in favor of CHP as an outcome of the alliance. The vote transition of MHP to Nation's Alliance is generally smaller compared to transition to People's Alliance. Also, most of the individuals voted for HDP in 2014 elections switched to Nation's Alliance in this cluster. The second largest cluster involves the metropolitans where IYI Party benefited from forming alliance. This cluster includes cities like Kocaeli, Sakarya, Manisa where MHP used to have significant share of votes in 2014. The vote transition from MHP to Nation's Alliance is mostly larger compared to transition to People's Alliance in this cluster. The third largest cluster is composed of metropolitans namely Diyarbakır, Mardin, Van, where HDP has the largest share of votes. This cluster can be characterized by the transitions from the voters of BDP and independent candidates in 2014. Muğla and Samsun are included in a cluster where there is considerable amount of independent votes in 2019. Vote transitions to independent candidates mostly occurred from CHP and MHP in this cluster. Şanlıurfa and Gaziantep have unique vote transitions between 2014 and 2019 compared to other metropolitans. With assumption of AKP's voter structure remained the same between 2014 and 2019, BDP's votes have been transferred to Saadet Party in 2019 in Şanlıurfa. The

majority of the votes of CHP and BDP have been transferred to DSP in 2019 in Gaziantep. The remaining clusters have metropolitans that do not fit well to a specific behavior.

The study is divided into seven main sections. After the first introduction section, the second chapter explains Turkish Local Elections and estimating vote transitions as well as Ecological Inference Problem, the third chapter gives a brief literature review, the fourth chapter describes the exploratory data analysis, the fifth chapter focuses on the methodology, the sixth chapter demonstrates computational experiments and election results of metropolitans and the seventh chapter concludes and gives a brief suggestion for future research.

2. BACKGROUND

2.1. About Turkish Local Elections

Turkish citizens vote for elections of local administrators in every five years. Turkey has a unitary state system, with 81 provinces subordinated to the central government. Of those 81 provinces, 30 are known as "metropolitan municipalities", while the other 51 are known as municipalities. Metropolitan municipalities are designated as provinces with at least three district municipalities or at least two municipalities with a minimum population of 750 thousand. The districts are the next largest administrative area; whereas towns are smallest administrative zones (Kuşcuoğlu, 2019).

In local elections of Turkey, the citizens who has the right to vote casts four votes; for the city or the metropolitan municipality, for the district or town municipality, for the municipal council, and for the mukhtar (head of a village or a neighborhood). The candidate with the most votes are chosen as the administrator of that area. Municipal council members are elected at the voting rates of their parties (Kuşcuoğlu, 2019).

The Supreme Election Council (YSK) is responsible for carrying out and conducting all procedures related to the management and honesty of the elections, examining and finalizing all corruptions, complaints and objections related to election issues during the election and after the election ("YSK Görev ve Yetkileri", 2019).

The latest election held on March 31, 2019. Turkish citizens went to the polls for 30 metropolitans, 51 cities, 973 districts and 386 town municipalities. According to YSK, there were 57,058,636 voters consisting of 50.7% women and 49.3% men. There were 13 parties competing in the elections and two alliances as 'The People's Alliance' and 'Nation's Alliance'. The People's Alliance consisted of the ruling Justice and Development Party (AKP), Nationalist Movement Party (MHP) and the Great Union Party (BBP). In 51 cities, AKP and MHP joined the elections as the "People's Alliance", for the rest 30 cities, the two parties joined the elections separately as competitors. The Nation Alliance consisted of Republican People's Party (CHP) and İYİ (Good) Party. The two parties joined the elections as allies for 49 city municipalities, competed against each other as separate parties in 32 cities (Kuşcuoğlu, 2019). Although the result of the elections determined all over Turkey, YSK has decided to recast the election for Istanbul metropolitan municipality on 23 June 2019 ("Basın Açıklaması", 2019).

Previous election was held on March 31, 2014. Turkish citizens went to the polls for 30 metropolitans, 51 cities and 960 districts and 390 town municipalities. According to YSK, there were 52.695.832 voters consisting of 50.7% women and 49.3% men. 26 parties were competing in the election (“Mahalli İdareler Genel Seçimleri Arşivi”, 2019).

2.2 Estimating Vote Transitions and Ecological Inference Problem

There are basically three alternative approaches to determine vote transition in the literature, the first one measures directly the variance between declared vote and the choice ranking of the voters majorly with feeling thermometer questions. This kind of questions are commonly applied for the estimation of people’s opinion about a political character. However, this method is widely open to bias since people may behave differently than what they claim.

The second approach which is “self-reporting methodology”, takes surveys into account. In these surveys, voters are questioned about the reasons of their preferences of whom to vote. However, this method may result in wrong estimation of vote transitions due to response bias of participants. Many researches show that people respond to surveys in favor of the parties which are stronger in election race.

The third approach considers aggregate election results. The most common approach to identify individual level preferences from the aggregate data is to solve the “Ecological Inference Problem”. The simple version of this problem is usually explained using different voting scenarios (King, 2013; Freedman, 1999). The book (King, 2013) by King, who promised major breakthroughs in the estimation of individual behavior using aggregate data, introduces the following example: in 1994, a federal court in Cleveland needed to understand if African Americans vote differently from whites in a case concerning the legality of Ohio’s State House districts. However, they have the information of election occurred in District 42 in 1990. This information is provided in Table 2.1.

Race of Voting-Age Person	Voting Decision			
	Democrat	Republican	No Vote	
black	?	?	?	55,054
white	?	?	?	25,706
	19,896	10,936	49,928	80,760

Table 2.1. The Ecological Inference Problem at the District Level (King, 2013). The aim is to find out the unknown entries.

The first entry of this table (the one in the upper left corner) is the unknown number of blacks voted for the Democrat candidate. One can come up with large number of alternatives to be put in this cell between 0 and 19,896 while satisfying row and column totals. This refers to the one of the first solution approaches to the ecological inference problem known as the method of bounds in the literature. However, this inference is found to be highly problematic since there is a finite but large set of alternative solutions consistent with aggregate level data. To obtain a unique or few alternative solutions, researchers applied multiple alternative aggregate-level observations assuming that each individual observed units are homogeneous (King, 2013). These units are referred to as “precincts” by King (King, 2013) where the parties in the Ohio case had data at the level of 131 precincts. In Turkish Election’s case, neighborhood level election results can be thought as “precinct” level. A sample table from one of the precincts of District 42 of Ohio is tabulated as in Table 2.2 by King (King, 2013).

Race of Voting-Age Person	Voting Decision			
	Democrat	Republican	No Vote	
black	?	?	?	221
white	?	?	?	484
	130	92	483	705

Table 2.2. The Ecological Inference Problem at the Precinct Level: One of the precincts of District 42 (King, 2013).

Understanding the individual-level of information is still a problem even there is a detailed information at this level. Similar ecological inference problem of finding out the

numbers in each cell at this level exists. On the other hand, having the information of smaller parts would give more information about the whole. Many researchers have focused on making use of the lower level of aggregate information to make reliable ecological inferences, relevant studies and further details are discussed in Section 3.

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3. LITERATURE REVIEW

Literature on estimation of vote transitions can be categorized into three approaches. As mentioned in Section 2.2, first two categories depend on the survey responses which are found to be problematic by many researchers as respondents have potential to behave differently than what they claim. Hence, the studies in these categories are left out of scope for this paper. This section is devoted to an overview of proposed solutions to ecological inference problem under specific conditions. For comprehensive information about the studies from the first two categories, please see Himmelweit et al. (1978) and Prosser and Mellon (2018).

Methods to estimate voter transitions between two consecutive elections based on the aggregate election results mostly deal with solving the ecological inference problem. Although, some researchers claim that it is hard to figure out the real vote transitions from aggregate data since there are many other factors that influence the voting behaviors such as new parties, new alias, changing election systems, etc. There are several studies in the literature demonstrated that it is possible by proposing alternative approaches.

The earliest study in this category by McCarthy and Ryan (1977) propose a quadratic programming solution that provides feasible estimates. However, a year after this study, Upton (1978) discusses that McCarthy and Ryan (1977)'s proposal overestimates the percentage of voters remaining loyal to their previous vote. To overcome potential problems of the existing approaches, Johnston and Hay (1983) propose a solution based on an entropy maximization approach which is shown to be accurate results on a real election data from New Zealand's general election in 1996 by Johnston and Pattie (2000). Although this approach is shown to be successful, it requires an accurate estimation of the aggregate vote transition matrix as an input. It is suggested to estimate this matrix using the exit poll surveys but it is a well-known phenomenon that people who changed their vote has potential to misreport their vote in the earlier election (Himmelweit et al., 1978).

King (1997) proposed a method has received considerable interest and attention. Proposed method benefited from existing statistical approaches (Goodman, 1953) to extract information within bounds (Duncan & Davis, 1953). This hybrid approach is shown to be less sensitive compared to the previous approaches. On the other hand, two years later, Freedman (1999) provided empirical evidence that King's proposal is not insensitive to

certain assumptions. Basically, the assumption in (Goodman, 1953) that the statistical behavior of a demographic group is independent of area of residence is shown to fail. Moreover, King (1997) provides a solution to two party, two election case (i.e. 2x2 ecological inference problem) which is not easy to extend to multiparty multiple election setting. Considering these facts, Rosen et al. (2001) extended the work of King (1997) to an RxC ecological problem using Markov Chain Monte Carlo (MCMC) hierarchical approach to estimate the vote transition probabilities. This approach is widely accepted and employed in many studies. For example, a recent analysis on vote transitions between 2015 and 2018 Turkish Parliamentary elections (“Haziran 2018 Seçim Analizi ve Oy Geçişleri”, 2019) have made use of the approach proposed by Rosen et al. (2001) and provided conclusions on the validity of their findings. To best of my knowledge, this is one of the most recent and comprehensive regarding the Turkish elections. Criticizing the computational requirements of (“Haziran 2018 Seçim Analizi ve Oy Geçişleri”, 2019), (Andreadis & Chadjipadelis, 2009) proposed a recursive approach to simplify the estimation problem and demonstrated its success on French presidential elections in 2007 (two rounds) and the Greek Parliamentary elections held in 2004 and 2007. To promote the reproducible research, they also made their implementation in R (R Core Team, 2019) which helps scholars of multiparty systems in estimation of voter transitions rates with different election data.

Based on these findings, this study will consider the approach proposed by Rosen et al. (2001) because of its known success in estimating vote transitions for multiple election data and provided R implementation. This approach is also used by (“Haziran 2018 Seçim Analizi ve Oy Geçişleri”, 2019) to compare 2015 and 2018 Turkish parliamentary elections which provided important and reasonable findings.

4. EXPLORATORY DATA ANALYSIS

4.1. Data

The data of Turkish Local Elections of March 2019 and March 2014 as well as June 2019 have been gathered from the website of the YSK. It includes the district, neighborhood and ballot box level vote distributions for metropolitans for each political party. June 2019 data only includes votes for Istanbul due to the decision of YSK to recast the election for Istanbul metropolitan municipality on 23 June 2019 (“Basın Açıklaması”, 2019).

4.2. Exploratory Data Analysis

For consistency check and analysis purposes, the participation levels of each election for all country and all metropolitans have been checked. Figure 4.2.1 shows the total participation for two elections; whereas Figure 4.2.2 shows participation levels for each metropolitan and election. When both figures are considered, 2019 participation level seems to be decreased compared to 2014. The same fact also stands for Istanbul; whereas Istanbul participation rate of June 2019 is slightly higher than March 2019.

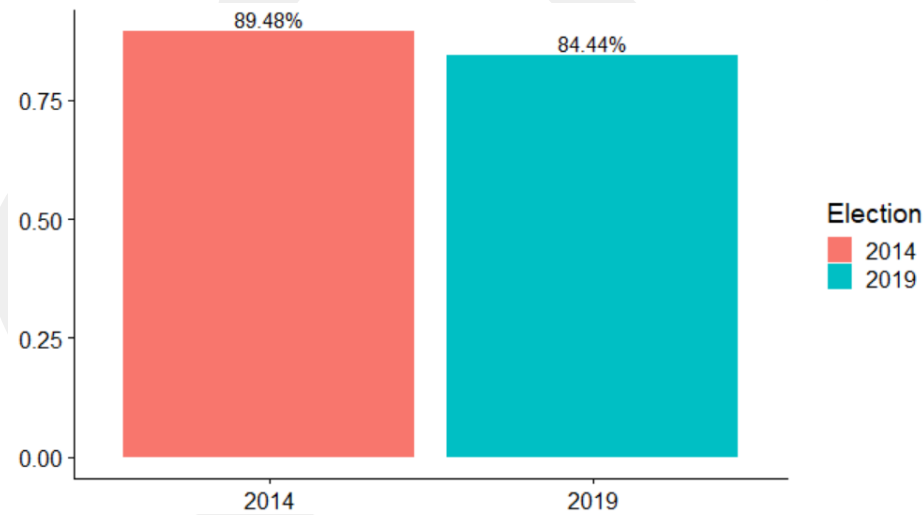


Figure 4.2.1: Total participation level of each election for all country

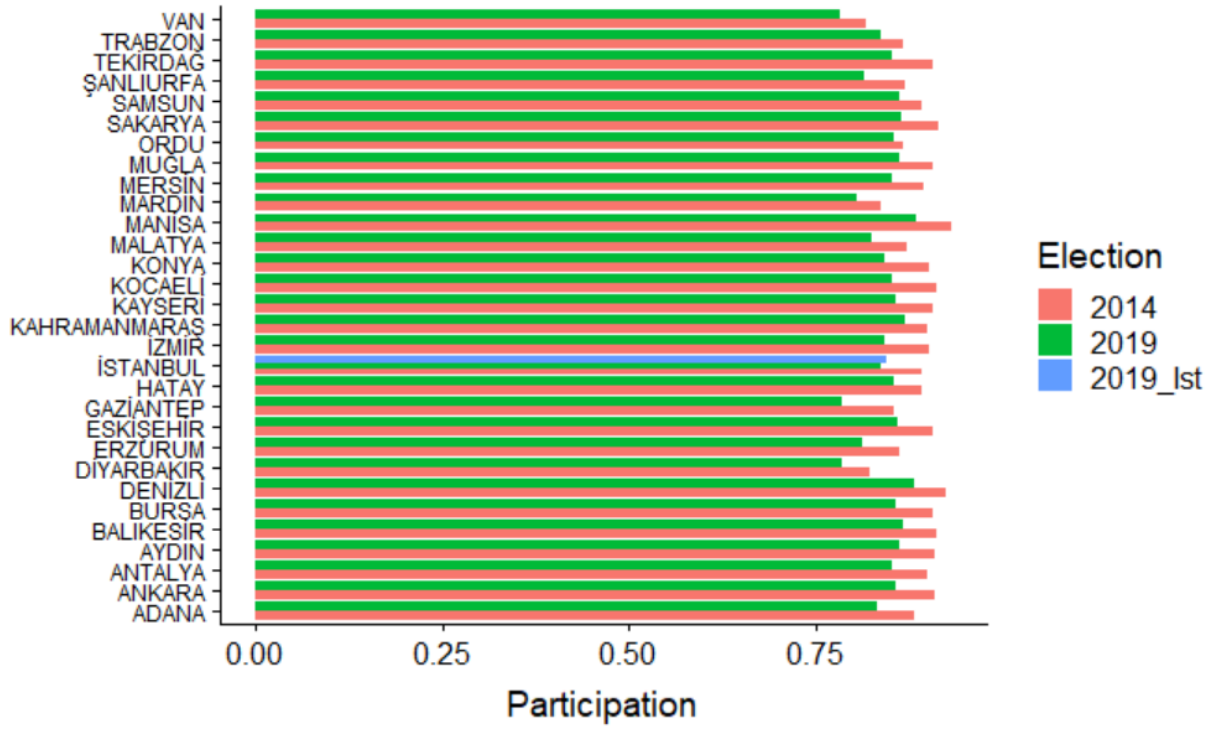


Figure 4.2.2: Participation level of each election for each metropolitan

In Figure 4.2.3, vote shares of top 6 metropolitans according to population size are also illustrated for consistency check and analysis purposes. At first glance, the drastic change of vote distributions of parties between two elections draws the attention.

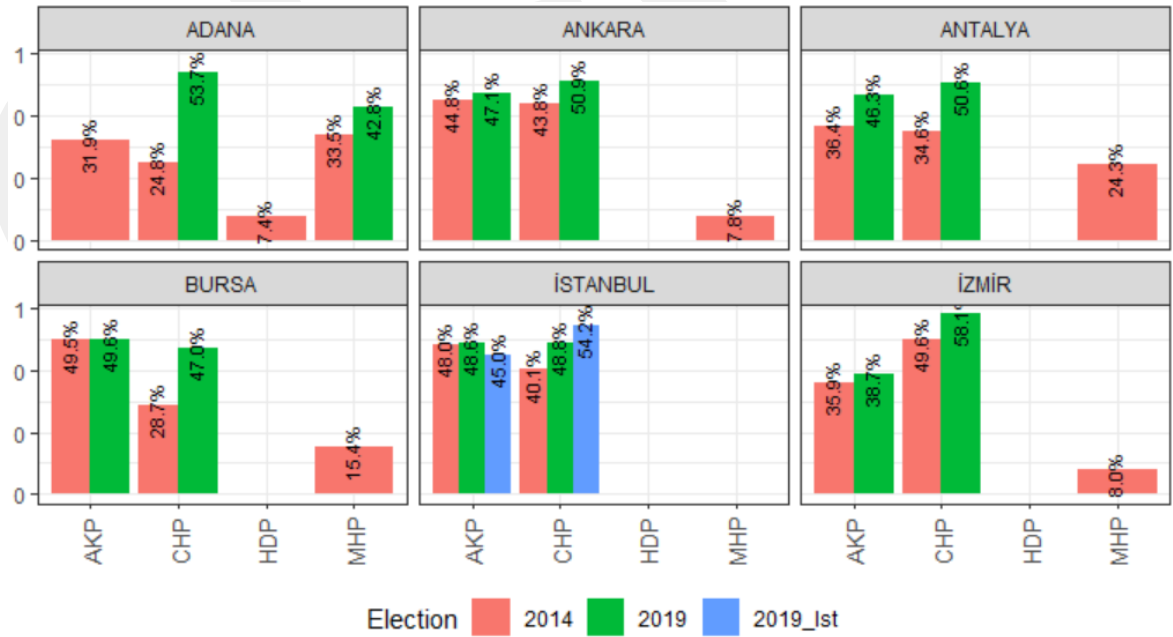


Figure 4.2.3: Vote shares of top 6 metropolitans according to population size for each election

To understand the relationship between parties, correlation matrix for each year have been created. Figure 4.2.4 and 4.2.5 show correlation matrix of parties for 2014 and 2019 elections, respectively. When both matrixes are analyzed together, the effect of the alliances established for 2019 elections is clearly recognized. In 2014, the highest negative correlation is between AKP and CHP. AKP is the leader party of Turkey overall for almost 17 years; whereas CHP is the main opposition party. However, when 2019 matrix is examined, a different picture than 2014 arises. In 2019, the highest negative correlations are between CHP and IYI Party as well as AKP and MHP. This is as a result of the allies established. Especially for metropolitans, both CHP & IYI Party and AKP & MHP chose to join the elections as allies which introduced negative correlation between these parties.

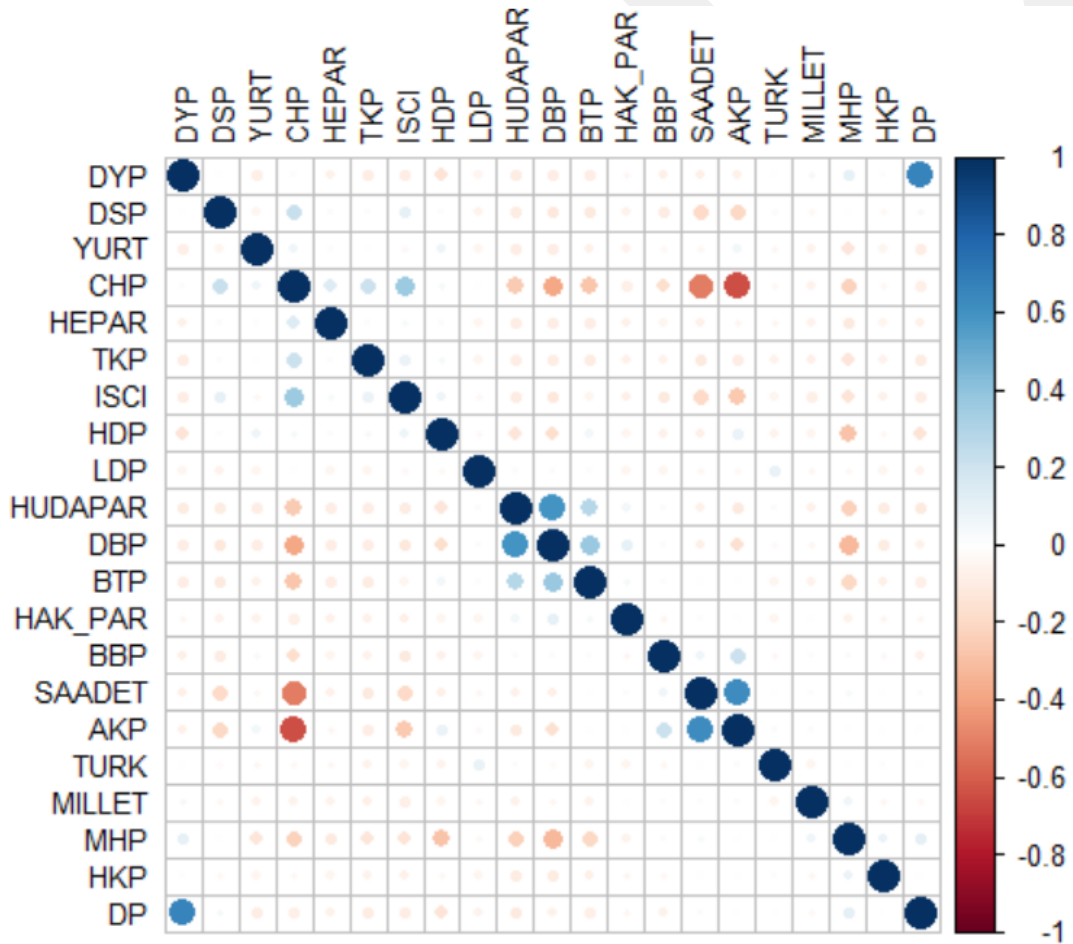


Figure 4.2.4: Correlation Matrix of Parties for 2014 Election

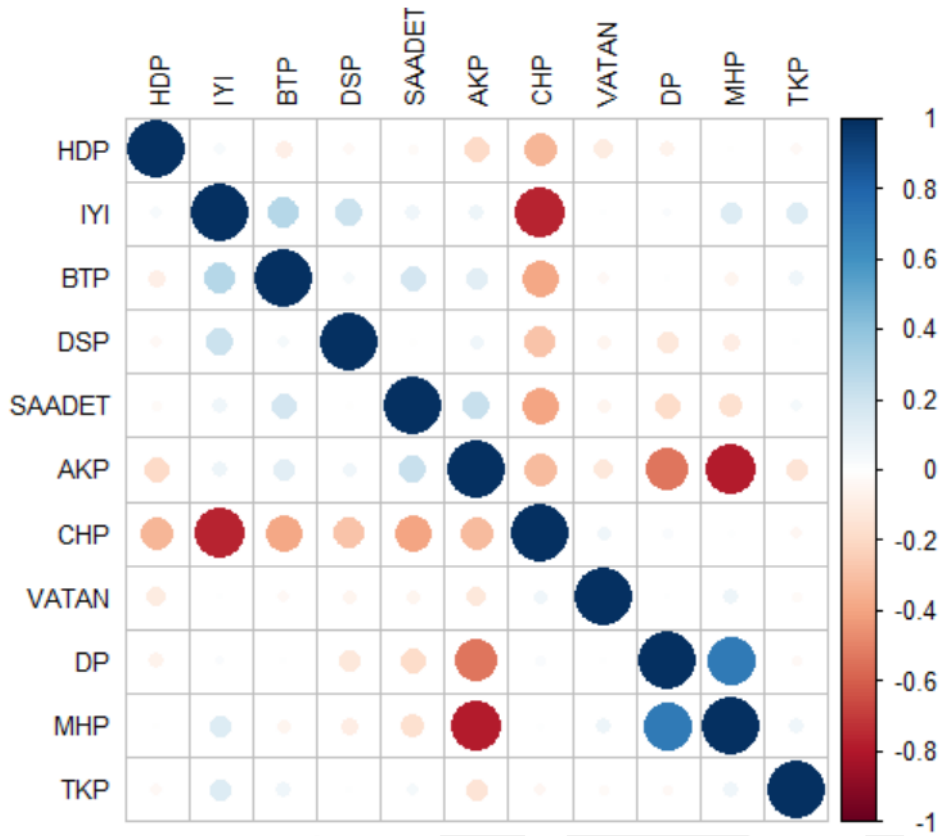


Figure 4.2.5: Correlation Matrix of Parties for 2019 Election

Based on these analyses, collected election data is validated and the vote counts are calculated in the neighborhood level for each metropolitan to infer the vote transition probabilities for each city.

5. METHODOLOGY

Firstly, the vote transition probabilities between 2014 and 2019 elections will be analyzed using the Bayesian and frequentist inference for ecological inference approach proposed by Rosen et al. (2001). Since the vote transition behavior for each metropolitan city is potentially different, this analysis will be conducted for each city separately. In addition, similar analysis will be performed for Istanbul elections to understand the large vote transitions for the re-run election. For the comparison of 2014 and 2019 elections, similar cities in terms of vote transition behavior will be identified using hierarchical clustering after obtaining the probabilities. This section is dedicated to the methodology behind the calculation of vote transition probabilities by Rosen et al. (2001) and the details of the hierarchical clustering.

5.1. Multinomial-Dirichlet (MD) Hierarchical Model

Suppose the vote transition probability estimation between two elections is represented as $R \times C$ table where there are R and C political parties in the first and second elections respectively. This can be illustrated using a simple example for a particular neighborhood i as in Table 5.1.1.

For each neighborhood i in a city, the fractions of the people who turn out to vote for specific parties in the latest election are (T_{1i}, \dots, T_{Ci}) and it is (X_{1i}, \dots, X_{Ri}) for the earlier election. These values are observable where the entries of the Table X $(\beta_{rc}^i, r = 1, \dots, R, c = 1, \dots, C)$, which are the fraction of people voted for party r in the first election, who vote for party/alliance c in the latest one, are unknown.

In the Multinomial-Dirichlet model proposed by Rosen et al. (2001), a hierarchical Bayesian model is fit to infer β_{rc}^i . In the first stage of the approach, the number of people who vote for the different parties (N_{1i}, \dots, N_{Ci}) is assumed to be follow a multinomial distribution with the parameters as follows:

$$(N_{1i}, \dots, N_{Ci}) \sim \text{Multinomial} \left(N_i, \sum_{r=1}^R \beta_{r1}^i X_{ri}, \dots, \sum_{r=1}^R \beta_{rC}^i X_{ri} \right)$$

Here, N_i represent the total number of voters for neighborhood i in the latest election. In the second stage of the hierarchical model, it is assumed that $\beta_r^i = (\beta_{r1}^i, \beta_{r2}^i, \dots, \beta_{rC}^i)$, the

unobserved cell fractions as independent Dirichlet distributions with the parameters as follows:

$$(\beta_{r1}^i, \beta_{r2}^i, \dots, \beta_{rc}^i) \sim \text{Dirichlet}(\alpha_{r1}, \alpha_{r2}, \dots, \alpha_{rc})$$

where α_{rc} are assumed to follow an independently and identically distributed Gamma distribution with parameters λ_1 and λ_2 . In the last stage, α_{rc} are inferred and the resulting values are basically the vote transition behavior in the city level.

	2019 Elections			
	Nation's Alliance	People's Alliance	Others	
AKP	β_{11}^i	β_{12}^i	$1 - \sum_{c=1}^2 \beta_{1c}^i$	X_{1i}
CHP	β_{21}^i	β_{22}^i	$1 - \sum_{c=1}^2 \beta_{2c}^i$	X_{2i}
HDP	β_{31}^i	β_{32}^i	$1 - \sum_{c=1}^2 \beta_{3c}^i$	X_{3i}
MHP	β_{41}^i	β_{42}^i	$1 - \sum_{c=1}^2 \beta_{4c}^i$	X_{4i}
SAADET	β_{51}^i	β_{52}^i	$1 - \sum_{c=1}^2 \beta_{5c}^i$	X_{5i}
Others	β_{61}^i	β_{62}^i	$1 - \sum_{c=1}^2 \beta_{6c}^i$	$1 - \sum_{r=1}^5 X_{ri}$
	T_{1i}	T_{2i}	$1 - \sum_{c=1}^2 T_{ci}$	

Table 5.1.1: Notation for the neighborhood i in a 6×4 table

To summarize, the hierarchical models starts with estimation of neighborhood level vote transition probabilities to infer a city level probabilities using three-stage modeling approach. The inference of these parameters are performed via Markov Chain Monte Carlo (MCMC) methods. During the iterations of MCMC algorithm, α_{rc} and β_{rc}^i values are

sampled given λ_1 and λ_2 values for the Gamma distribution and they are updated using a Bayesian framework during the iterations. There are several methods to assess the convergence of the parameters given a dataset. This study considers the visual inspection of α_{rc} values over the iterations. MCMC algorithm is expected to converge stable values of α_{rc} after some iterations which is also the case in this study with sufficient number of iteration setting. For details of the inference procedure in MCMC algorithm, see Rosen et al. (2001).

5.2. Hierarchical Clustering

Clustering is a well-known unsupervised learning approach in data mining and statistics. The aim is to categorize the observations into a hierarchical set of groups. There are two alternative approaches to perform hierarchical clustering: agglomerative and divisive approach. Agglomerative approach (also known as “bottom up” approach) starts assuming that each observation is a cluster itself and then the pairs of clusters are merged to form larger clusters. On the other hand, divisive (also known as “top down” approach) starts with a single cluster of all observations and splits the clusters to obtain clusters with less number of observations. Agglomerative clustering is more popular in applications because of its less computational cost and simpler strategy. Therefore, this study follows an agglomerative clustering approach to identify the cities that behave similarly in terms of the vote transitions. From this point on, hierarchical clustering will refer to agglomerative clustering in this study. There are few important parameters of hierarchical clustering. These are:

- Distance measure: There are many distance measures defined for the datasets generated from different domains. This study considers the Euclidean distance, which is a popular one, to calculate the dissimilarity between the observations. Euclidean distance falls in the category of Minkowski metric family.
- Linkage: Defines how the distance between clusters will be calculated. Recall that only one pair of clusters are merged in each iteration and the definition of the distance between the clusters with more than one observation should be determined. There are many alternative linkage functions where “complete” linkage is used in this study. Complete linkage considers the distance between the farthest pair of points of each cluster and it is known to be robust to the outliers in the dataset.

The results of hierarchical clustering are usually presented in a tree structure called dendrogram. In Section 6, the results are presented using the dendrogram. Dendrogram depicts the information of the distance between the clusters in a hierarchical (tree-based) structure.

Another important consideration in clustering analysis problems is to determine the number of clusters. There are several approaches to achieve this task and this study considers the silhouette information to determine the number of clusters. Silhouette analysis aims at quantifying if an observation is clustered well. Formally, for each observation i , the silhouette width s_i is calculated as follows:

1. Average dissimilarity to all members of the cluster to which i belongs is calculated as a_i . This can be thought of as a measure of within cluster distance.
2. Average dissimilarity to members of the clusters C , to which i does not belong, is calculated as $d(i, C)$. The minimum of these $d(i, C)$ is denoted as $b_i = \min_C d(i, C)$. This is a pessimistic measure quantifying the dissimilarity of the observation i to the nearest cluster to which it does not belong. It can be thought of as a measure for between cluster distances.
3. Then the silhouette width of the observation i is defined by the formula:
$$S_i = (b_i - a_i) / \max(a_i, b_i).$$

S_i provides insights in to how well an observation i is clustered. Basically, observations with a large S_i can be considered as well-clustered. S_i values close to zero means that observation is between two or more clusters where negative S_i values refer to observations placed in a wrong cluster.

6. COMPUTATIONAL EXPERIMENTS AND RESULTS

The comparative analysis of 2014 and 2019 official Turkish Local Election Results for metropolitans are included comprehensively in Section 6.1. Instead of ballot box level, neighborhood level is taken as the detailed level of comparison because the results are more meaningful for analysis in this aggregate level. Since the neighborhood structure is changed between two elections, the neighborhoods that exist for both 2014 and 2019 elections are taken into consideration. Therefore, the statistics for voters and participants in the study can differ from the whole election statistics. In a separate section 6.2, the official June and unofficial March 2019 Elections of Istanbul is also analyzed.

Vote transition behavior between the elections for each city is computed using the Rosen et al. (2001) implemented in eiPack package (version 0.1-9) of R Software (reference here). As discussed in Section 5, in order to learn the MD model for Ecological Inference, there are certain parameters to be set. Conducting an analysis using the MD model requires two steps. First, parameters used for sampling from the parameter distributions in MCMC algorithm should be tuned. Number of tuning iterations is set to 5 and each tuning is done by using 5000 iterations (namely *ntune* and *totaldraws* argument in the package). The chains are iterated 20000 times. Thinning interval for posterior draws is set to 500 and the number of draws to be saved from the chain is set to 20. These values are determined based on the ranges considered in (“Haziran 2018 Seçim Analizi ve Oy Geçişleri”, 2019). The same parameters are used for all cities for the vote transition calculation between 2014 and 2019 elections. However, number of MCMC iterations is set to 40000 for March and June Istanbul elections after the analysis of the change of the vote transition probabilities over the iterations. The experiments are performed on a Windows Desktop with Intel Xeon E5-1620 v2 processor and 32 GB RAM. Average time for computing the vote transition probabilities for each city has taken approximately 2 days due to the slow implementation of Rosen et al. (2001) in eiPack package. The convergence characteristics of the iterations for each city can be reached through Appendix A.

6.1. Results of Metropolitans

Table 6.1.1 shows the total number of voters, participants and participation rates of two elections for the corresponding neighborhood numbers. Since the neighborhood structure is changed between two elections, the neighborhoods that exist for both 2014 and 2019 elections are taken into consideration. Therefore, the statistics of voters and participants in the table can differ from the whole election statistics.

Metropolitan	Neighborhoods	Voters 2014	Participants 2014	Participation Rate 2014	Voters 2019	Participants 2019	Participation Rate 2019
İSTANBUL	925	9,998,236	8,937,594	89.4%	10,279,828	8,626,307	83.9%
ANKARA	1,191	3,530,941	3,214,774	91.0%	3,862,467	3,307,361	85.6%
İZMİR	1,191	3,019,782	2,728,234	90.3%	3,232,326	2,720,984	84.2%
BURSA	958	1,973,212	1,789,603	90.7%	2,164,834	1,856,615	85.8%
ANTALYA	855	1,507,958	1,355,522	89.9%	1,681,113	1,432,125	85.2%
ADANA	741	1,448,204	1,278,328	88.3%	1,522,353	1,265,617	83.1%
KONYA	1,046	1,260,732	1,135,158	90.0%	1,437,361	1,210,970	84.2%
KOCAELİ	443	1,175,177	1,072,330	91.2%	1,346,531	1,147,404	85.2%
MERSİN	732	1,179,160	1,053,878	89.4%	1,274,095	1,085,499	85.2%
GAZİANTEP	678	1,066,371	912,311	85.6%	1,163,319	914,593	78.6%
MANİSA	901	972,100	904,124	93.0%	1,029,331	908,845	88.3%
HATAY	553	963,130	858,822	89.2%	1,046,580	894,489	85.5%
SAMSUN	1,165	901,557	804,498	89.2%	954,424	822,147	86.1%
ŞANLIURFA	1,093	896,021	775,040	86.5%	991,115	803,096	81.0%
KAYSERİ	660	778,001	705,797	90.7%	925,222	793,434	85.8%
BALIKESİR	979	872,566	795,770	91.2%	884,205	769,022	87.0%
DİYARBAKIR	908	908,421	744,960	82.0%	901,228	709,624	78.7%
AYDIN	608	745,416	676,888	90.8%	813,046	701,119	86.2%
DENİZLİ	562	691,842	640,416	92.6%	746,806	657,853	88.1%
TEKİRDAĞ	328	633,353	574,677	90.7%	735,940	627,160	85.2%
SAKARYA	621	646,930	591,476	91.4%	707,877	612,008	86.5%
KAHRAMANMARAŞ	654	680,771	612,810	90.0%	700,953	609,905	87.0%
MUĞLA	514	622,603	564,318	90.6%	664,940	576,469	86.7%
ESKİŞEHİR	427	594,817	539,047	90.6%	643,215	552,216	85.9%
VAN	656	571,506	467,592	81.8%	638,096	498,809	78.2%
TRABZON	683	551,424	478,027	86.7%	584,587	489,002	83.6%
ORDU	718	535,476	465,266	86.9%	555,737	474,730	85.4%
MALATYA	684	522,729	455,619	87.2%	558,186	461,044	82.6%
ERZURUM	1,104	478,886	412,485	86.1%	492,005	399,446	81.2%
MARDİN	548	413,968	345,153	83.4%	467,210	374,060	80.1%

Table 6.1.1: Total number of participants and voters of each election in metropolitans for the same neighborhoods

6.1.1. City clusters based on the vote transition behavior

Understanding the cities with similar vote transition behavior is essential. Therefore, a clustering analysis is performed on the probabilities. A hierarchical clustering with complete linkage is used to find the cluster of cities. The choice of complete linkage is due to its robustness to outliers. Euclidean distance is used in distance calculations. In order to identify the number of clusters, average silhouette width of the clustering result is taken into consideration and ideal number of clusters is found to be six in the analysis. Figure 6.1.1.1 shows the resulting cluster dendrogram.

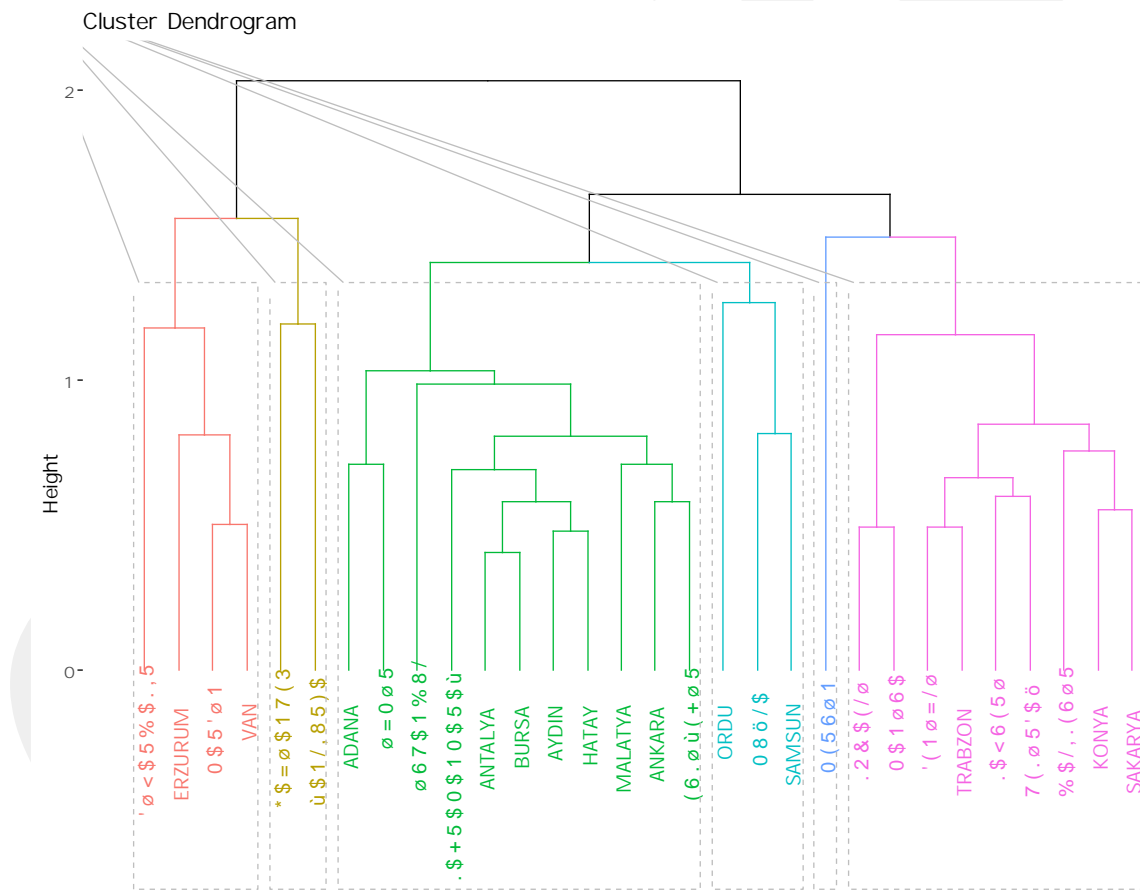


Figure 6.1.1.1. Cluster Dendrogram of the hierarchical clustering

Although dendrogram provides some insights into how well a city fits to its cluster, silhouette information is also provided for each city in Figure 6.1.1.2. In the first cluster, Malatya seems to be farther to the other members of the cluster. The cities in the sixth cluster, namely Ordu, Muğla and Samsun, behave differently within cluster. Negative and small

silhouette widths imply that each city has different vote transition characteristics and their similarities to the cities in the other clusters are not that high. Following subsections discussed the cluster behaviors in details.

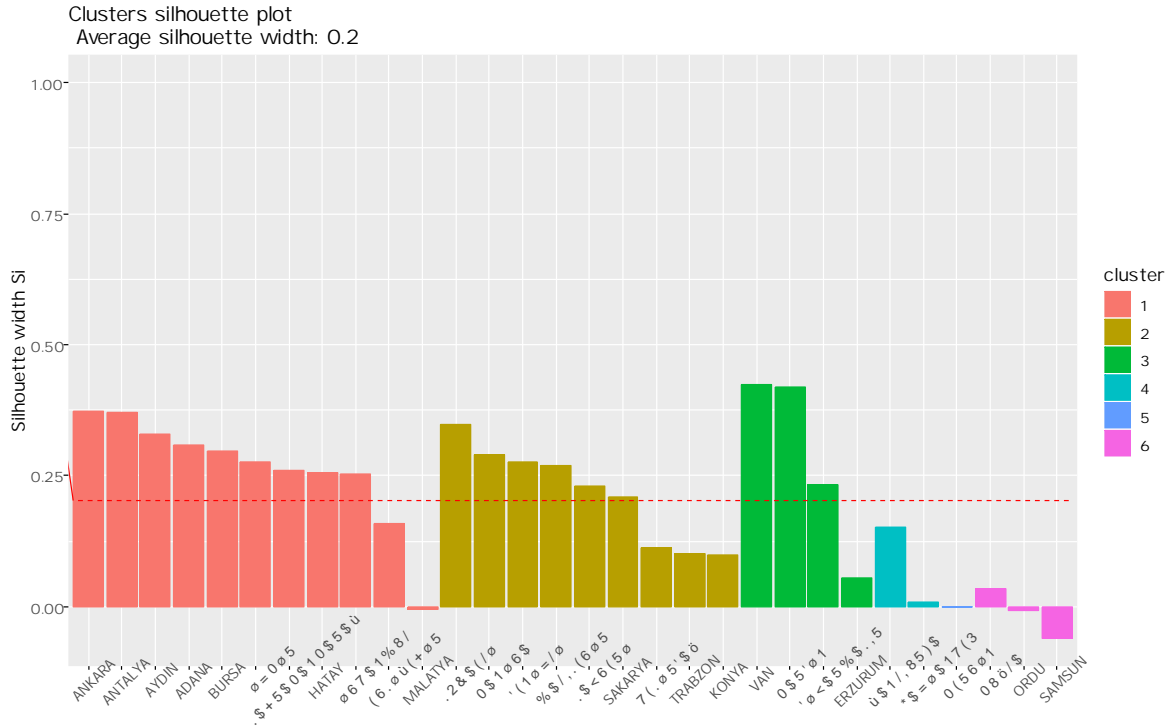


Figure 6.1.1.2. Silhouette Information for each city

6.1.2. Cluster 1 where CHP has increased its vote share over 5%

The common characteristics of Cluster 1 can be interpreted as the metropolitans where CHP has increased its vote share over 5% in 2019 compared to 2014. Table 6.1.2.1 - Table 6.1.2.22 illustrate that the major reason of this increase is as a result of Nation's Alliance. In most of the metropolitans, IYI Party's votes have contributed in favor of CHP as an outcome of the alliance. Vote transition probability tables show that MHP's votes have been distributed between Nation's and People's Alliance due to IYI Party. Another effect is that in some metropolitans CHP has also taken the votes of HDP voters. This effect can be seen on vote transition probability tables of Adana, İstanbul and İzmir.

ANKARA

Election Results	2014	2019
CHP	43.8%	50.9%
AKP	44.8%	47.1%
MHP	7.8%	0.0%
Rest	3.6%	1.9%

Nation`s Alliance		50.9%
People`s Alliance		47.1%

Table 6.1.2.1: Ankara Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.68	0.00	0.00	0.19	0.01	0.07	0.02	0.02
	AKP	0.14	0.00	0.00	0.07	0.00	0.71	0.00	0.01
	CHP	0.07	0.00	0.00	0.86	0.00	0.01	0.00	0.00
	DSP	0.23	0.23	0.01	0.15	0.05	0.17	0.08	0.07
	HDP	0.12	0.01	0.00	0.75	0.01	0.03	0.02	0.04
	MHP	0.01	0.00	0.00	0.30	0.01	0.59	0.01	0.08
	Others	0.04	0.01	0.00	0.07	0.02	0.63	0.04	0.19
	SAADET	0.05	0.02	0.00	0.07	0.03	0.34	0.35	0.12
	Invalid	0.02	0.01	0.00	0.16	0.03	0.54	0.02	0.23

Table 6.1.2.2: Ankara vote transition probabilities from 2014 to 2019

ANTALYA

Election Results	2014	2019
CHP	34.6%	50.6%
AKP	36.4%	46.3%
MHP	24.3%	0.0%
Rest	4.6%	3.1%

Nation`s Alliance		50.6%
People`s Alliance		46.3%

Table 6.1.2.3: Antalya Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.60	0.00	0.00	0.06	0.01	0.31	0.01	0.01
	AKP	0.27	0.02	0.00	0.10	0.01	0.54	0.01	0.01
	CHP	0.03	0.00	0.00	0.90	0.01	0.04	0.00	0.01
	DSP	0.16	0.06	0.01	0.30	0.11	0.22	0.08	0.06
	HDP	0.21	0.01	0.00	0.65	0.02	0.06	0.04	0.02
	MHP	0.01	0.00	0.00	0.41	0.01	0.51	0.01	0.04
	Others	0.02	0.01	0.00	0.19	0.05	0.57	0.01	0.14
	SAADET	0.04	0.01	0.00	0.08	0.04	0.46	0.19	0.17
	Invalid	0.01	0.00	0.00	0.03	0.08	0.58	0.01	0.29

Table 6.1.2.4: Antalya vote transition probabilities from 2014 to 2019

AYDIN

Election Results	2014	2019
CHP	43.8%	53.9%
AKP	29.2%	43.7%
MHP	21.5%	0.0%
Rest	5.5%	2.3%

Nation`s Alliance		53.9%
People`s Alliance		43.7%

Table 6.1.2.5: Aydın Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.57	0.01	0.00	0.36	0.02	0.02	0.01	0.01
	AKP	0.02	0.00	0.00	0.08	0.00	0.87	0.01	0.02
	CHP	0.19	0.01	0.00	0.61	0.00	0.14	0.00	0.01
	DSP	0.22	0.02	0.00	0.43	0.03	0.25	0.01	0.03
	HDP	0.15	0.01	0.00	0.77	0.01	0.01	0.02	0.03
	MHP	0.01	0.00	0.00	0.51	0.01	0.43	0.01	0.03
	Others	0.04	0.01	0.00	0.27	0.04	0.36	0.02	0.25
	SAADET	0.05	0.04	0.01	0.08	0.08	0.33	0.13	0.27
	Invalid	0.01	0.01	0.00	0.42	0.02	0.22	0.01	0.30

Table 6.1.2.6: Aydın vote transition probabilities from 2014 to 2019

ADANA

Election Results	2014	2019
CHP	24.8%	53.7%
MHP	33.5%	42.8%
AKP	31.9%	0.0%
HDP	7.3%	0.0%
Rest	2.4%	3.5%

Nation`s Alliance		53.7%
People`s Alliance		42.8%

Table 6.1.2.7: Adana Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADDET	Invalid
2014	Absent	0.61	0.01	0.00	0.29	0.01	0.04	0.01	0.04
	AKP	0.17	0.00	0.00	0.13	0.01	0.60	0.01	0.04
	CHP	0.05	0.00	0.00	0.92	0.00	0.01	0.01	0.00
	DSP	0.03	0.02	0.01	0.59	0.02	0.24	0.02	0.05
	HDP	0.09	0.01	0.00	0.86	0.01	0.01	0.01	0.02
	MHP	0.13	0.00	0.00	0.30	0.00	0.48	0.02	0.01
	Others	0.04	0.01	0.00	0.03	0.02	0.81	0.01	0.07
	SAADDET	0.03	0.03	0.00	0.12	0.10	0.22	0.32	0.18
	Invalid	0.02	0.01	0.00	0.07	0.07	0.40	0.01	0.42

Table 6.1.2.8: Adana vote transition probabilities from 2014 to 2019

BURSA

Election Results	2014	2019
AKP	49.5%	49.6%
CHP	28.7%	47.0%
MHP	15.4%	0.0%
Rest	6.4%	3.3%

People`s Alliance		49.6%
Nation`s Alliance		47.0%

Table 6.1.2.9: Bursa Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.73	0.00	0.00	0.06	0.00	0.17	0.02	0.01
	AKP	0.13	0.00	0.00	0.12	0.01	0.66	0.01	0.01
	CHP	0.04	0.00	0.00	0.93	0.00	0.01	0.00	0.00
	DSP	0.10	0.10	0.01	0.43	0.11	0.13	0.06	0.07
	HDP	0.09	0.01	0.00	0.65	0.01	0.07	0.03	0.13
	MHP	0.01	0.00	0.00	0.48	0.01	0.42	0.01	0.06
	Others	0.02	0.01	0.00	0.27	0.21	0.32	0.02	0.14
	SAADET	0.02	0.01	0.00	0.04	0.02	0.57	0.21	0.12
	Invalid	0.01	0.01	0.00	0.02	0.03	0.71	0.02	0.20

Table 6.1.2.10: Bursa vote transition probabilities from 2014 to 2019

İZMİR

Election Results	2014	2019
CHP	49.6%	58.1%
AKP	35.9%	38.7%
MHP	8.0%	0.0%
HDP	3.4%	0.0%
Rest	3.1%	3.2%

Nation`s Alliance		58.1%
People`s Alliance		38.7%

Table 6.1.2.11: İzmir Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.81	0.01	0.00	0.08	0.04	0.02	0.03	0.01
	AKP	0.17	0.01	0.00	0.11	0.00	0.65	0.01	0.01
	CHP	0.04	0.00	0.00	0.89	0.00	0.04	0.00	0.00
	DSP	0.03	0.02	0.00	0.71	0.05	0.14	0.01	0.05
	HDP	0.07	0.00	0.00	0.77	0.01	0.09	0.01	0.04
	MHP	0.00	0.01	0.00	0.05	0.02	0.85	0.01	0.06
	Others	0.02	0.01	0.00	0.25	0.09	0.48	0.01	0.14
	SAADET	0.04	0.05	0.00	0.05	0.03	0.44	0.13	0.25
	Invalid	0.01	0.01	0.00	0.03	0.02	0.67	0.01	0.27

Table 6.1.2.12: İzmir vote transition probabilities from 2014 to 2019

KAHRAMANMARAŞ

Election Results	2014	2019
AKP	58.8%	67.6%
CHP	6.3%	27.3%
MHP	30.5%	0.0%
Rest	4.4%	5.1%

People`s Alliance	67.6%
Nation`s Alliance	27.3%

Table 6.1.2.13: Kahramanmaraş Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.54	0.01	0.00	0.36	0.01	0.02	0.02	0.02
	AKP	0.05	0.01	0.00	0.03	0.01	0.81	0.01	0.02
	CHP	0.05	0.08	0.00	0.63	0.01	0.03	0.01	0.02
	DSP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HDP	0.09	0.01	0.00	0.85	0.01	0.01	0.01	0.01
	MHP	0.14	0.01	0.00	0.37	0.01	0.35	0.01	0.02
	Others	0.05	0.01	0.00	0.09	0.09	0.40	0.06	0.28
	SAADET	0.03	0.01	0.00	0.07	0.09	0.51	0.14	0.15
	Invalid	0.08	0.01	0.00	0.20	0.04	0.20	0.03	0.45

Table 6.1.2.14: Kahramanmaraş vote transition probabilities from 2014 to 2019

HATAY

Election Results	2014	2019
CHP	41.0%	55.2%
AKP	40.4%	42.8%
MHP	15.4%	0.0%
Rest	3.1%	2.0%

Nation`s Alliance	55.2%
People`s Alliance	42.8%

Table 6.1.2.15: Hatay Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.63	0.00	0.00	0.32	0.00	0.01	0.00	0.03
	AKP	0.06	0.00	0.00	0.07	0.00	0.80	0.01	0.01
	CHP	0.10	0.01	0.00	0.83	0.00	0.01	0.00	0.00
	DSP	0.31	0.09	0.01	0.26	0.06	0.13	0.02	0.10
	HDP	0.28	0.01	0.00	0.60	0.04	0.02	0.01	0.04
	MHP	0.03	0.00	0.00	0.51	0.00	0.44	0.01	0.01
	Others	0.09	0.02	0.00	0.31	0.04	0.34	0.02	0.17
	SAADET	0.05	0.01	0.00	0.33	0.01	0.35	0.20	0.04
	Invalid	0.03	0.01	0.00	0.31	0.02	0.25	0.01	0.38

Table 6.1.2.16: Hatay vote transition probabilities from 2014 to 2019

İSTANBUL

Election Results	2014	2019
CHP	40.1%	48.8%
AKP	48.0%	48.6%
HDP	4.8%	0.0%
MHP	4.0%	0.0%
Rest	3.1%	2.6%
Nation`s Alliance		48.8%
People`s Alliance		48.6%

Table 6.1.2.17: İstanbul Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.85	0.00	0.00	0.10	0.00	0.01	0.01	0.01
	AKP	0.12	0.00	0.00	0.03	0.00	0.80	0.00	0.01
	CHP	0.04	0.00	0.00	0.88	0.00	0.01	0.00	0.01
	DSP	0.15	0.31	0.00	0.10	0.11	0.07	0.07	0.18
	HDP	0.05	0.00	0.00	0.86	0.01	0.01	0.01	0.05
	MHP	0.01	0.00	0.00	0.11	0.05	0.65	0.02	0.17
	Others	0.07	0.03	0.00	0.42	0.14	0.20	0.01	0.14
	SAADET	0.04	0.02	0.00	0.11	0.05	0.06	0.47	0.24
	Invalid	0.02	0.00	0.00	0.24	0.04	0.45	0.00	0.24

Table 6.1.2.18: İstanbul vote transition probabilities from 2014 to 2019

ESKİŞEHİR

Election Results	2014	2019
CHP	45.2%	52.3%
AKP	39.1%	45.1%
MHP	11.2%	0.0%
Rest	4.5%	2.6%

Nation`s Alliance		52.3%
People`s Alliance		45.1%

Table 6.1.2.19: Eskişehir Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.55	0.01	0.00	0.20	0.01	0.20	0.02	0.01
	AKP	0.10	0.00	0.00	0.09	0.00	0.74	0.01	0.01
	CHP	0.13	0.00	0.00	0.81	0.00	0.02	0.00	0.01
	DSP	0.18	0.06	0.01	0.11	0.04	0.46	0.07	0.05
	HDP	0.06	0.02	0.00	0.51	0.05	0.15	0.06	0.14
	MHP	0.05	0.01	0.00	0.46	0.01	0.41	0.01	0.04
	Others	0.07	0.01	0.00	0.15	0.03	0.58	0.01	0.14
	SAADET	0.19	0.04	0.00	0.12	0.04	0.23	0.10	0.27
	Invalid	0.01	0.01	0.00	0.04	0.02	0.71	0.02	0.18

Table 6.1.2.20: Eskişehir vote transition probabilities from 2014 to 2019

MALATYA

Election Results	2014	2019
AKP	61.6%	68.5%
CHP	17.8%	23.2%
SAADET	9.9%	5.3%
MHP	7.7%	0.0%
Rest	3.1%	3.0%

People`s Alliance		68.5%
Nation`s Alliance		23.2%

Table 6.1.2.21: Malatya Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.61	0.00	0.01	0.02	0.01	0.23	0.03	0.03
	AKP	0.11	0.00	0.00	0.03	0.01	0.74	0.03	0.01
	CHP	0.05	0.01	0.01	0.85	0.01	0.02	0.01	0.01
	DSP	0.19	0.04	0.05	0.15	0.15	0.16	0.13	0.12
	HDP	0.11	0.01	0.33	0.43	0.03	0.02	0.02	0.03
	MHP	0.04	0.00	0.00	0.29	0.01	0.59	0.01	0.04
	Others	0.17	0.01	0.01	0.10	0.07	0.44	0.04	0.16
	SAADET	0.06	0.00	0.01	0.01	0.01	0.61	0.21	0.07
	Invalid	0.38	0.01	0.01	0.08	0.02	0.23	0.02	0.26

Table 6.1.2.22: Malatya vote transition probabilities from 2014 to 2019

6.1.3. Cluster 2 where IYI Party has vote rating over 20% in 2019

Cluster 2 is the cluster where IYI Party has vote rating over 20% in 2019 Elections. Table 6.1.3.1 - Table 6.1.3.16 show that IYI Party's vote ratings are higher than MHP vote ratings in 2014 as a result of Nation's Alliance except Manisa. In most of the metropolitans, CHP's votes have contributed in favor of IYI Party as an outcome of the alliance. Vote transition probability tables demonstrate that MHP's votes have been distributed between Nation's and People's Alliance due to the effect of IYI Party. In cluster 2, this distribution is majorly in favor of Nation's Alliance. Tables 6.1.3.17 and 6.1.3.18 illustrates that the only exception in cluster 2 is Tekirdağ. Nation's Alliance has entered to Tekirdağ 2019 Elections only with CHP. As shown in 6.1.3.18, the reason why Tekirdağ is included in cluster 2 could be that 62% of 2014 MHP votes is estimated to contribute to Nation's Alliance in 2019. Considering CHP's 2019 vote share increase by 5.5% versus 2014, Tekirdağ is also suitable for cluster 1. However, MHP vote distribution effect seems to dominate CHP's vote share increase.

KOCAELİ

Election Results	2014	2019
AKP	50.6%	55.6%
IYI	0.0%	32.7%
SAADET	5.0%	5.0%
CHP	26.2%	0.0%
MHP	14.0%	0.0%
Rest	4.2%	6.7%

People`s Alliance		55.6%
Nation`s Alliance		32.7%

Table 6.1.3.1: Kocaeli Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.77	0.01	0.01	0.03	0.04	0.04	0.05	0.04
	AKP	0.11	0.01	0.02	0.03	0.01	0.79	0.02	0.01
	CHP	0.10	0.01	0.02	0.78	0.01	0.02	0.03	0.01
	DSP	0.11	0.12	0.08	0.14	0.17	0.16	0.16	0.07
	HDP	0.05	0.02	0.78	0.02	0.02	0.02	0.02	0.06
	MHP	0.01	0.01	0.01	0.55	0.01	0.37	0.02	0.03
	Others	0.02	0.02	0.01	0.10	0.12	0.32	0.04	0.35
	SAADET	0.03	0.02	0.01	0.02	0.04	0.46	0.33	0.09
Invalid	0.02	0.01	0.01	0.05	0.06	0.44	0.02	0.39	

Table 6.1.3.2: Kocaeli vote transition probabilities from 2014 to 2019

DENİZLİ

Election Results	2014	2019
AKP	45.2%	50.6%
IYI	0.0%	43.9%
CHP	38.8%	0.0%
MHP	11.8%	0.0%
Rest	4.2%	5.5%

People`s Alliance		50.6%
Nation`s Alliance		43.9%

Table 6.1.3.3: Denizli Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.65	0.01	0.01	0.23	0.03	0.05	0.01	0.01
	AKP	0.07	0.00	0.01	0.05	0.01	0.82	0.00	0.01
	CHP	0.09	0.01	0.01	0.79	0.01	0.06	0.00	0.01
	DSP	0.09	0.11	0.08	0.16	0.16	0.15	0.07	0.15
	HDP	0.26	0.03	0.33	0.12	0.04	0.06	0.04	0.10
	MHP	0.03	0.01	0.00	0.46	0.02	0.39	0.01	0.08
	Others	0.03	0.01	0.01	0.04	0.27	0.48	0.01	0.14
	SAADET	0.13	0.09	0.04	0.11	0.13	0.15	0.22	0.13
	Invalid	0.01	0.01	0.01	0.07	0.05	0.47	0.01	0.36

Table 6.1.3.4: Denizli vote transition probabilities from 2014 to 2019

MANİSA

Election Results	2014	2019
MHP	40.1%	52.8%
IYI	0.0%	38.1%
HDP	2.5%	4.3%
AKP	36.7%	0.0%
CHP	18.3%	0.0%
Rest	2.4%	4.8%

People`s Alliance		52.8%
Nation`s Alliance		38.1%

Table 6.1.3.5: Manisa Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.72	0.01	0.01	0.13	0.04	0.05	0.01	0.03
	AKP	0.04	0.00	0.03	0.10	0.02	0.72	0.01	0.06
	CHP	0.04	0.01	0.01	0.79	0.01	0.10	0.00	0.03
	DSP	0.08	0.12	0.08	0.07	0.28	0.14	0.16	0.06
	HDP	0.05	0.01	0.86	0.02	0.01	0.01	0.01	0.02
	MHP	0.09	0.00	0.01	0.35	0.01	0.47	0.01	0.02
	Others	0.03	0.03	0.02	0.08	0.29	0.15	0.06	0.33
	SAADET	0.05	0.02	0.02	0.11	0.17	0.21	0.31	0.11
	Invalid	0.01	0.01	0.01	0.05	0.09	0.34	0.02	0.47

Table 6.1.3.6: Manisa vote transition probabilities from 2014 to 2019

BALIKESİR

Election Results	2014	2019
AKP	39.7%	47.8%
IYI	0.0%	46.5%
MHP	31.6%	0.0%
CHP	25.3%	0.0%
Rest	3.3%	5.7%

People`s Alliance		47.8%
Nation`s Alliance		46.5%

Table 6.1.3.7: Balıkesir Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.65	0.01	0.01	0.14	0.03	0.08	0.01	0.02
	AKP	0.08	0.00	0.01	0.05	0.01	0.74	0.01	0.01
	CHP	0.09	0.01	0.01	0.72	0.02	0.03	0.01	0.02
	DSP	0.04	0.06	0.04	0.10	0.46	0.10	0.02	0.18
	HDP	0.15	0.02	0.22	0.08	0.14	0.29	0.04	0.05
	MHP	0.05	0.00	0.00	0.59	0.01	0.30	0.01	0.02
	Others	0.02	0.02	0.01	0.05	0.05	0.58	0.04	0.23
	SAADET	0.06	0.01	0.01	0.30	0.01	0.51	0.04	0.06
Invalid	0.01	0.01	0.01	0.05	0.07	0.52	0.01	0.31	

Table 6.1.3.8: Balıkesir vote transition probabilities from 2014 to 2019

KAYSERİ

Election Results	2014	2019
AKP	58.9%	63.4%
IYI	0.0%	31.5%
MHP	27.0%	0.0%
CHP	8.9%	0.0%
Rest	5.2%	5.1%

People`s Alliance		63.4%
Nation`s Alliance		31.5%

Table 6.1.3.9: Kayseri Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.58	0.01	0.01	0.08	0.03	0.20	0.03	0.06
	AKP	0.09	0.00	0.00	0.05	0.00	0.77	0.02	0.01
	CHP	0.06	0.01	0.01	0.84	0.03	0.01	0.02	0.03
	DSP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HDP	0.29	0.04	0.22	0.16	0.09	0.08	0.08	0.05
	MHP	0.08	0.00	0.00	0.57	0.01	0.27	0.02	0.02
	Others	0.03	0.01	0.01	0.23	0.03	0.45	0.01	0.21
	SAADET	0.06	0.01	0.01	0.03	0.02	0.45	0.34	0.08
	Invalid	0.05	0.01	0.01	0.02	0.03	0.59	0.01	0.28

Table 6.1.3.10: Kayseri vote transition probabilities from 2014 to 2019

SAKARYA

Election Results	2014	2019
AKP	57.9%	65.0%
IYI	0.0%	27.6%
SAADET	3.1%	3.9%
MHP	26.8%	0.0%
CHP	9.2%	0.0%
Rest	3.0%	3.4%

People`s Alliance		65.0%
Nation`s Alliance		27.6%

Table 6.1.3.11: Sakarya Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.63	0.01	0.01	0.05	0.04	0.20	0.04	0.03
	AKP	0.12	0.00	0.01	0.11	0.01	0.68	0.03	0.01
	CHP	0.03	0.01	0.01	0.60	0.02	0.25	0.04	0.05
	DSP	0.20	0.11	0.04	0.15	0.16	0.19	0.05	0.07
	HDP	0.09	0.04	0.26	0.17	0.06	0.12	0.12	0.14
	MHP	0.09	0.00	0.01	0.48	0.01	0.36	0.01	0.03
	Others	0.06	0.01	0.01	0.04	0.09	0.54	0.11	0.13
	SAADET	0.03	0.01	0.01	0.04	0.03	0.75	0.06	0.08
	Invalid	0.04	0.01	0.01	0.04	0.05	0.48	0.02	0.36

Table 6.1.3.12: Sakarya vote transition probabilities from 2014 to 2019

TRABZON

Election Results	2014	2019
AKP	59.4%	64.6%
IYI	0.0%	29.5%
CHP	24.9%	0.0%
MHP	11.1%	0.0%
Rest	4.6%	5.9%

People`s Alliance		64.6%
Nation`s Alliance		29.5%

Table 6.1.3.13: Trabzon Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.43	0.00	0.00	0.01	0.02	0.49	0.01	0.03
	AKP	0.13	0.00	0.00	0.05	0.01	0.67	0.02	0.01
	CHP	0.12	0.00	0.00	0.76	0.01	0.04	0.01	0.02
	DSP	0.16	0.10	0.02	0.11	0.11	0.18	0.09	0.20
	HDP	0.13	0.07	0.02	0.18	0.23	0.11	0.13	0.13
	MHP	0.07	0.01	0.00	0.40	0.03	0.39	0.02	0.07
	Others	0.12	0.01	0.00	0.07	0.15	0.48	0.03	0.12
	SAADET	0.36	0.01	0.00	0.02	0.06	0.17	0.33	0.05
Invalid	0.05	0.01	0.00	0.05	0.03	0.52	0.02	0.31	

Table 6.1.3.14: Trabzon vote transition probabilities from 2014 to 2019

KONYA

Election Results	2014	2019
AKP	64.3%	70.5%
IYI	0.0%	20.2%
SAADET	7.5%	4.1%
MHP	18.5%	0.0%
CHP	5.7%	0.0%
Rest	4.1%	5.2%

People`s Alliance		70.5%
Nation`s Alliance		20.2%

Table 6.1.3.15: Konya Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.63	0.01	0.01	0.01	0.02	0.27	0.03	0.02
	AKP	0.14	0.00	0.02	0.05	0.01	0.70	0.01	0.01
	CHP	0.06	0.02	0.01	0.66	0.03	0.14	0.02	0.06
	DSP	0.11	0.16	0.08	0.18	0.12	0.10	0.08	0.16
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.03	0.01	0.01	0.55	0.03	0.25	0.03	0.07
	Others	0.26	0.02	0.18	0.04	0.03	0.25	0.12	0.09
	SAADET	0.01	0.01	0.01	0.07	0.03	0.72	0.11	0.04
	Invalid	0.01	0.01	0.01	0.03	0.08	0.47	0.01	0.38

Table 6.1.3.16: Konya vote transition probabilities from 2014 to 2019

TEKİRDAĞ

Election Results	2014	2019
CHP	45.8%	51.2%
AKP	37.1%	43.8%
MHP	12.7%	0.0%
Rest	4.4%	5.0%

Nation`s Alliance		51.2%
People`s Alliance		43.8%

Table 6.1.3.17: Tekirdağ Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.63	0.01	0.01	0.16	0.02	0.14	0.01	0.03
	AKP	0.09	0.01	0.01	0.03	0.00	0.81	0.01	0.01
	CHP	0.07	0.01	0.01	0.79	0.00	0.06	0.00	0.01
	DSP	0.21	0.22	0.05	0.13	0.13	0.12	0.04	0.12
	HDP	0.16	0.03	0.19	0.31	0.02	0.15	0.04	0.08
	MHP	0.02	0.01	0.00	0.62	0.01	0.31	0.01	0.01
	Others	0.06	0.01	0.01	0.36	0.07	0.23	0.01	0.23
	SAADET	0.14	0.04	0.02	0.20	0.11	0.23	0.11	0.14
	Invalid	0.05	0.01	0.01	0.23	0.04	0.41	0.02	0.23

Table 6.1.3.18: Tekirdağ vote transition probabilities from 2014 to 2019

6.1.4. Cluster 3 where HDP is the leading party in 2019 Elections

Cluster 3 results can be interpreted as the cluster where HDP is leading party followed by AKP in 2019 Elections. Considering the Tables 6.1.4.1 – 6.1.4.6, another common characteristic for this cluster seems to be that Nation`s Alliance has only taken maximum 3% of the votes. Tables 6.1.4.7 and 6.1.4.8 demonstrate that the only exception in

cluster 3 is Erzurum. In Figure 6.1.1.2., Erzurum seems to be farther to the other members of the cluster 3 which can be concluded as an outlier.

DİYARBAKIR

Election Results	2014	2019
HDP	0.0%	62.9%
AKP	35.0%	31.0%
BDP	55.1%	0.0%
HUDAPAR	4.6%	0.0%
Rest	5.3%	6.1%

People`s Alliance		31.0%
Nation`s Alliance		1.8%

Table 6.1.4.1: Diyarbakir Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.45	0.00	0.33	0.01	0.01	0.14	0.01	0.05
	AKP	0.22	0.01	0.09	0.01	0.01	0.43	0.01	0.03
	CHP	0.09	0.02	0.04	0.07	0.02	0.49	0.20	0.04
	DSP	0.06	0.06	0.09	0.09	0.20	0.18	0.11	0.18
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.22	0.02	0.05	0.06	0.05	0.48	0.03	0.08
	Others	0.09	0.00	0.63	0.01	0.01	0.06	0.01	0.01
	SAADET	0.09	0.02	0.37	0.04	0.06	0.21	0.10	0.10
	Invalid	0.02	0.01	0.10	0.04	0.02	0.45	0.01	0.34

Table 6.1.4.2: Diyarbakir vote transition probabilities from 2014 to 2019

MARDİN

Election Results	2014	2019
HDP	0.0%	56.2%
AKP	37.4%	38.5%
CHP	0.9%	1.8%
SAADET	2.6%	1.1%
IYI	0.0%	1.1%
Independent	52.2%	0.3%
HUDAPAR	2.3%	0.0%
Rest	4.7%	0.8%

People`s Alliance		38.5%
Nation`s Alliance		2.9%

Table 6.1.4.3: Mardin Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.54	0.00	0.12	0.02	0.01	0.21	0.01	0.07
	AKP	0.19	0.00	0.12	0.02	0.01	0.56	0.01	0.03
	CHP	0.31	0.01	0.04	0.33	0.04	0.15	0.03	0.08
	DSP	0.07	0.13	0.16	0.08	0.17	0.13	0.11	0.10
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.13	0.02	0.22	0.16	0.08	0.15	0.03	0.20
	Others	0.07	0.00	0.73	0.01	0.00	0.09	0.01	0.02
	SAADET	0.07	0.01	0.02	0.02	0.04	0.64	0.05	0.17
	Invalid	0.12	0.01	0.30	0.09	0.02	0.31	0.01	0.14

Table 6.1.4.4: Mardin vote transition probabilities from 2014 to 2019

VAN

Election Results	2014	2019
HDP	0.0%	53.9%
AKP	41.2%	40.5%
CHP	0.8%	1.9%
SAADET	1.3%	1.9%
IYI	0.0%	1.1%
BDP	53.2%	0.0%
Rest	3.5%	0.8%

People`s Alliance		40.5%
Nation`s Alliance		3.0%

Table 6.1.4.5: Van Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.41	0.00	0.39	0.03	0.00	0.09	0.01	0.06
	AKP	0.19	0.00	0.05	0.01	0.00	0.69	0.01	0.01
	CHP	0.33	0.02	0.15	0.13	0.03	0.17	0.08	0.08
	DSP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.23	0.02	0.05	0.27	0.03	0.27	0.06	0.07
	Others	0.14	0.00	0.68	0.01	0.00	0.09	0.02	0.01
	SAADET	0.18	0.01	0.02	0.03	0.02	0.69	0.01	0.03
	Invalid	0.11	0.01	0.11	0.11	0.01	0.18	0.02	0.44

Table 6.1.4.6: Van vote transition probabilities from 2014 to 2019

ERZURUM

Election Results	2014	2019
AKP	58.8%	62.8%
IYI	0.0%	25.4%
HDP	0.0%	6.0%
CHP	1.6%	2.4%
MHP	28.9%	0.0%
BDP	6.2%	0.0%
Rest	4.4%	3.3%

People`s Alliance		62.8%
Nation`s Alliance		27.9%

Table 6.1.4.7: Erzurum Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.60	0.00	0.01	0.04	0.01	0.27	0.01	0.07
	AKP	0.15	0.00	0.01	0.14	0.00	0.58	0.02	0.02
	CHP	0.07	0.01	0.02	0.78	0.01	0.03	0.01	0.04
	DSP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.06	0.00	0.00	0.45	0.01	0.40	0.02	0.03
	Others	0.11	0.01	0.53	0.17	0.01	0.05	0.03	0.05
	SAADET	0.09	0.01	0.01	0.20	0.01	0.58	0.02	0.07
	Invalid	0.05	0.01	0.01	0.13	0.01	0.54	0.01	0.24

Table 6.1.4.8: Erzurum vote transition probabilities from 2014 to 2019

6.1.5. Cluster 4 where unique vote transitions exist between 2014 and 2019

Şanlıurfa and Gaziantep which are included in cluster 4 have unique vote transitions between 2014 and 2019 compared to other metropolitans. With assumption of AKP's voter structure remained the same between 2014 and 2019, Table 6.1.5.1 illustrates that BDP's votes have been transferred to Saadet Party in 2019 in Şanlıurfa. Tables 6.1.5.3 and 6.1.5.4 show that majority of the votes of CHP and BDP have been transferred to DSP in 2019 in Gaziantep. In vote transition probabilities tables, BDP is included within Others in 2014.

ŞANLIURFA

Election Results	2014	2019
AKP	61.6%	60.8%
SAADET	2.3%	36.3%
BDP	30.5%	0.0%
Rest	5.6%	2.8%

People`s Alliance		60.8%
Nation`s Alliance		0.0%

Table 6.1.5.1: Şanlıurfa Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.36	0.01	0.00	0.00	0.03	0.41	0.11	0.07
	AKP	0.19	0.00	0.00	0.00	0.01	0.53	0.14	0.02
	CHP	0.03	0.02	0.00	0.00	0.03	0.61	0.26	0.03
	DSP	0.19	0.08	0.02	0.02	0.19	0.12	0.13	0.24
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.01	0.01	0.00	0.00	0.01	0.93	0.03	0.01
	Others	0.14	0.01	0.00	0.00	0.02	0.08	0.66	0.04
	SAADET	0.06	0.01	0.00	0.00	0.01	0.83	0.08	0.01
	Invalid	0.04	0.02	0.00	0.00	0.04	0.67	0.03	0.19

Table 6.1.5.2: Şanlıurfa vote transition probabilities from 2014 to 2019

GAZIANTEP

Election Results	2014	2019
AKP	54.6%	54.0%
DSP	0.1%	26.2%
IYI	0.0%	16.4%
CHP	21.5%	0.0%
MHP	11.9%	0.0%
BDP	6.2%	0.0%
Rest	5.7%	3.4%

People`s Alliance		54.0%
Nation`s Alliance		16.4%

Table 6.1.5.3: Gaziantep Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.39	0.11	0.00	0.08	0.01	0.31	0.02	0.07
	AKP	0.29	0.10	0.00	0.06	0.00	0.41	0.01	0.01
	CHP	0.06	0.46	0.00	0.23	0.01	0.17	0.01	0.02
	DSP	0.13	0.06	0.01	0.12	0.18	0.29	0.07	0.12
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.02	0.01	0.00	0.25	0.01	0.66	0.01	0.05
	Others	0.14	0.50	0.00	0.04	0.01	0.21	0.03	0.05
	SAADET	0.03	0.03	0.00	0.12	0.01	0.73	0.03	0.04
	Invalid	0.04	0.01	0.00	0.10	0.06	0.49	0.04	0.26

Table 6.1.5.4: Gaziantep vote transition probabilities from 2014 to 2019

6.1.6. Cluster 5 which is solely Mersin

Cluster 5 only includes Mersin majorly due to complicated vote transition nature of Mersin compared to other metropolitans. Table 6.1.6.1 and 6.1.6.2 show 2014 & 2019 election results and vote transition probabilities from 2014 to 2019 elections, respectively. 31% of Absent, 13% of AKP, 87% of CHP, %11 of DSP and %84 of Others (majorly BDP) in 2014 is estimated to vote for Nation`s Alliance in 2019. On the other hand, 45% of AKP, 18% of DSP, 70% of MHP, %16 of Saadet and %48 of Invalid votes in 2014 is estimated to contribute to People`s Alliance. The probability of 22% of AKP voters in 2014 is estimated to be absent in 2019 elections is noteworthy. Considering CHP`s 2019 vote share increase by 16.8% versus 2014, Mersin can also be considered as suitable for cluster 1.

MERSİN

Election Results	2014	2019
CHP	28.3%	45.1%
MHP	31.9%	41.0%
DP	0.3%	12.0%
AKP	28.0%	0.0%
BDP	9.7%	0.0%
Rest	1.8%	1.9%

Nation`s Alliance	45.1%
People`s Alliance	41.0%

Table 6.1.6.1: Mersin Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.64	0.00	0.00	0.31	0.01	0.02	0.01	0.01
	AKP	0.22	0.00	0.00	0.13	0.11	0.45	0.01	0.02
	CHP	0.06	0.00	0.00	0.87	0.02	0.02	0.00	0.01
	DSP	0.13	0.22	0.01	0.11	0.14	0.18	0.13	0.07
	HDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MHP	0.01	0.00	0.00	0.03	0.24	0.70	0.00	0.02
	Others	0.10	0.00	0.00	0.84	0.00	0.01	0.01	0.03
	SAADET	0.14	0.03	0.00	0.04	0.38	0.16	0.08	0.15
	Invalid	0.05	0.01	0.00	0.03	0.06	0.48	0.01	0.35

Table 6.1.6.2: Mersin vote transition probabilities from 2014 to 2019

6.1.7. Cluster 6 where independent votes are over 20% in 2019 Elections

Cluster 6 is the cluster where independent votes have rating over 20% in 2019 Elections. Table 6.1.7.1 - Table 6.1.7.4 show that Muğla and Samsun have considerable amount of independent votes in 2019. Tables 6.1.7.5 and 6.1.7.6 illustrate that unlike Muğla and Samsun, Ordu has vote transition towards Saadet instead of independents in 2019. Ordu could also be suitable for cluster 4 where unique vote transitions exist between 2014 and 2019.

MUĞLA

Election Results	2014	2019
CHP	49.1%	36.0%
AKP	29.0%	28.4%
Independent	0.0%	26.7%
MHP	18.0%	0.0%
Rest	3.9%	8.9%

Nation`s Alliance		36.0%
People`s Alliance		28.4%

Table 6.1.7.1: Muğla Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.76	0.01	0.00	0.14	0.04	0.02	0.01	0.01
	AKP	0.04	0.01	0.00	0.03	0.23	0.63	0.00	0.03
	CHP	0.06	0.01	0.00	0.51	0.28	0.05	0.00	0.01
	DSP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	HDP	0.37	0.02	0.00	0.46	0.04	0.06	0.02	0.02
	MHP	0.02	0.01	0.00	0.22	0.41	0.27	0.01	0.04
	Others	0.02	0.01	0.00	0.06	0.48	0.32	0.02	0.08
	SAADET	0.07	0.12	0.01	0.11	0.12	0.18	0.13	0.25
	Invalid	0.02	0.02	0.00	0.23	0.06	0.34	0.02	0.31

Table 6.1.7.2: Muğla vote transition probabilities from 2014 to 2019

SAMSUN

Election Results	2014	2019
AKP	54.8%	47.4%
IYI	0.0%	26.7%
Independent	0.1%	21.1%
MHP	25.2%	0.0%
CHP	15.9%	0.0%
Rest	4.0%	4.8%
People`s Alliance		47.4%
Nation`s Alliance		26.7%

Table 6.1.7.3: Samsun Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADET	Invalid
2014	Absent	0.43	0.01	0.00	0.01	0.18	0.35	0.01	0.01
	AKP	0.12	0.00	0.00	0.13	0.19	0.45	0.01	0.01
	CHP	0.09	0.01	0.00	0.72	0.07	0.05	0.01	0.02
	DSP	0.09	0.13	0.02	0.07	0.27	0.16	0.06	0.20
	HDP	0.14	0.03	0.01	0.27	0.15	0.19	0.09	0.09
	MHP	0.12	0.00	0.00	0.22	0.29	0.31	0.01	0.03
	Others	0.04	0.01	0.00	0.02	0.15	0.62	0.03	0.13
	SAADET	0.07	0.01	0.00	0.01	0.21	0.49	0.16	0.04
	Invalid	0.01	0.01	0.00	0.02	0.03	0.54	0.01	0.37

Table 6.1.7.4: Samsun vote transition probabilities from 2014 to 2019

ORDU

Election Results	2014	2019
AKP	54.4%	56.9%
SAADDET	1.0%	26.1%
CHP	34.1%	15.5%
MHP	8.1%	0.0%
Rest	2.3%	1.5%

People`s Alliance		56.9%
Nation`s Alliance		15.5%

Table 6.1.7.5: Ordu Election results 2014 and 2019

Vote Transition Probability		2019							
		Absent	DSP	HDP	Nation`s Alliance	Others	People`s Alliance	SAADDET	Invalid
2014	Absent	0.59	0.01	0.00	0.02	0.01	0.24	0.03	0.04
	AKP	0.06	0.00	0.00	0.03	0.00	0.63	0.15	0.01
	CHP	0.11	0.00	0.00	0.35	0.01	0.07	0.35	0.02
	DSP	0.04	0.02	0.01	0.68	0.04	0.05	0.07	0.07
	HDP	0.10	0.07	0.01	0.23	0.12	0.15	0.09	0.20
	MHP	0.02	0.01	0.00	0.01	0.01	0.56	0.33	0.06
	Others	0.05	0.01	0.00	0.02	0.09	0.63	0.09	0.10
	SAADDET	0.06	0.02	0.00	0.02	0.09	0.46	0.28	0.06
Invalid	0.12	0.01	0.00	0.01	0.02	0.49	0.08	0.26	

Table 6.1.7.6: Ordu vote transition probabilities from 2014 to 2019

6.2. March and June 2019 Results of İstanbul

In Table 6.2.1, total number of participants and voters of March and June Elections in İstanbul are illustrated. At first glance, there seems to be a slight increase in the participation rate of June compared to March.

Metropolitan	Neighborhoods	Voters June	Participants June	Participation Rate June	Voters March	Participants March	Participation Rate March
İSTANBUL	956	10,570,011	8,924,827	84.4%	10,570,596	8,864,704	83.9%

Table 6.2.1: Total number of participants and voters of March and June 2019 Elections in İstanbul

Table 6.2.2 demonstrates that Nation's Alliance increased its vote by 5.4% in June compared to March results; whereas People's Alliance lost 3.6% of its votes.

Election Results	March	June
Nation's Alliance	48.8%	54.2%
People's Alliance	48.6%	45.0%
Rest	2.6%	0.8%

Table 6.2.2: İstanbul Election results in March and June 2019

Table 6.2.3 shows vote transition probabilities between March and June elections of İstanbul. This table can be helpful in explaining the Nation's Alliance vote increase between March and June results. 24% of the absent votes in March is estimated to vote for Nation's Alliance; whereas majority of the rest still remains to be absent. Additionally, DSP (83%), DP (25%) and TKP (24%) are estimated to contribute to the votes of Nation's Alliance.

Vote Transition Probability		June				
		Absent	Nation`s Alliance	Others	People`s Alliance	Invalid
March	Absent	0.75	0.24	0.00	0.01	0.00
	BTP	0.08	0.07	0.20	0.10	0.54
	DP	0.11	0.25	0.06	0.54	0.04
	DSP	0.08	0.83	0.01	0.07	0.02
	Nation`s Alliance	0.01	0.98	0.00	0.01	0.00
	Others	0.16	0.13	0.30	0.08	0.33
	People`s Alliance	0.03	0.05	0.00	0.92	0.00
	SAADET	0.06	0.03	0.37	0.40	0.14
	Invalid	0.57	0.02	0.01	0.04	0.36
	TKP	0.16	0.24	0.21	0.15	0.24

Table 6.2.3: Vote transition probabilities from March to June Elections

7. CONCLUSION AND FUTURE RESEARCH

Debates around how voters switched their votes relative to previous elections are always the topic after the Election Day and this study presents a comparative analysis on the vote transition behavior of the voters for 2014 and 2019 Turkish Local Elections together with the re-run election of İstanbul. The vote transitions between the political parties in 30 metropolitans of Turkey is estimated by Bayesian and frequentist inference for ecological inference approach proposed by Rosen et al. (2001). After the vote transition probabilities are obtained, hierarchical clustering is used to characterize the similar transition behavior over multiple cities. Two clusters with largest number of cities have shown that the political parties have benefited from forming alliances. Especially vote transition to Nation's Alliance from MHP and HDP led CHP and IYI Party to increase their votes significantly in most of the cities. For the re-run election case, the slight number of vote difference between the alliances in March has increased significantly. When the vote transitions are analyzed, this is mainly due to contribution of absentees to Nation's Alliance and around %5 of the People's Alliance supporters in March who estimated to vote for Nation's Alliance.

This study focused on only aggregate level votes to infer the vote transition probabilities between two elections. Understanding the reasons of this transition behavior requires further analysis using additional information such as campaign activities, demographics, and macroeconomic indicators. A comprehensive analysis on why individuals switched to another party is very crucial for political parties to shape their strategy in the future elections. Moreover, ecological inference is just an estimation tool and has its own assumptions. Normally, the studies employing ecological inference confirms their results with some post-surveys. Conducting a large scale post-surveys will be helpful to confirm the validity of the findings in this study.

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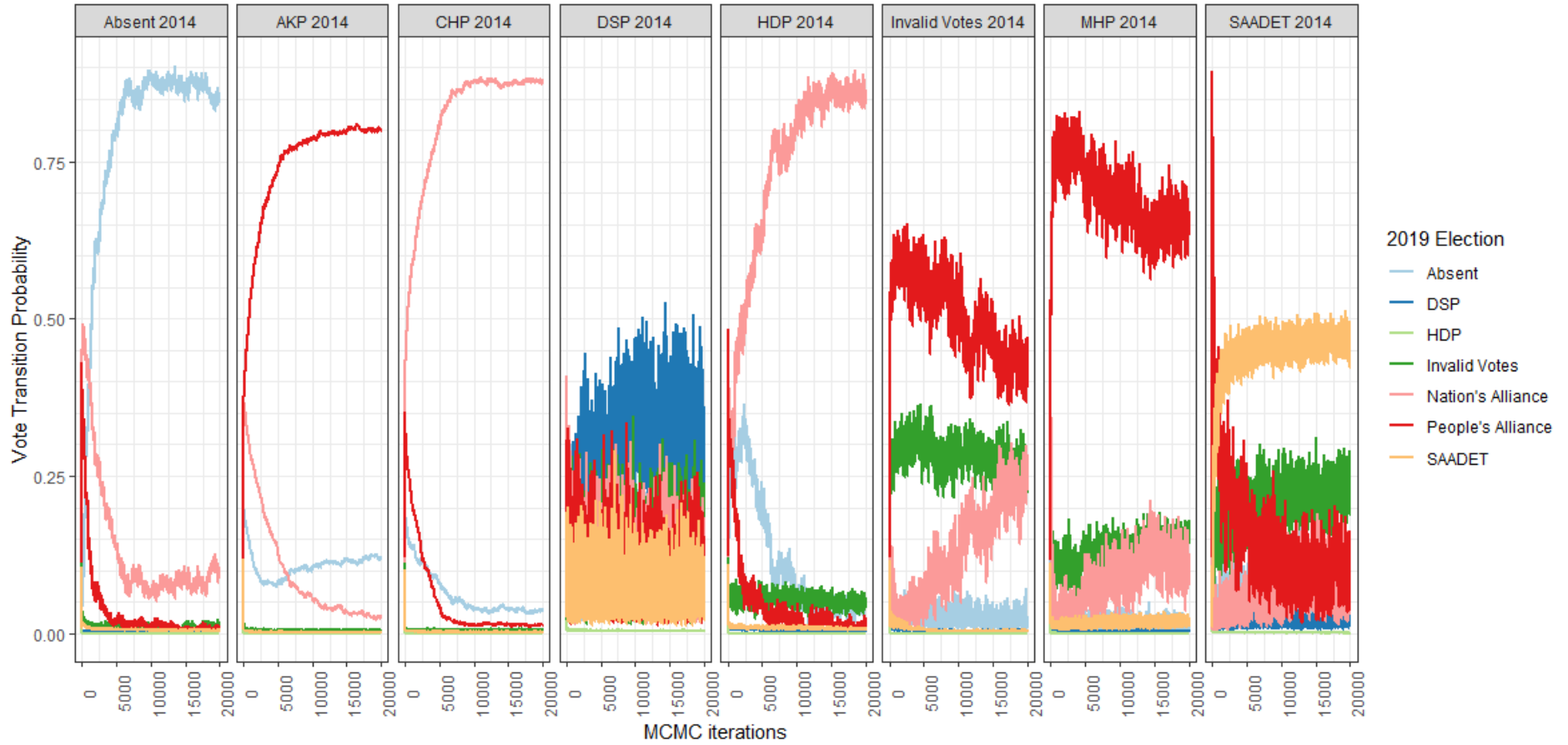
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APPENDIX A

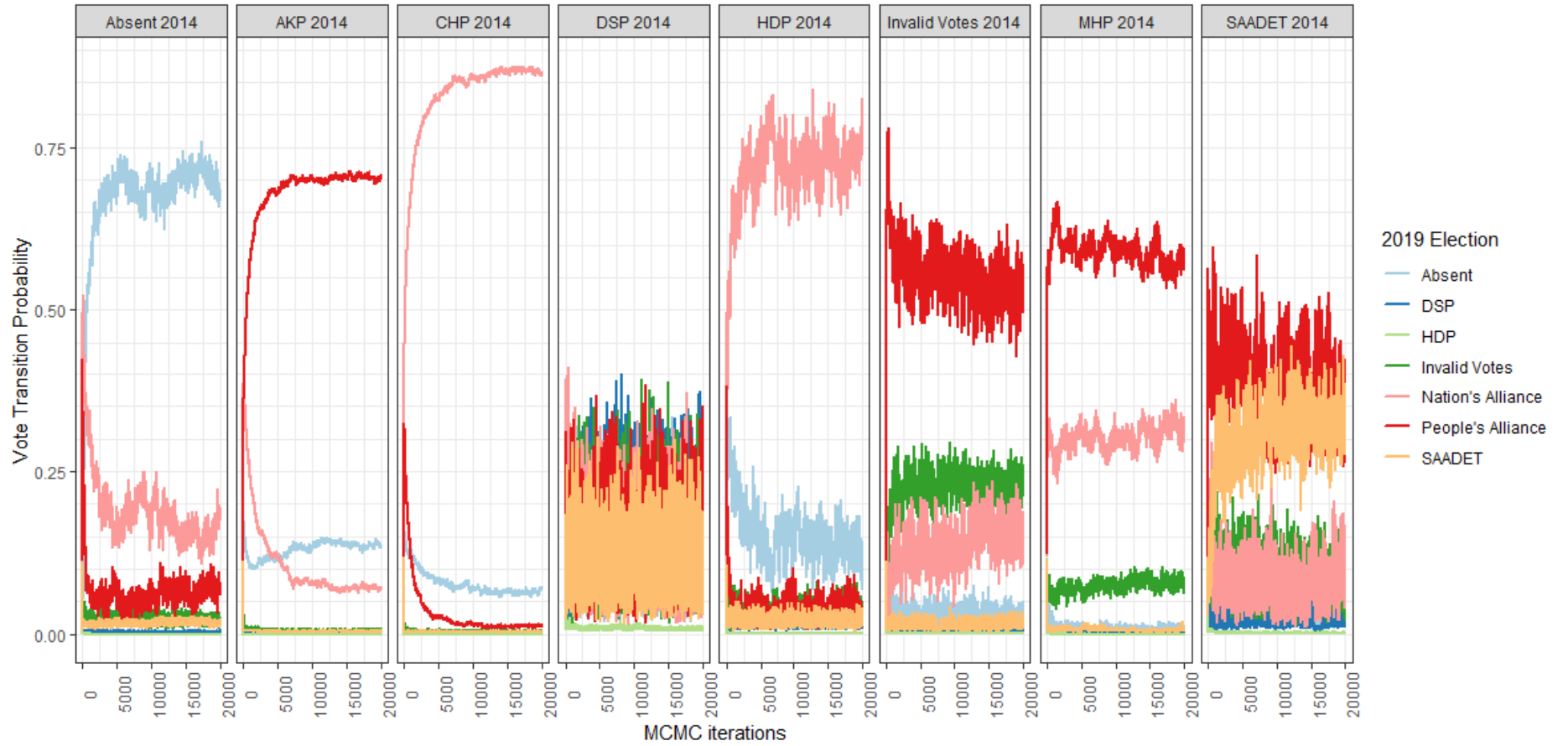
CONVERGENCE PLOTS FOR MCMC ITERATIONS

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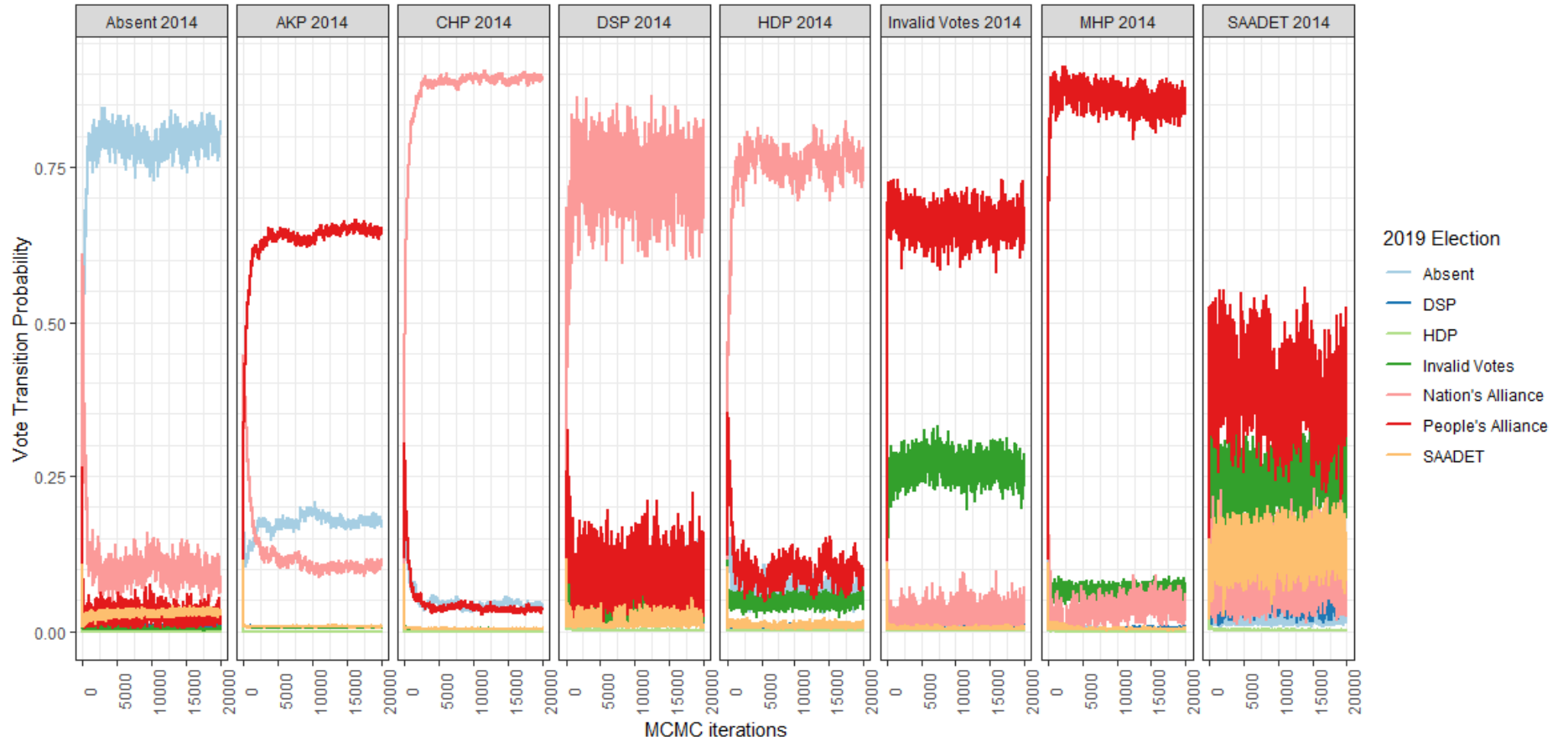
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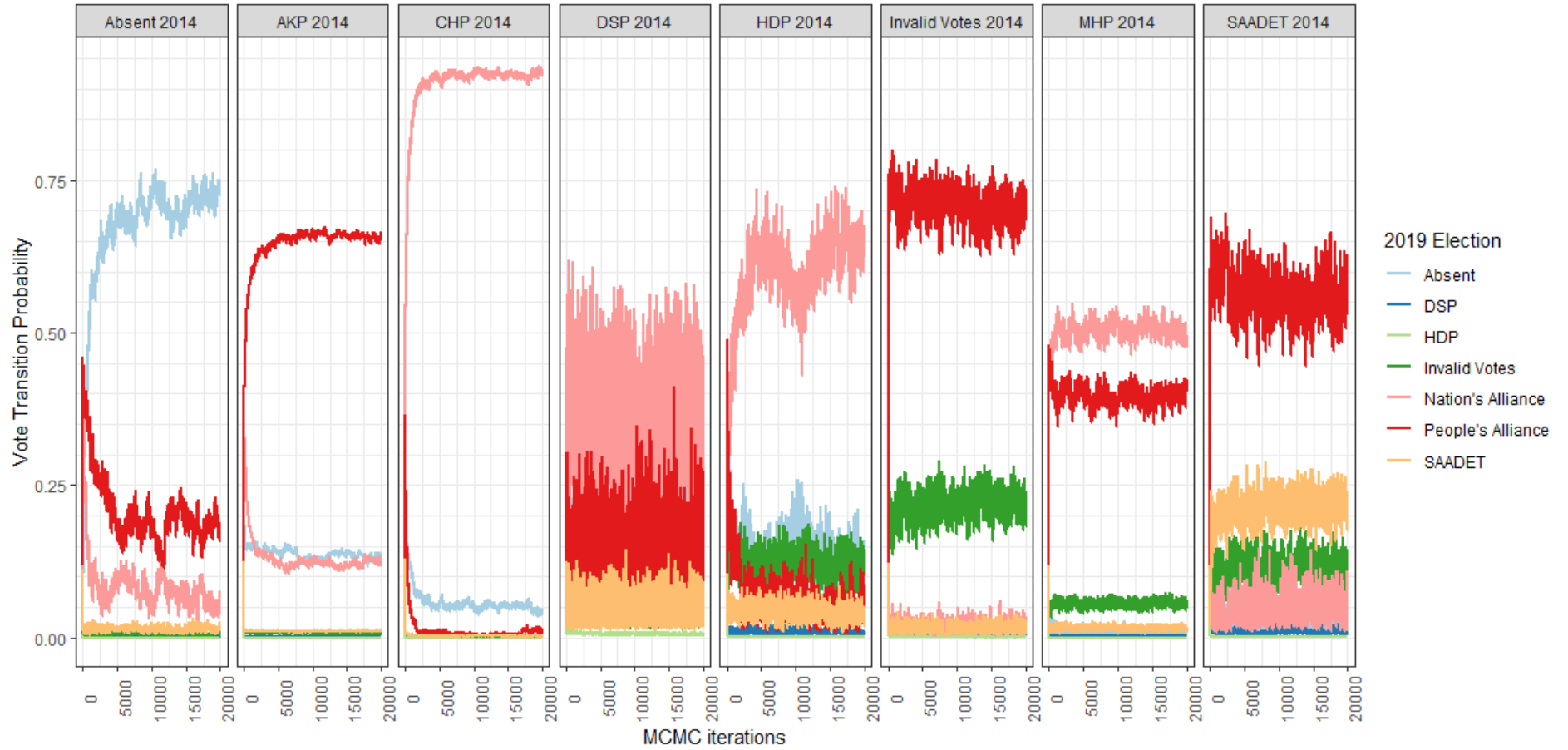
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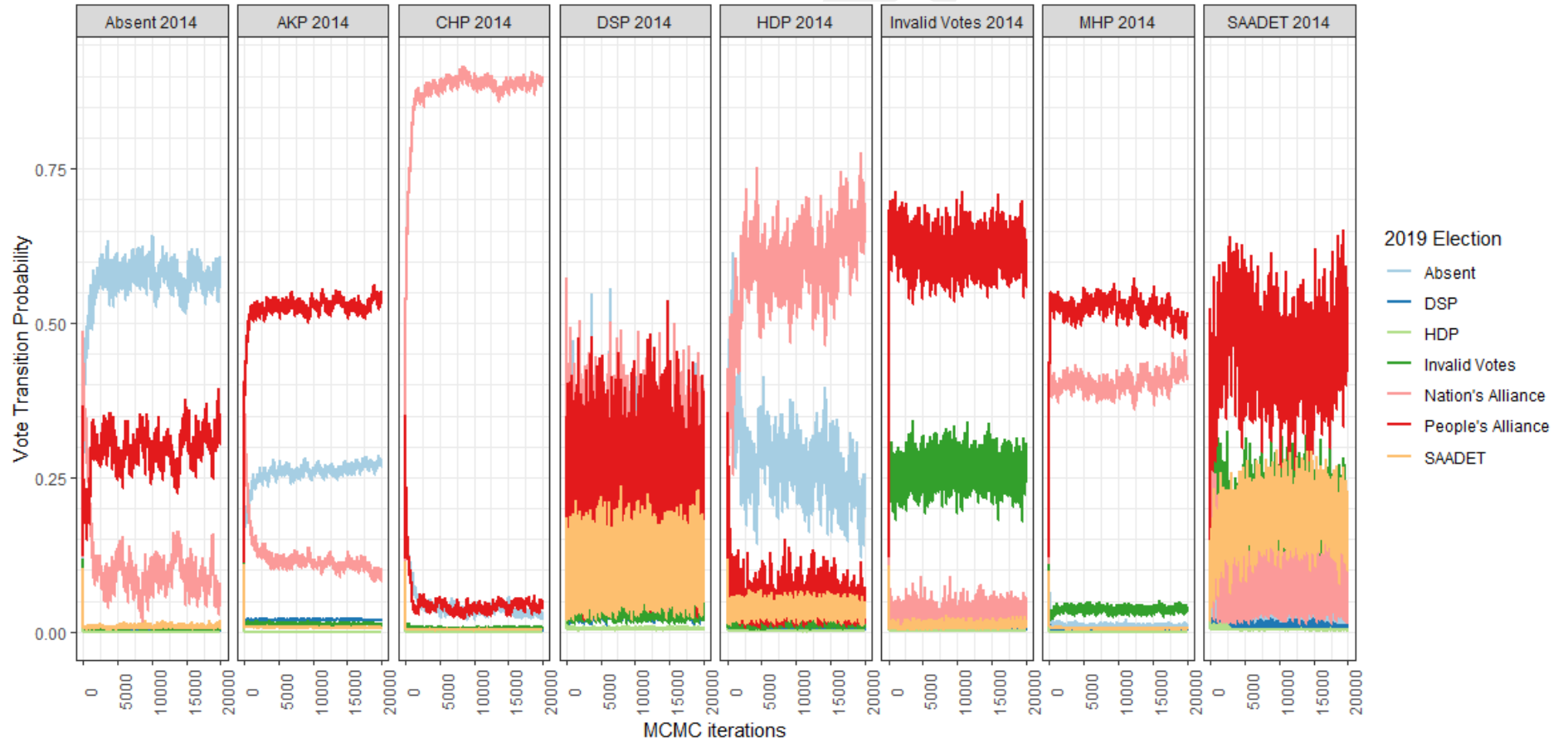
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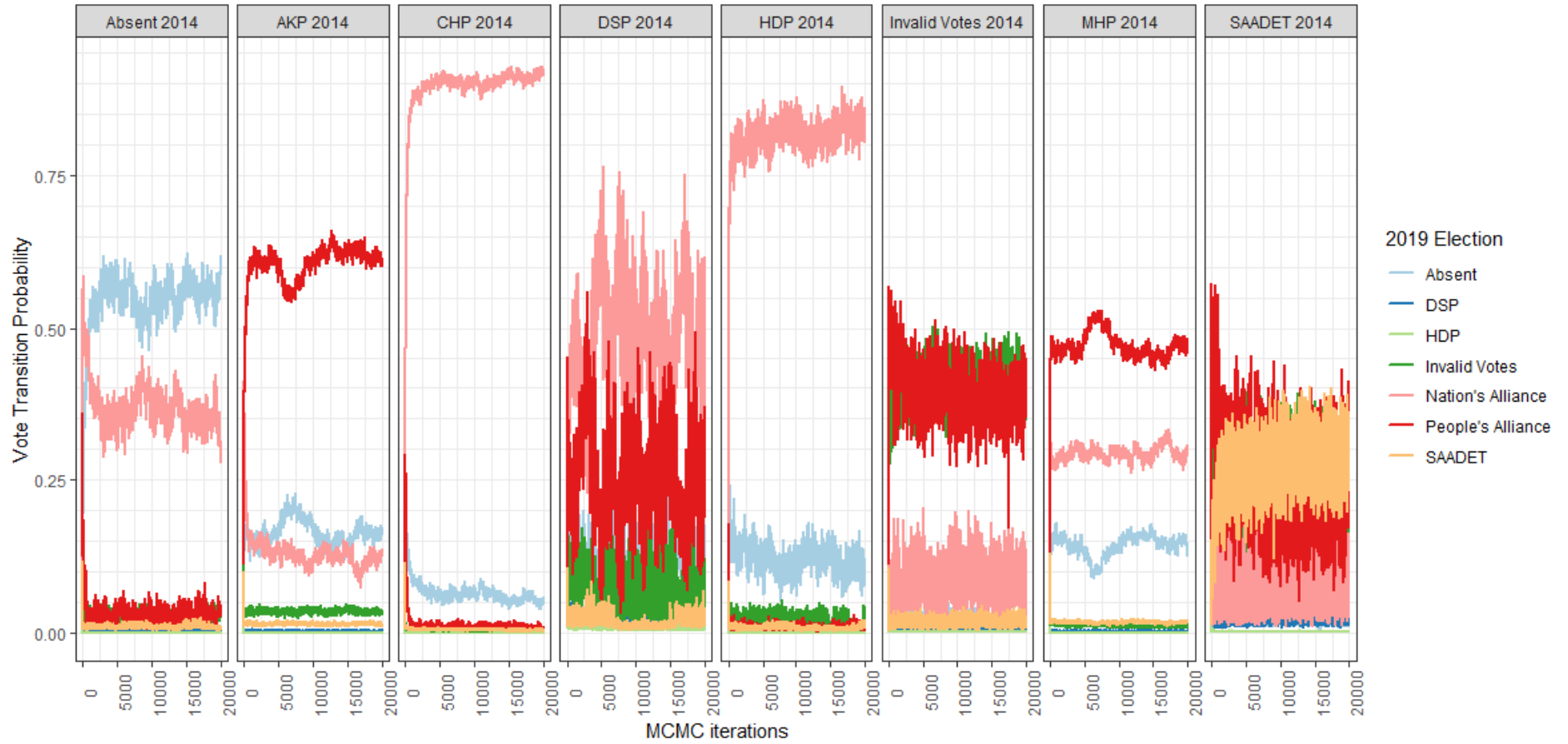
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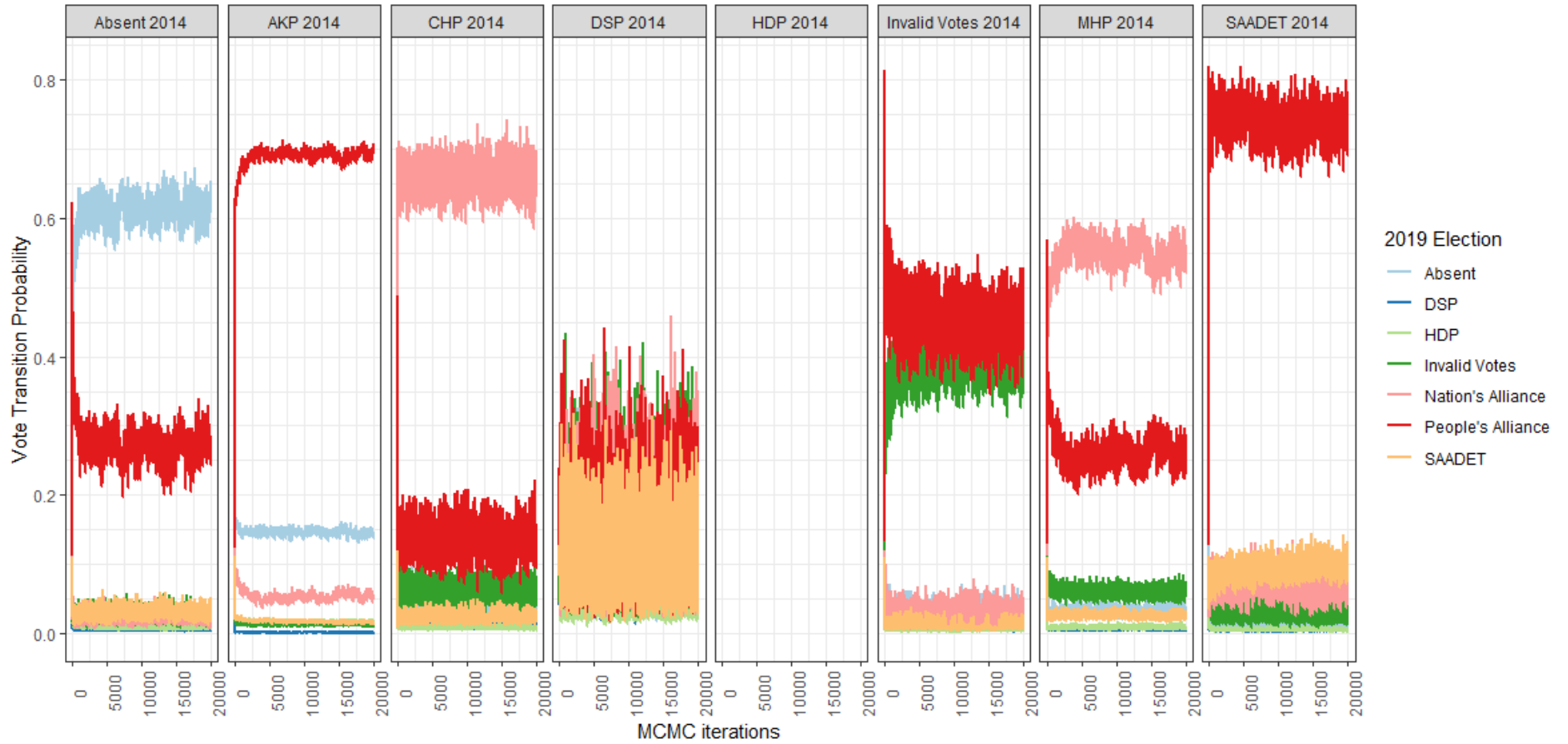
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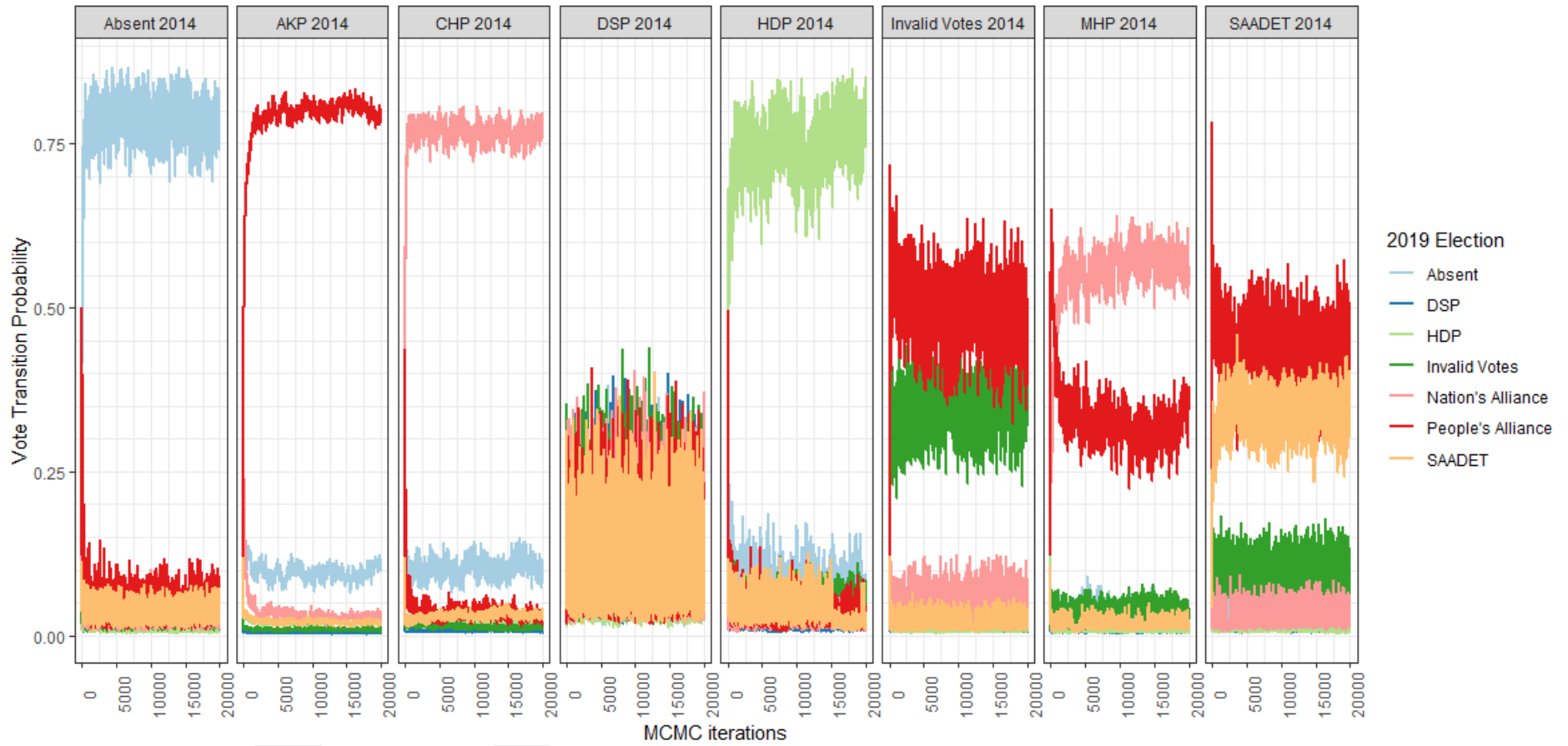
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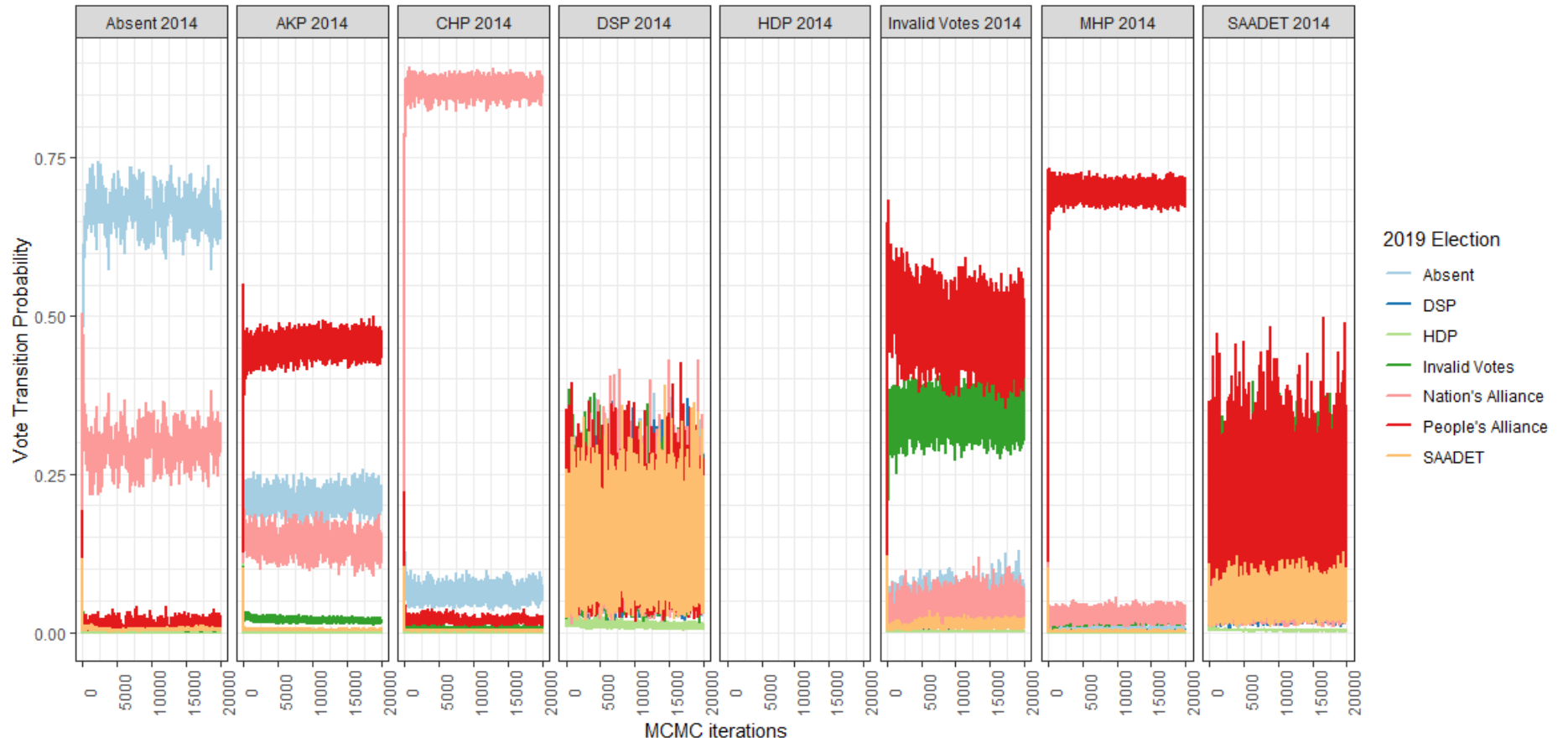
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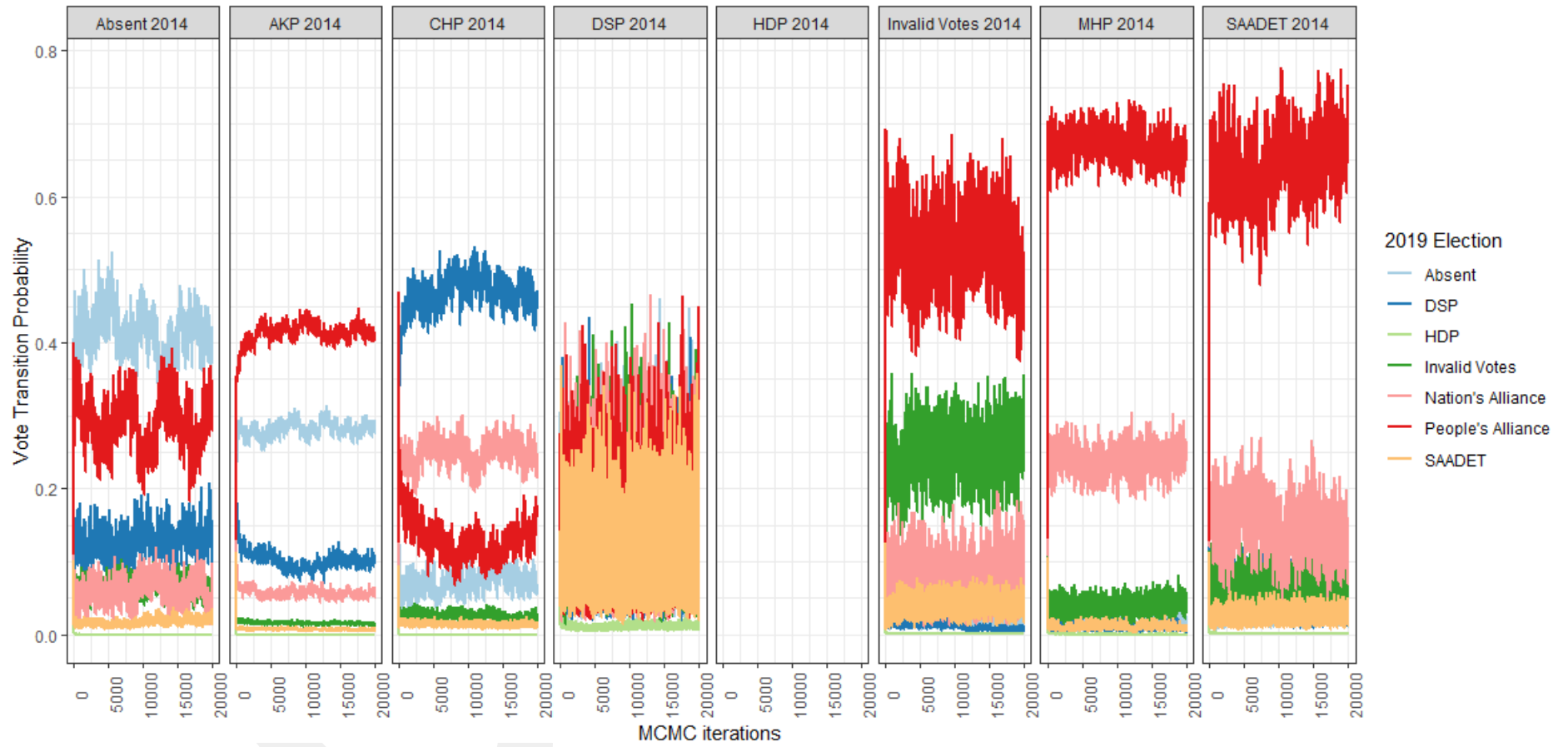
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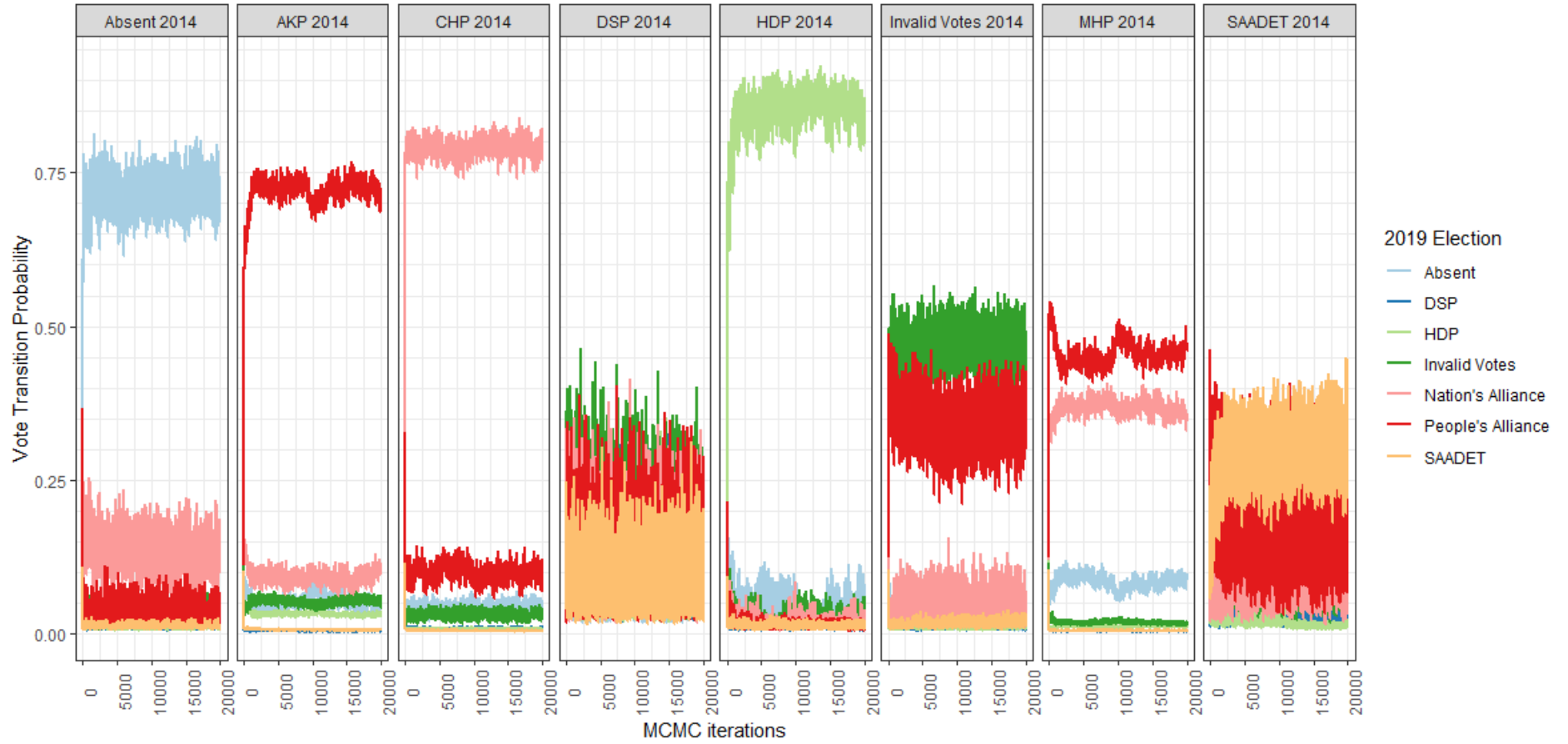
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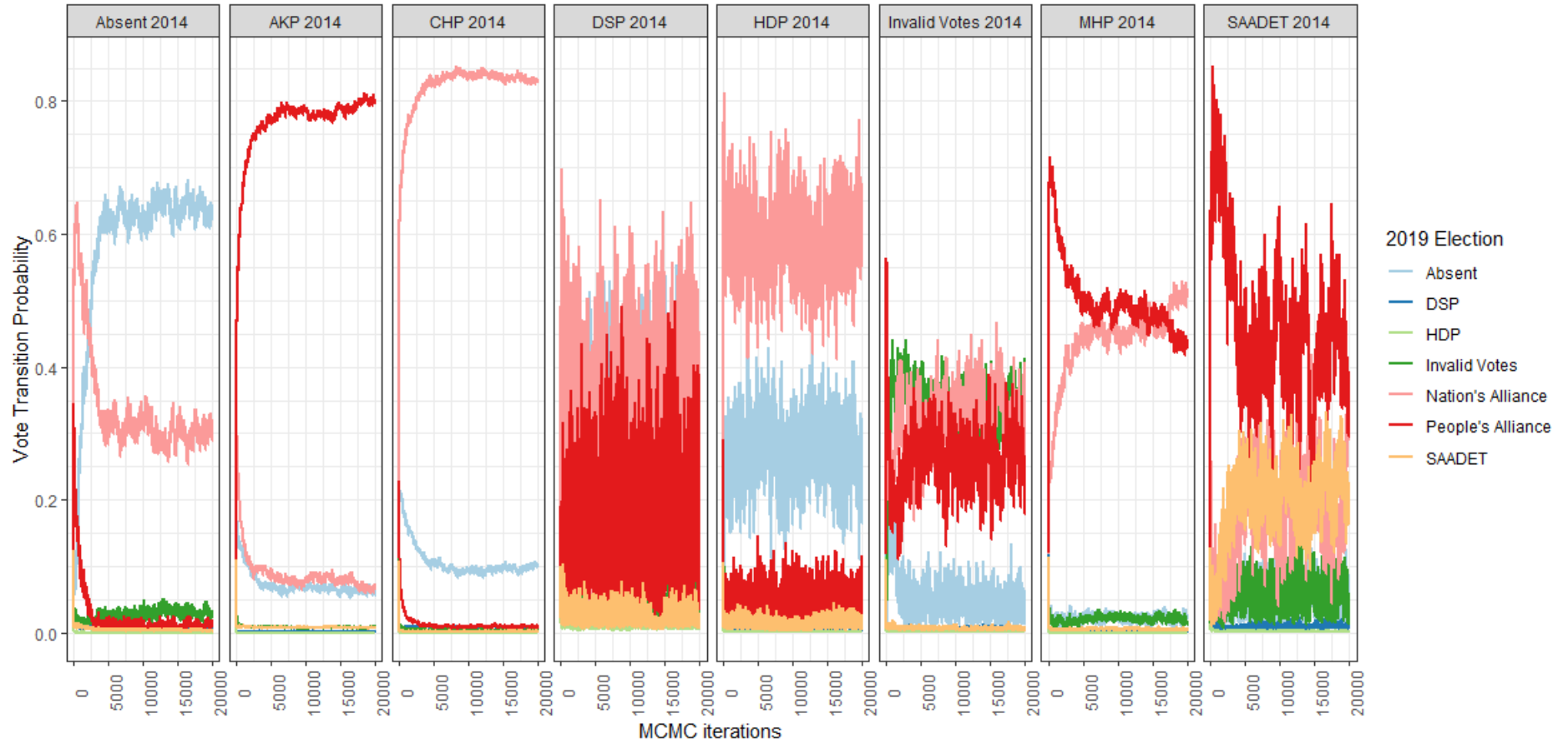
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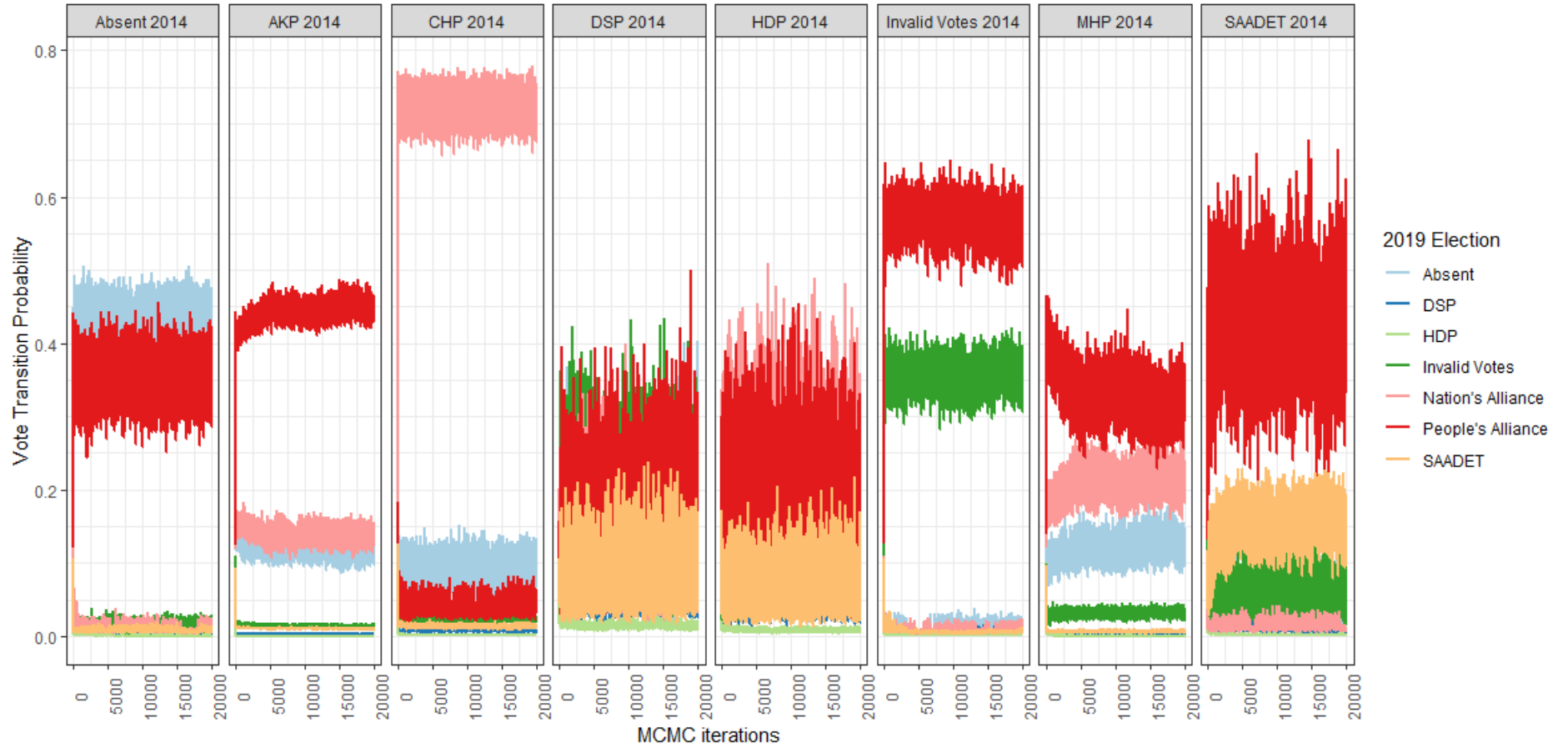
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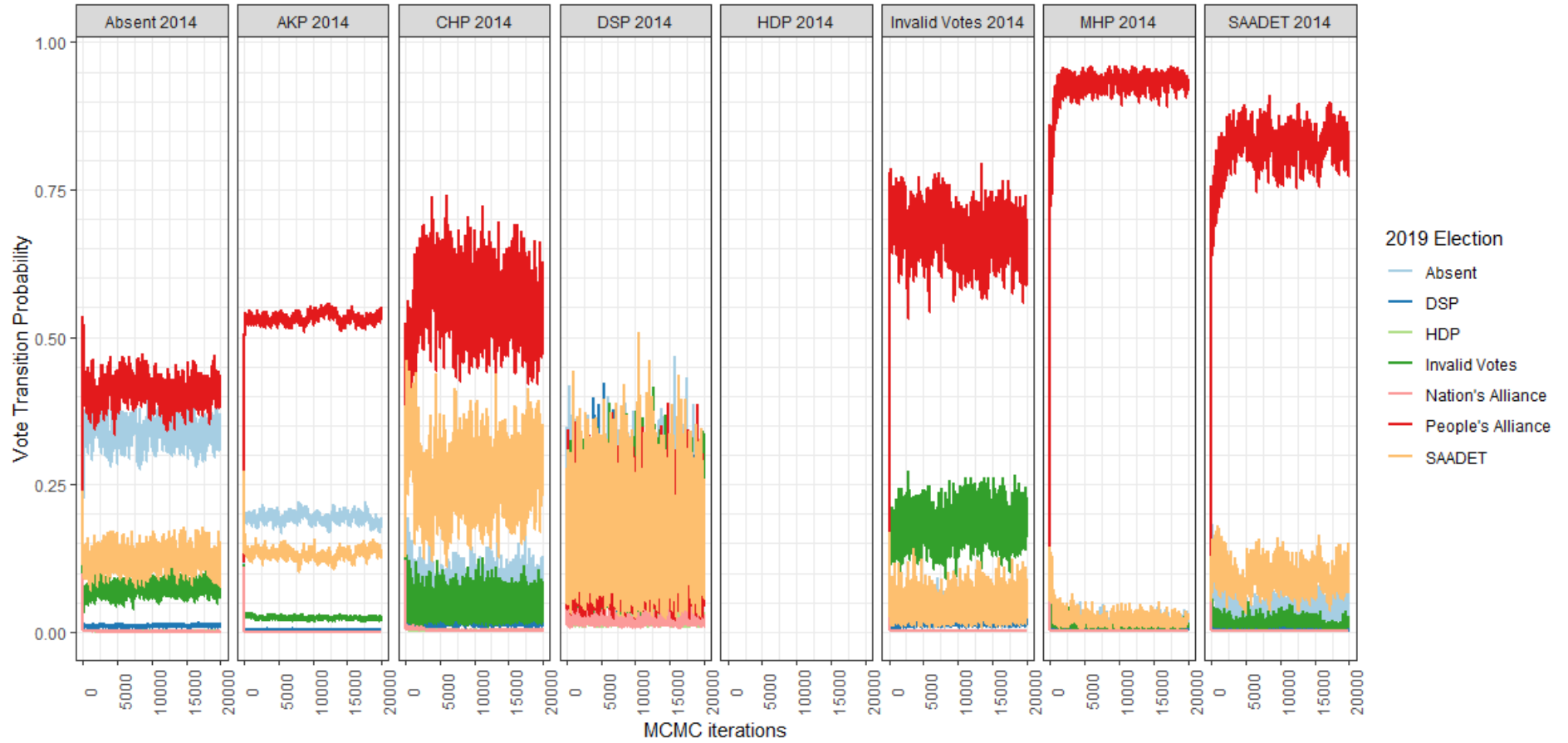
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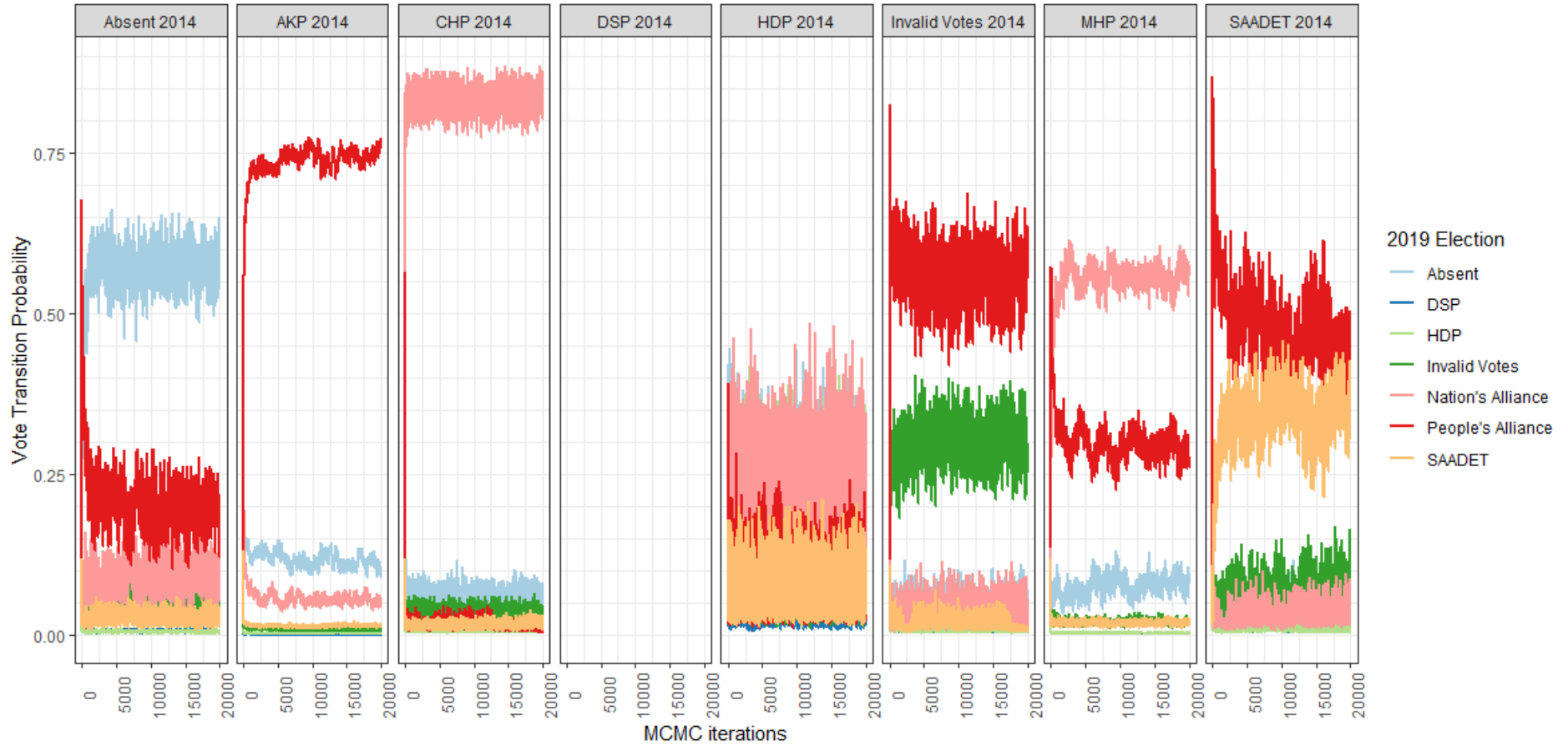
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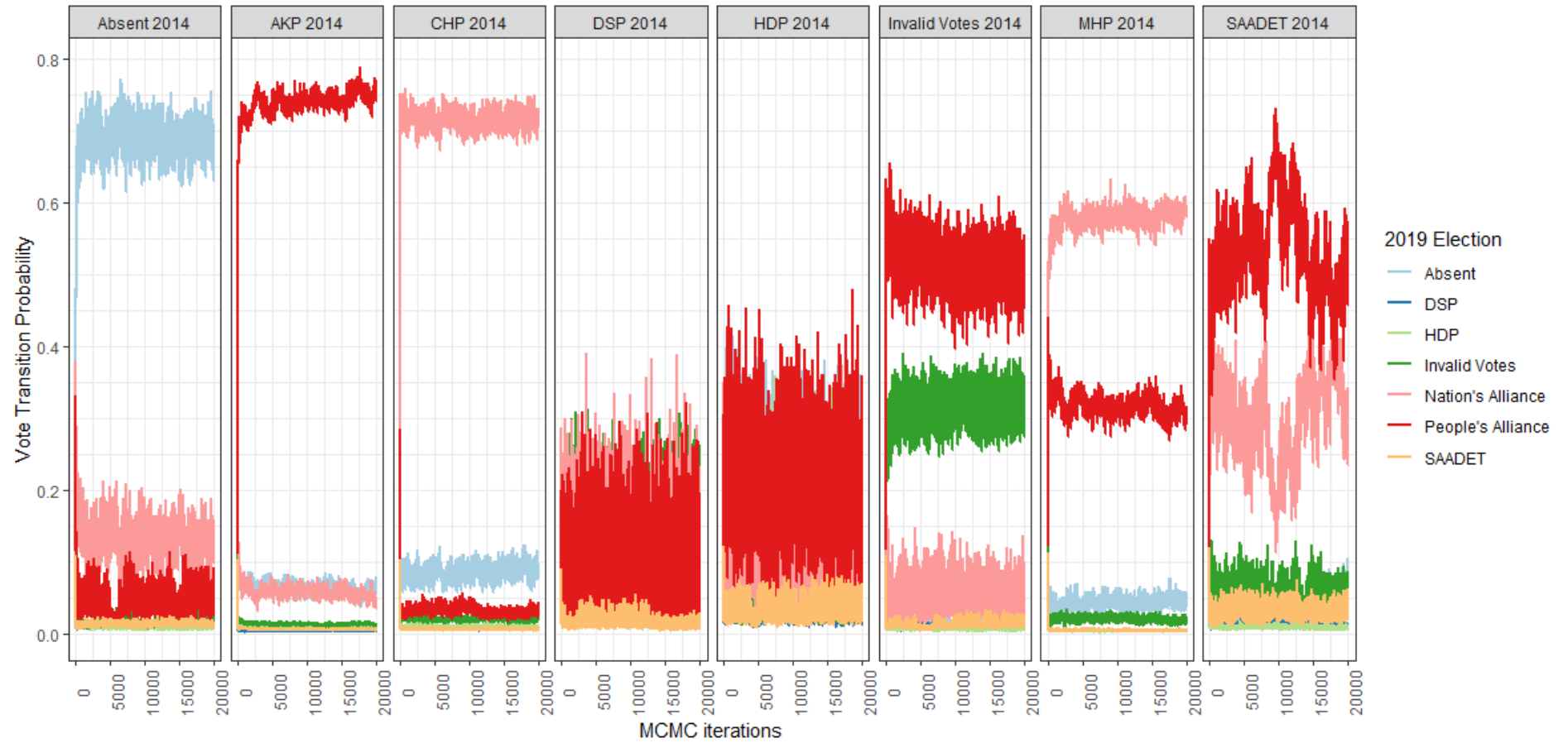
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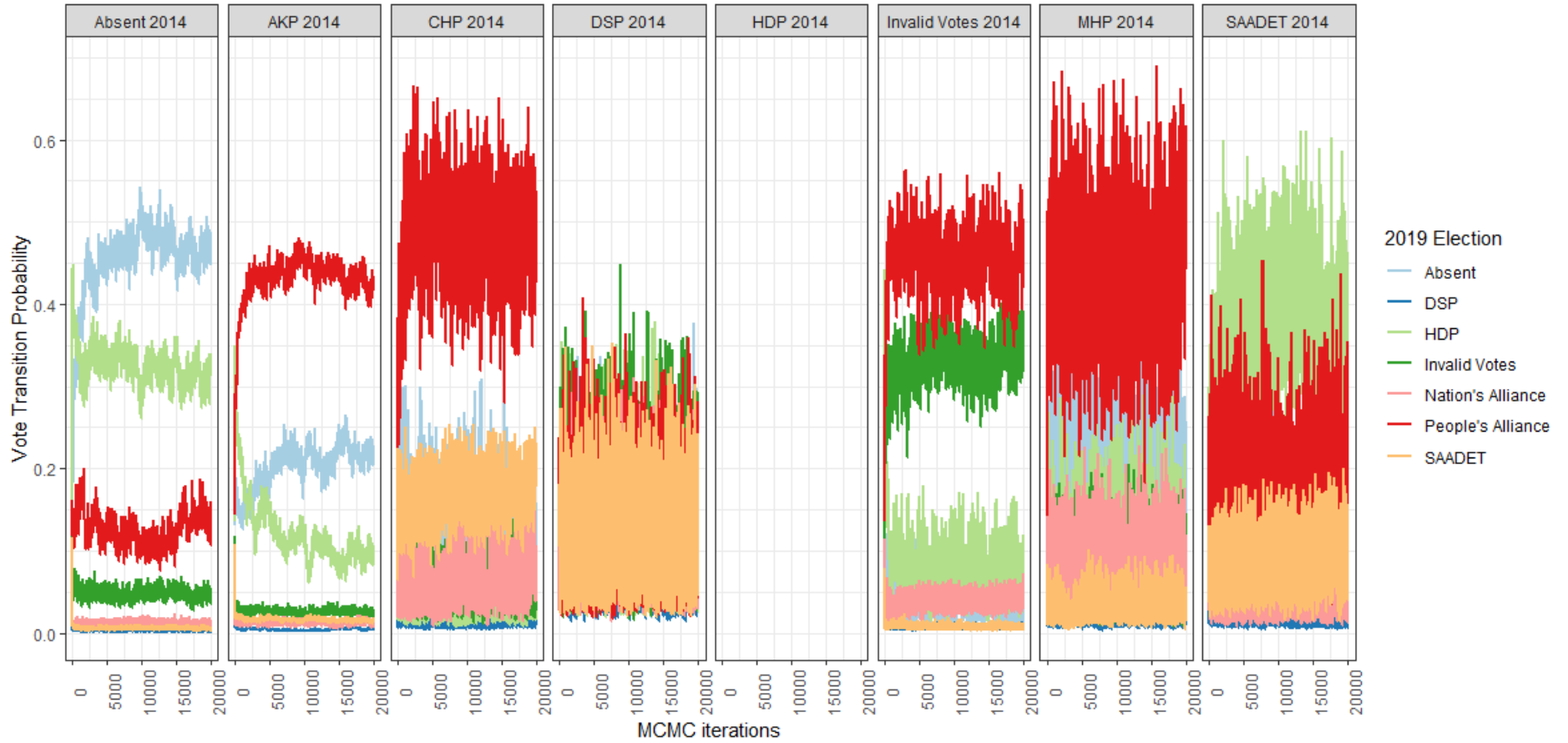
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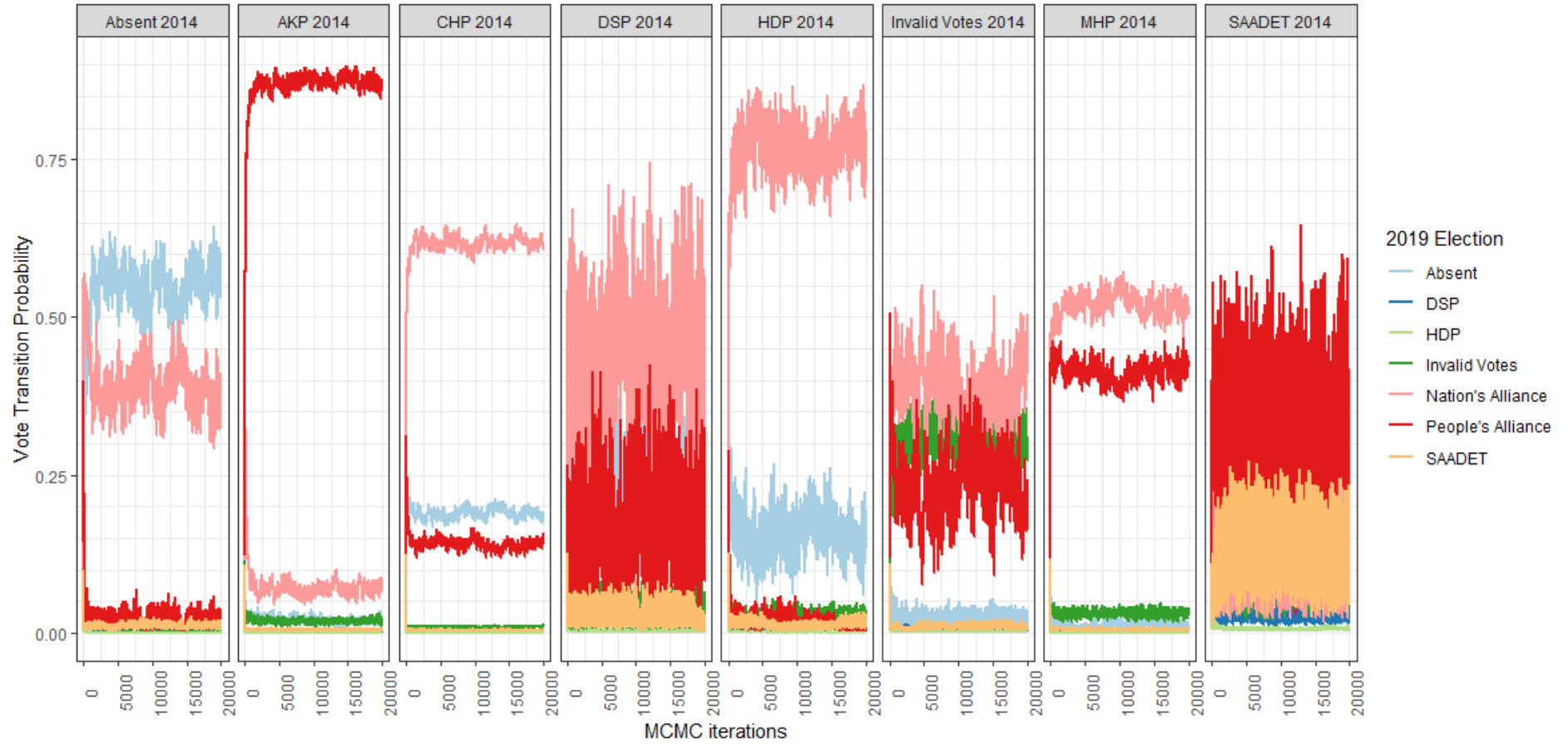
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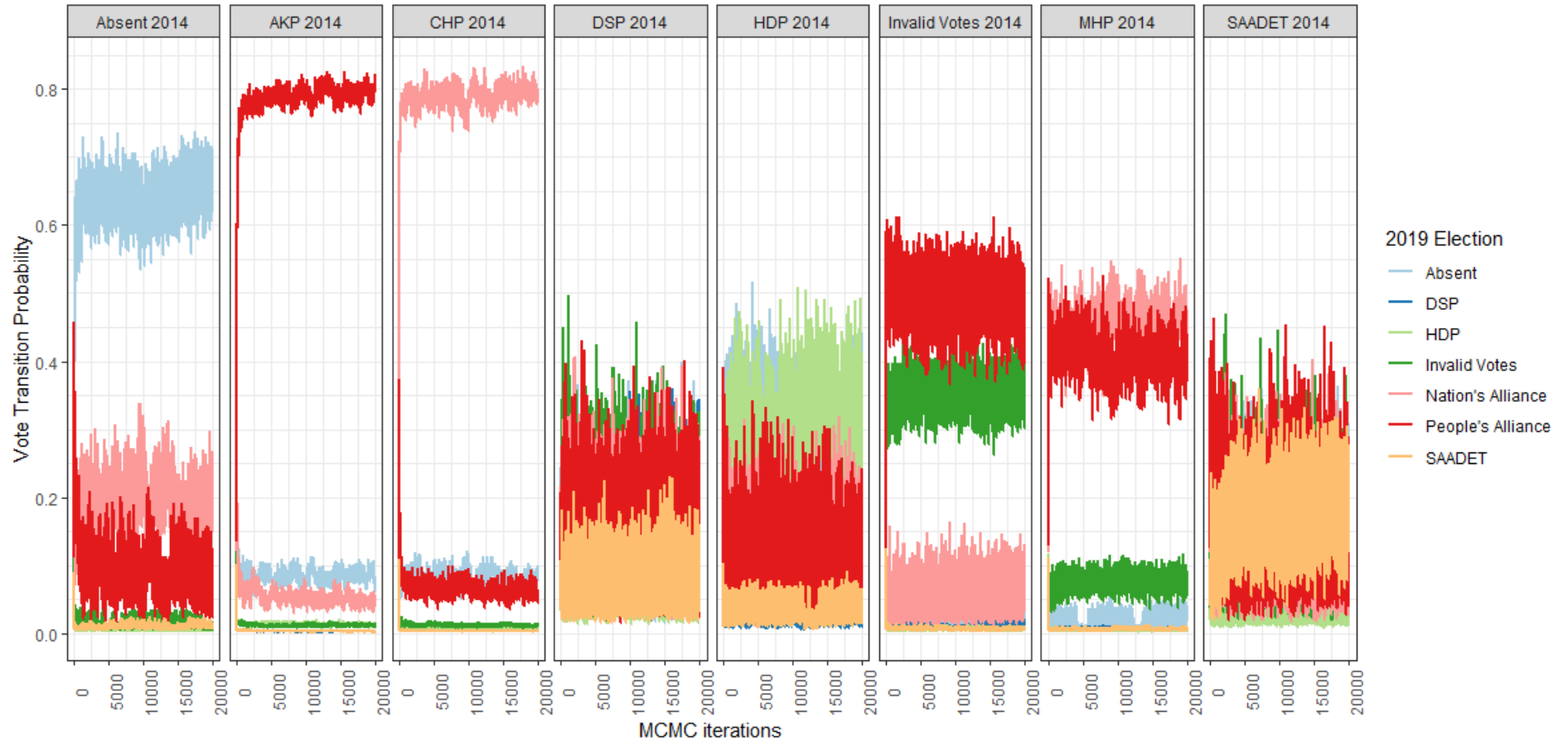
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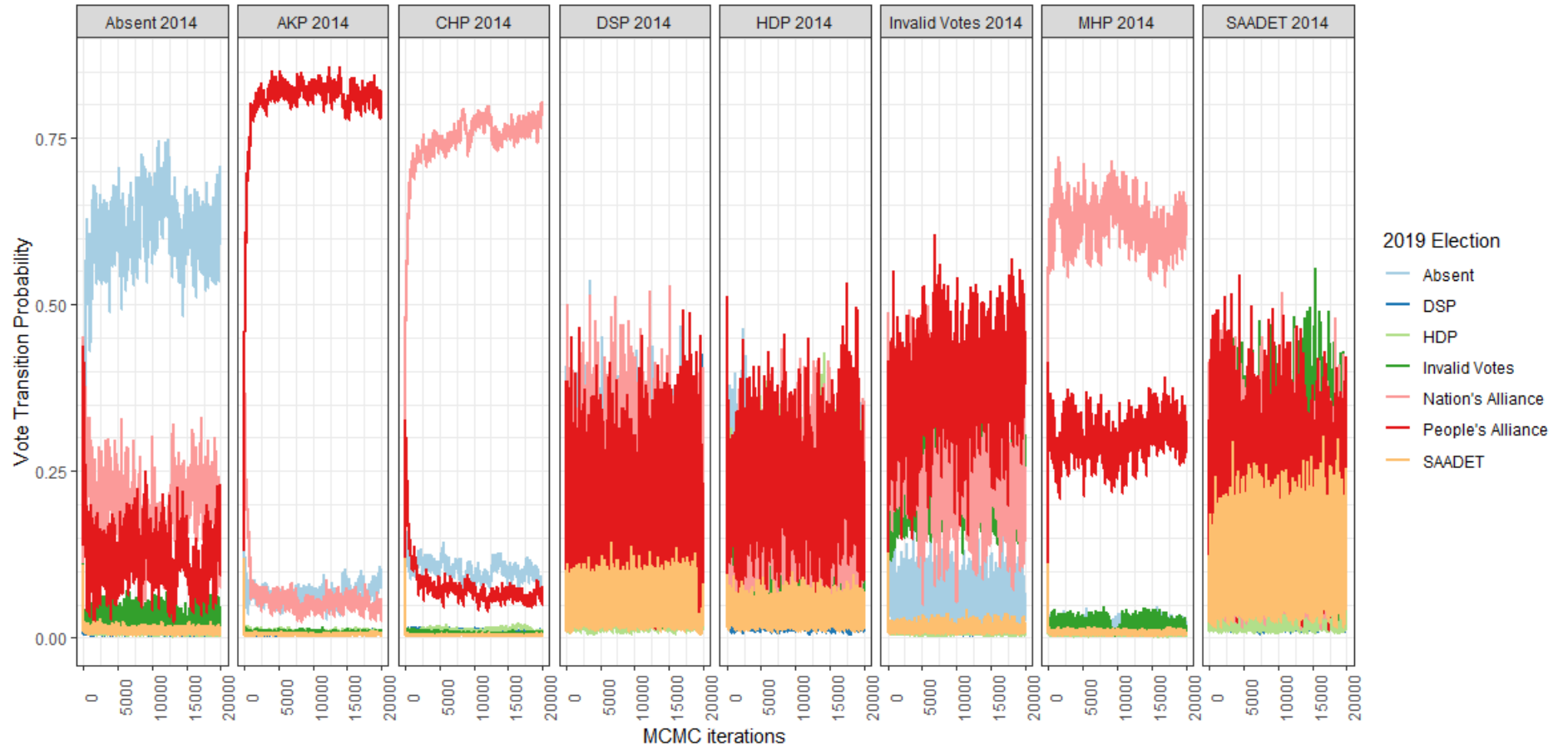
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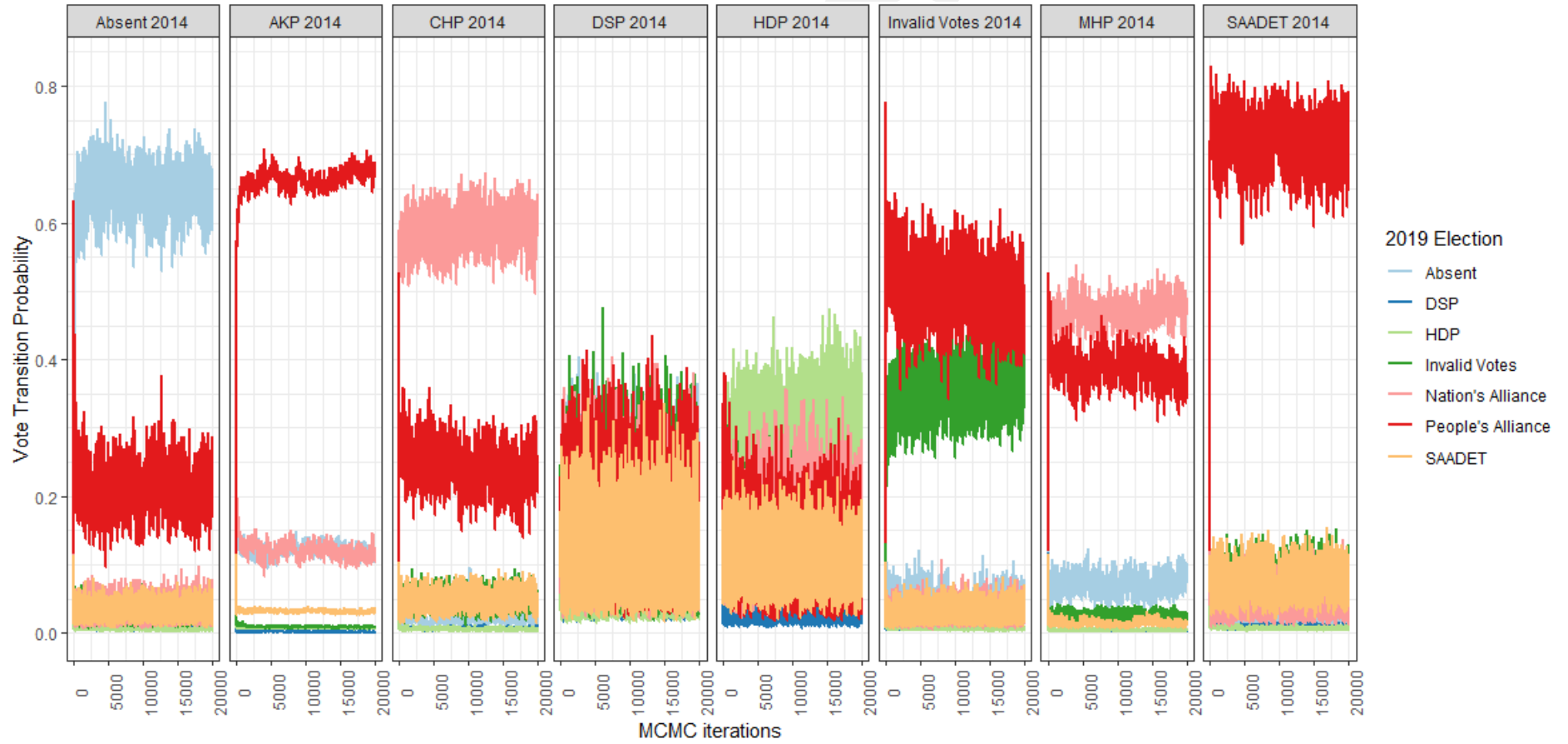
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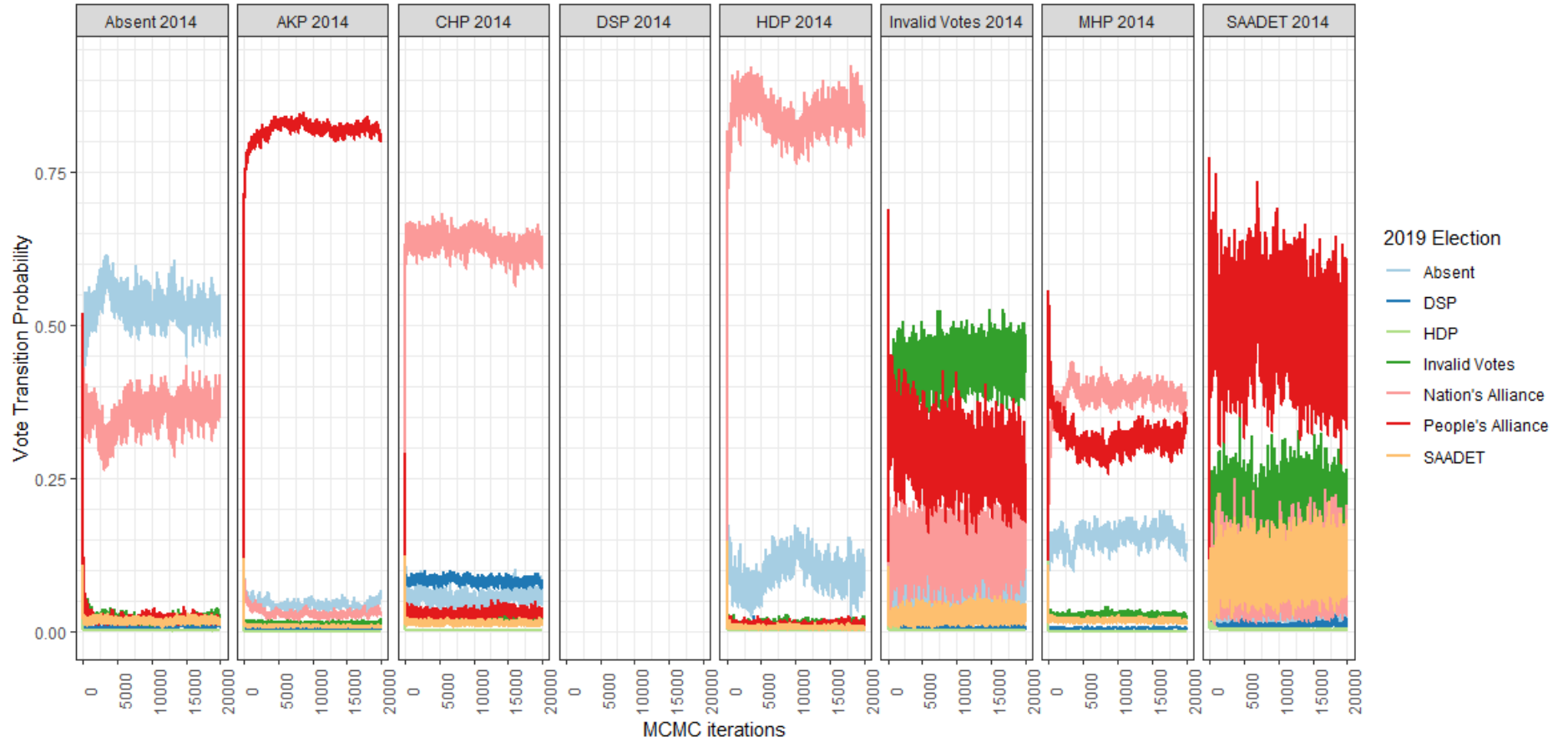
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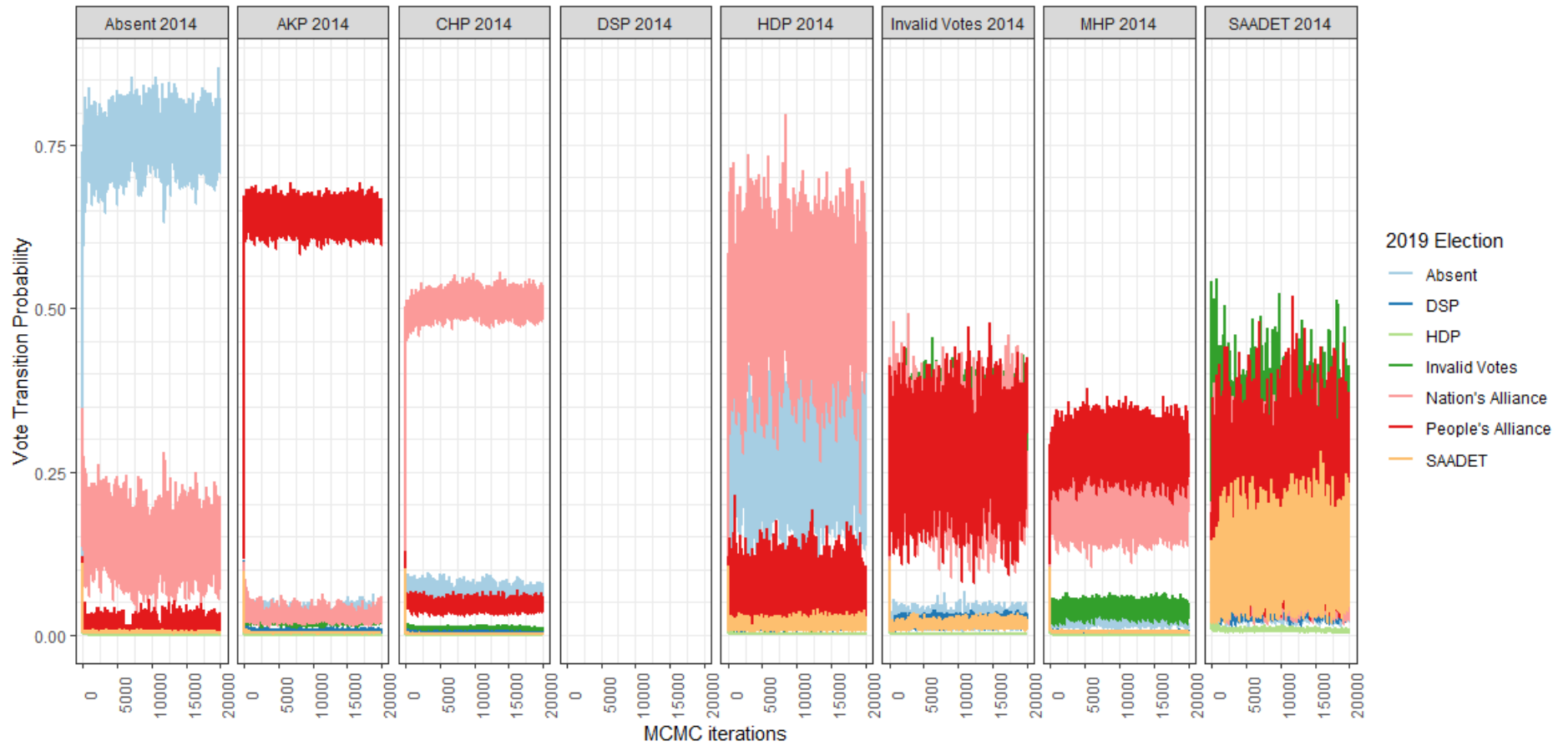
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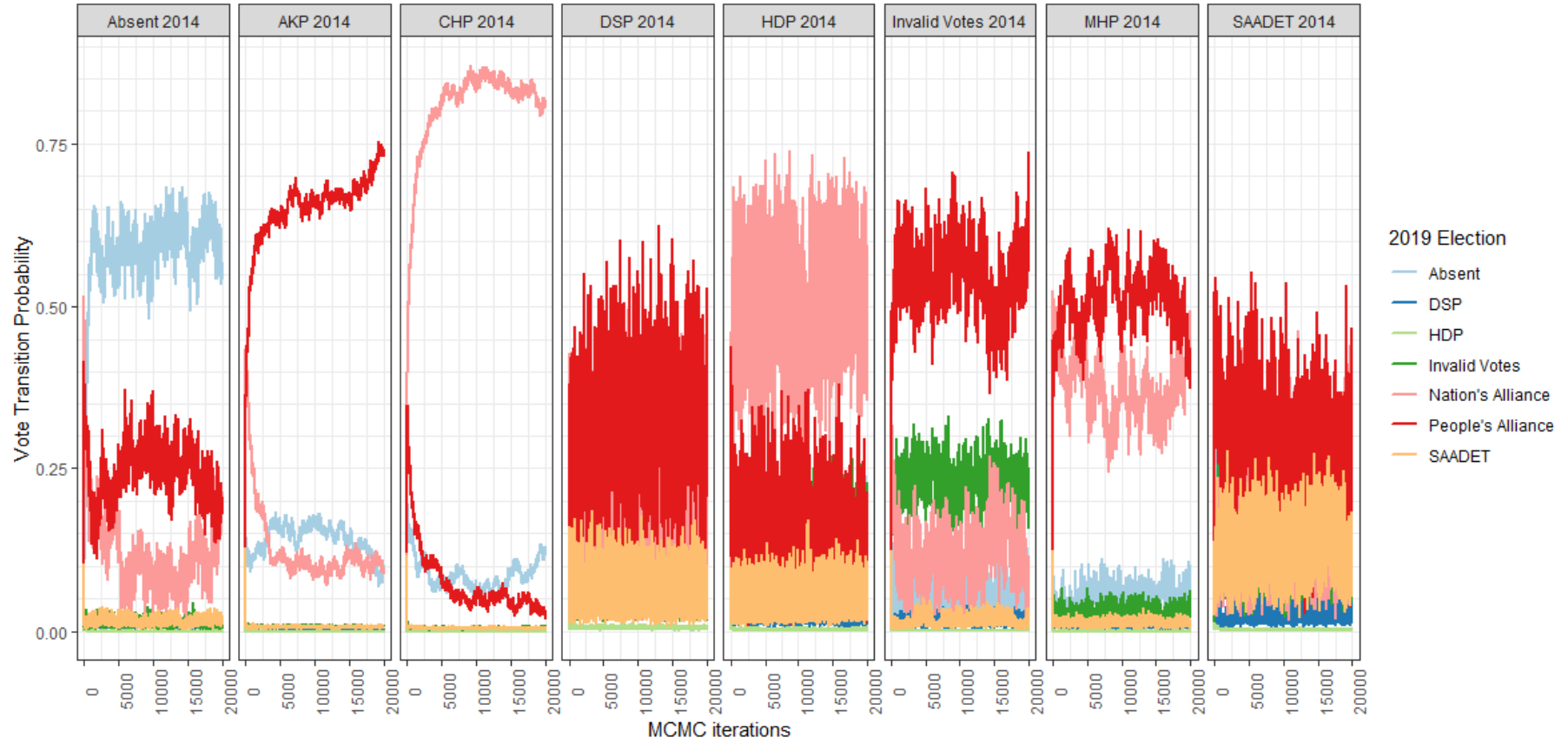
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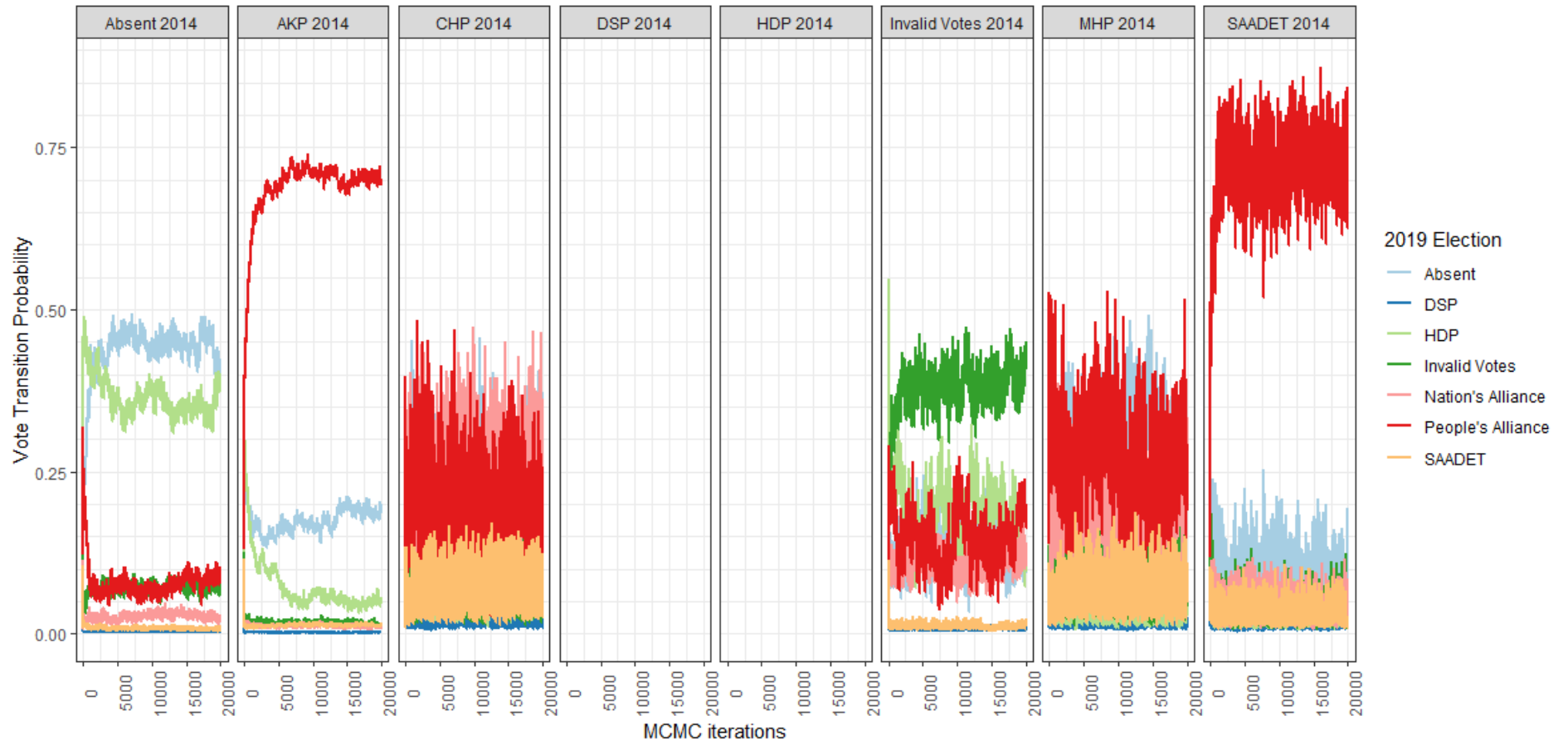
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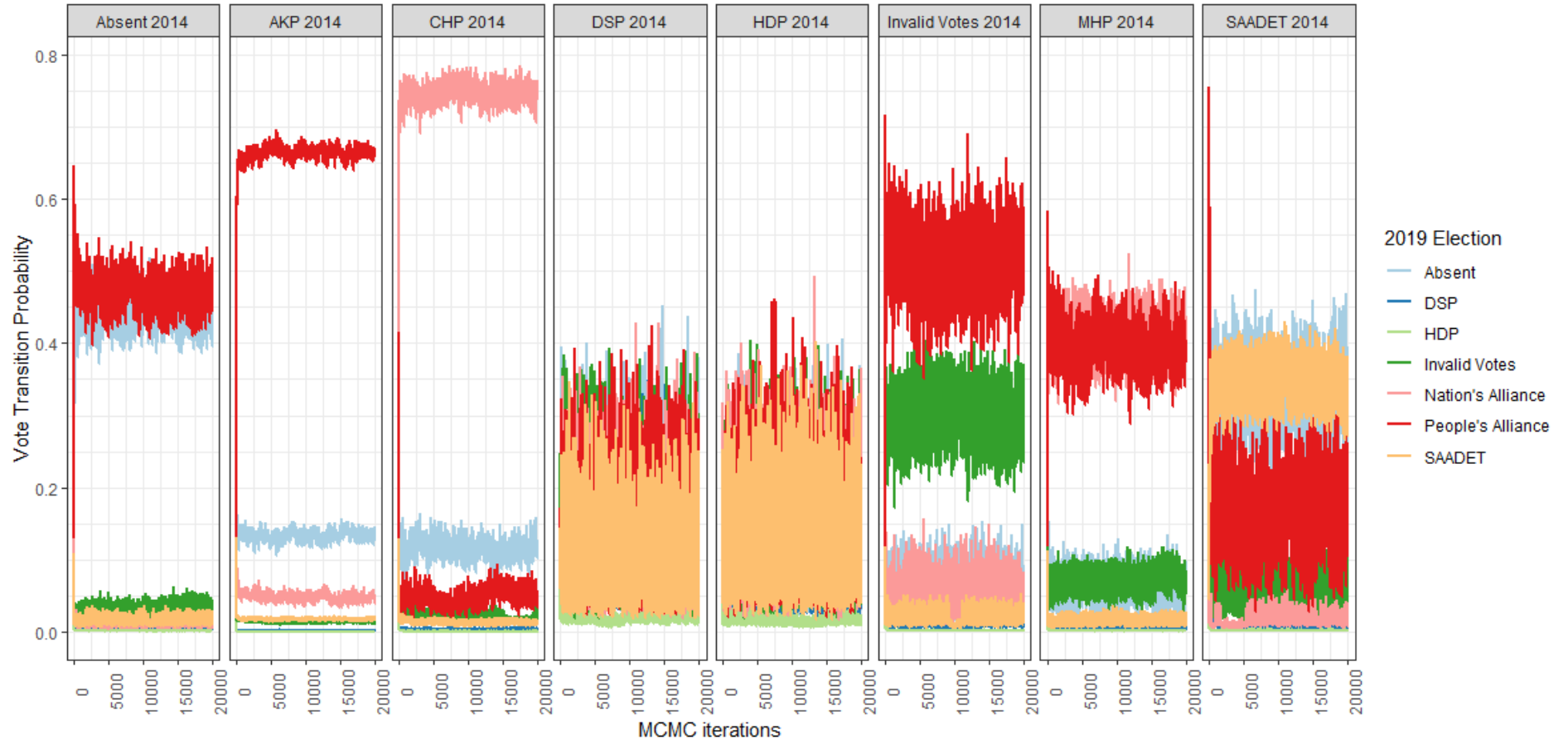
ESKİŞEHİR



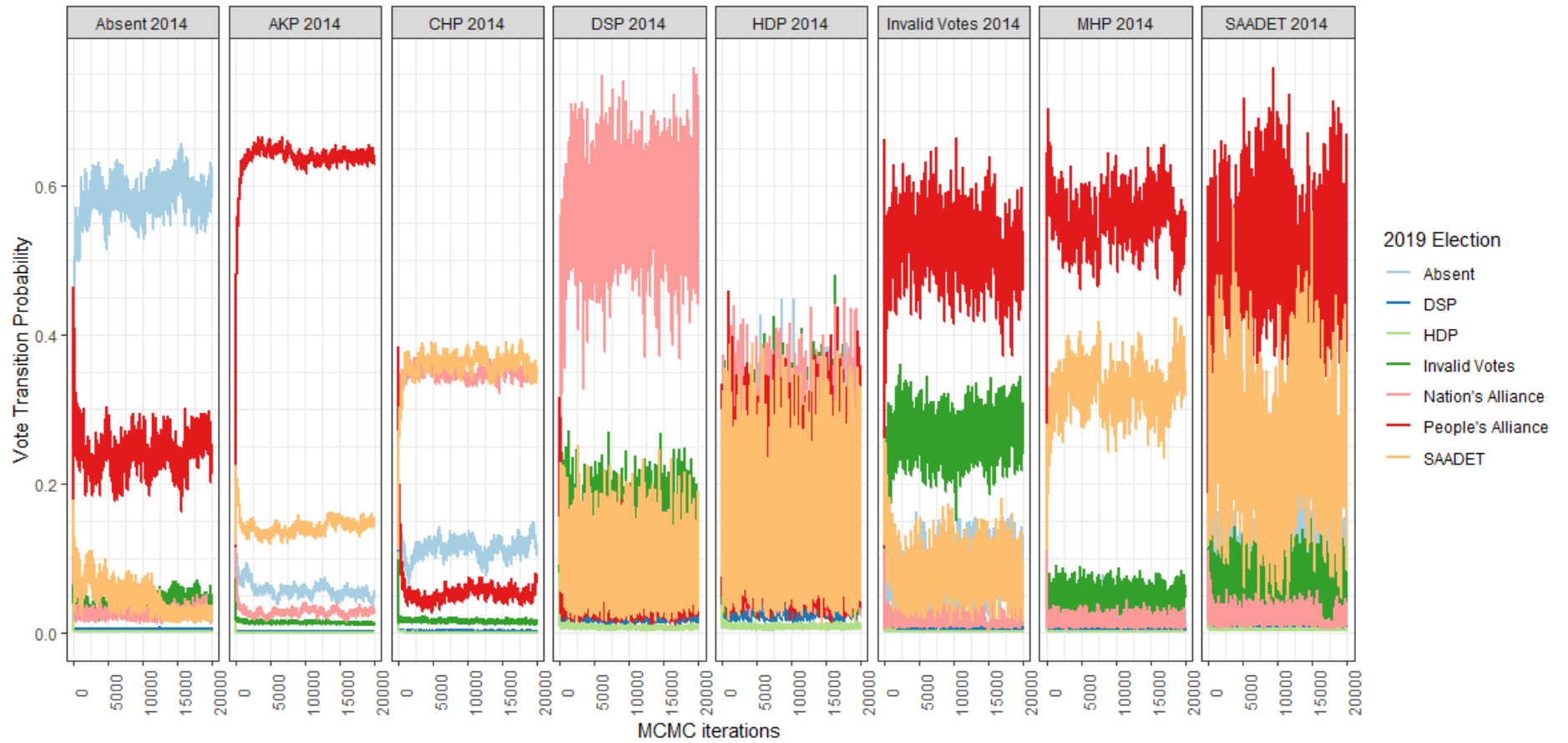
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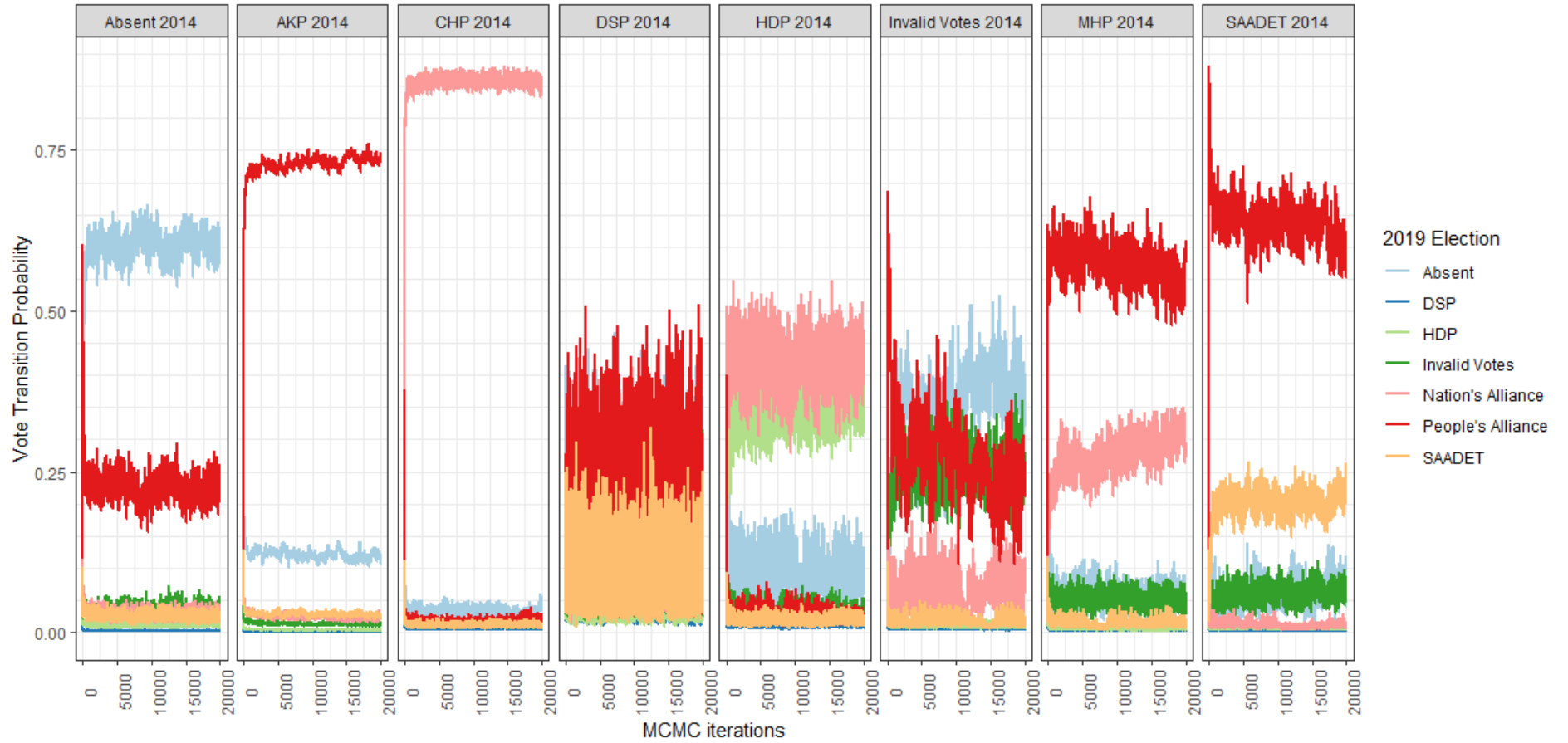
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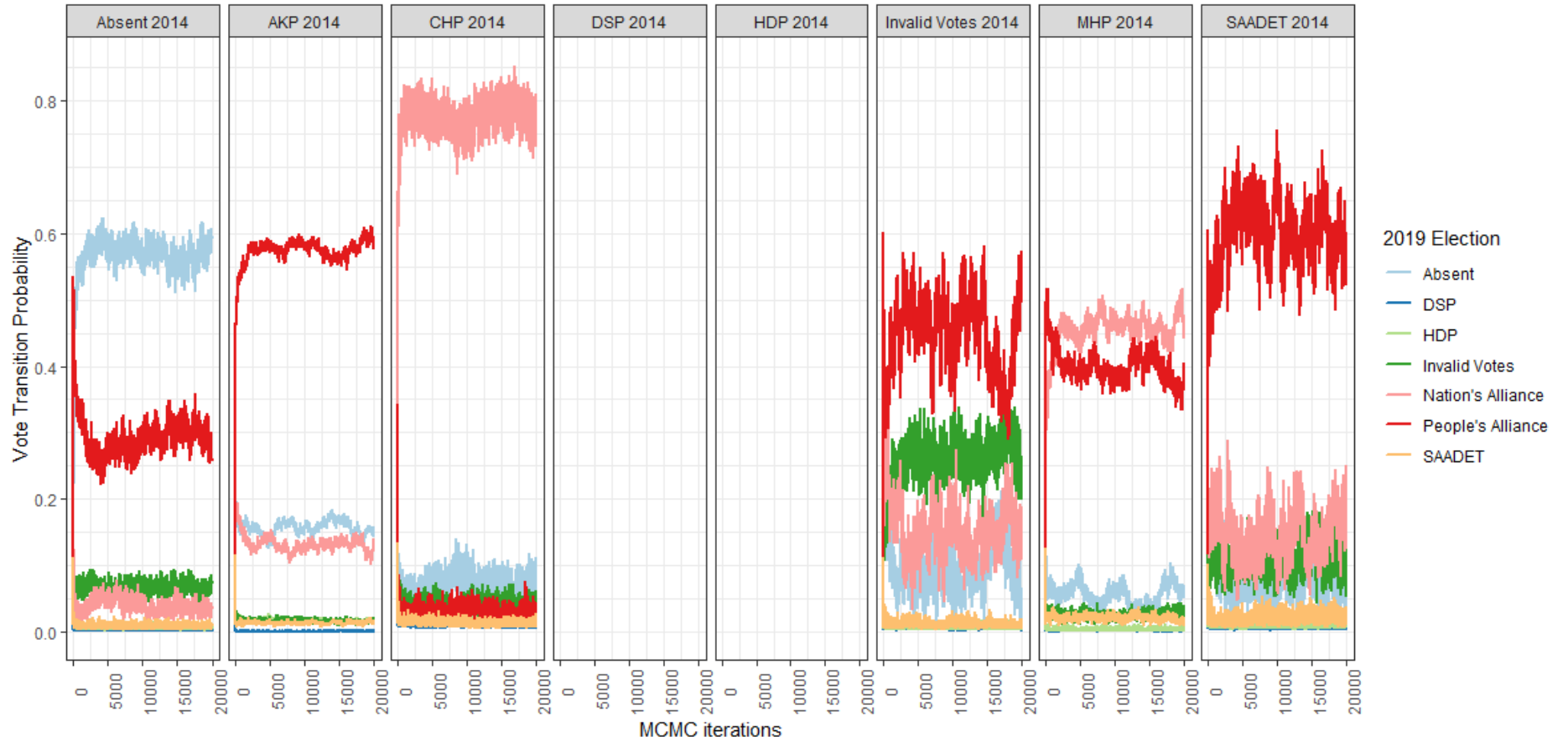
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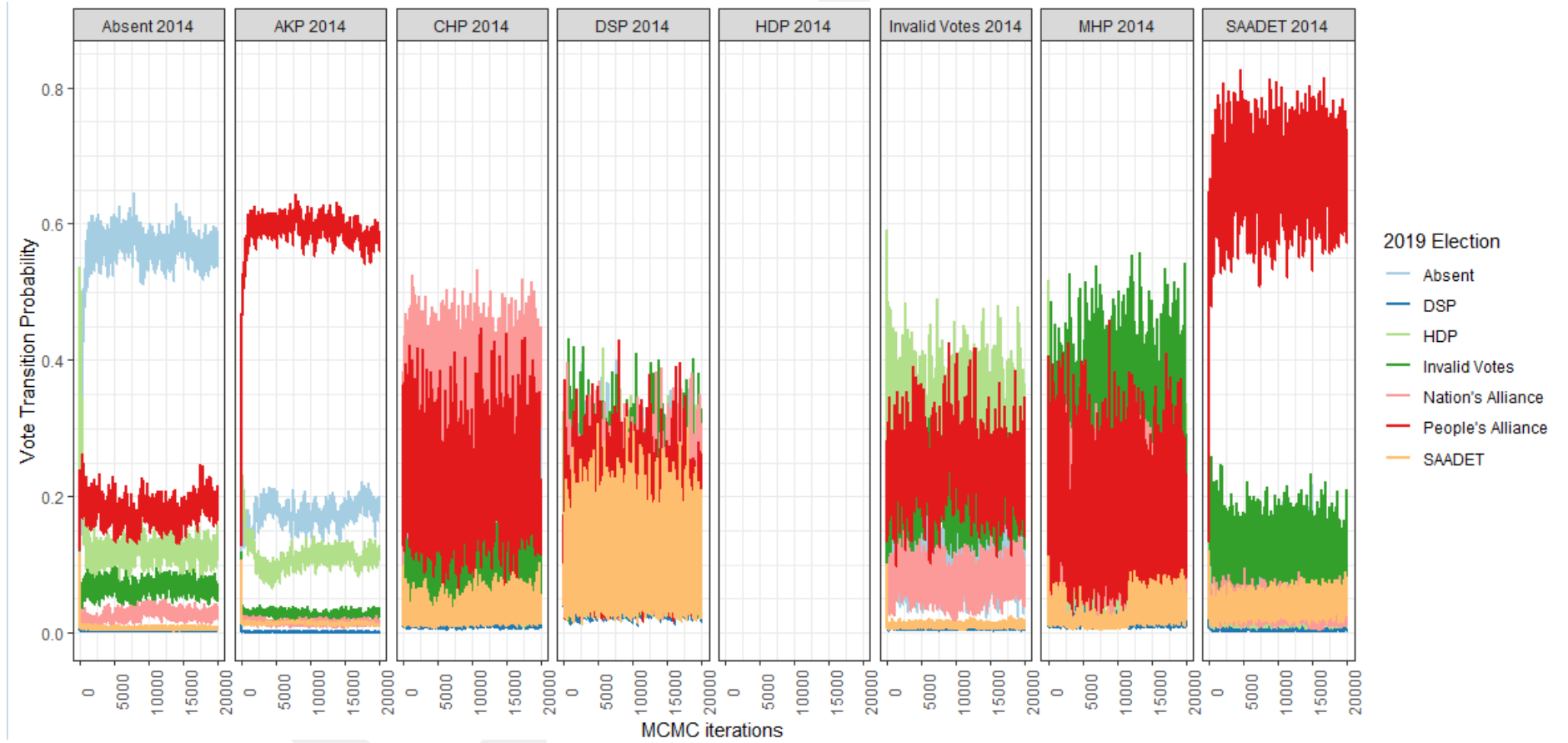
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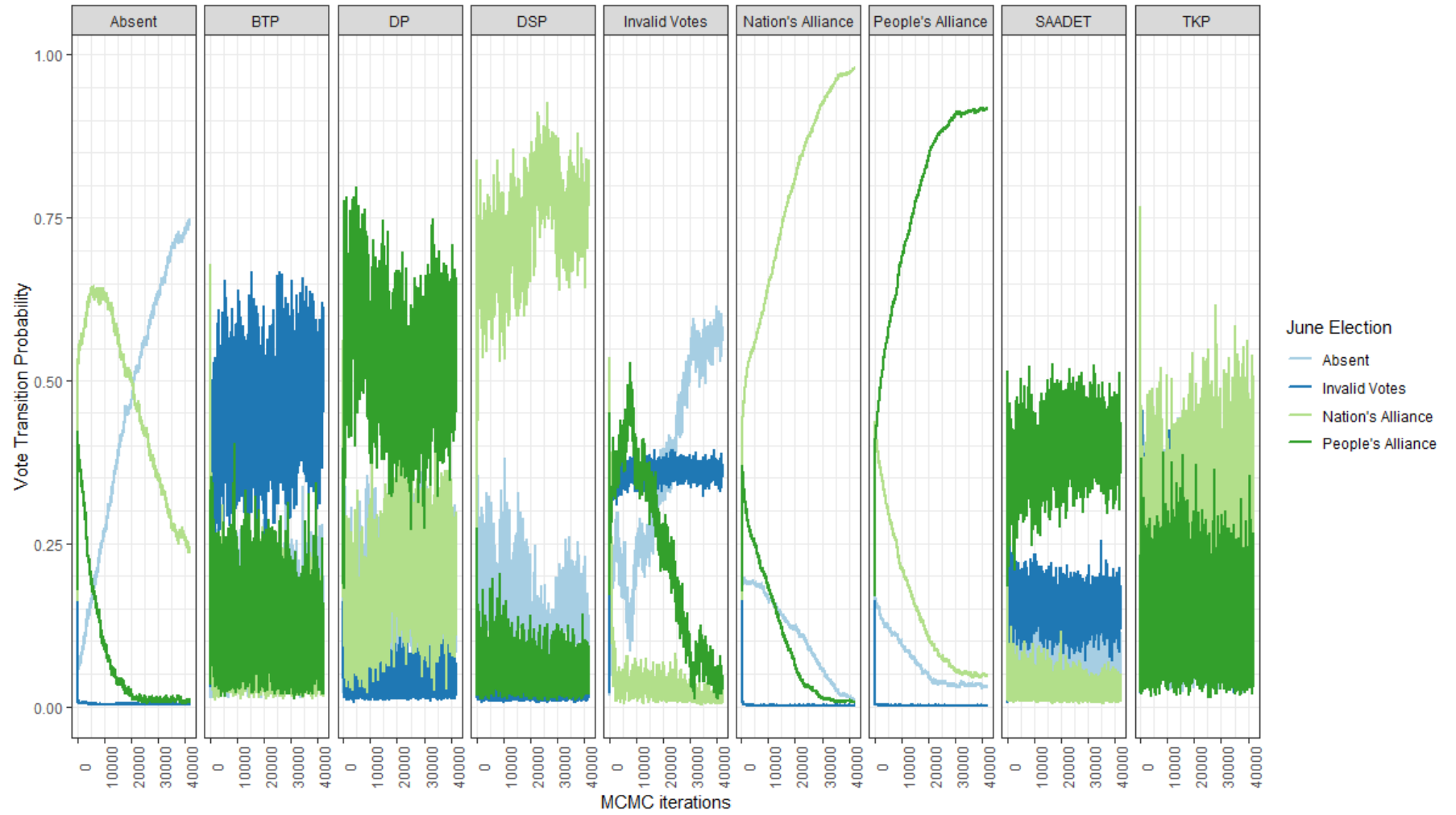
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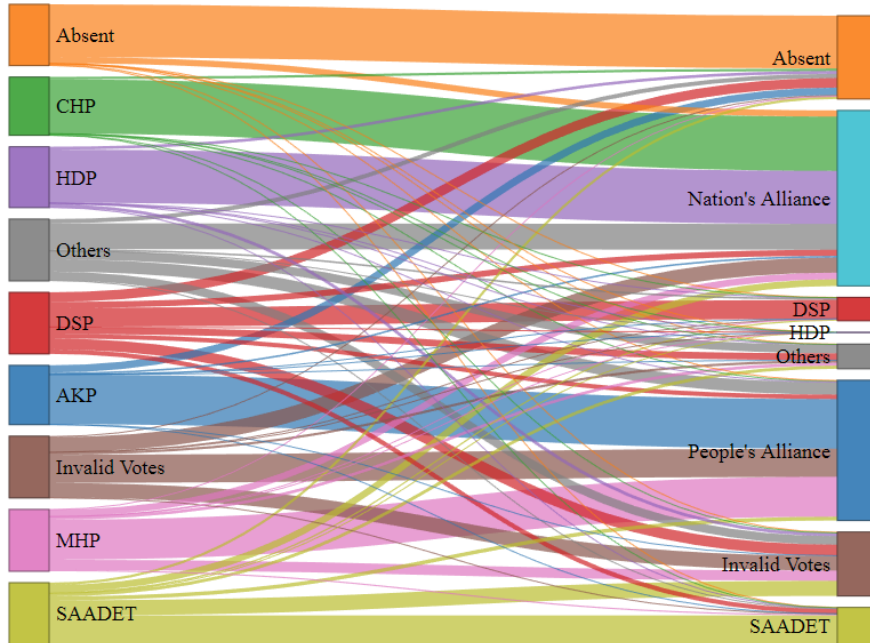
İSTANBUL (March and June 2019)



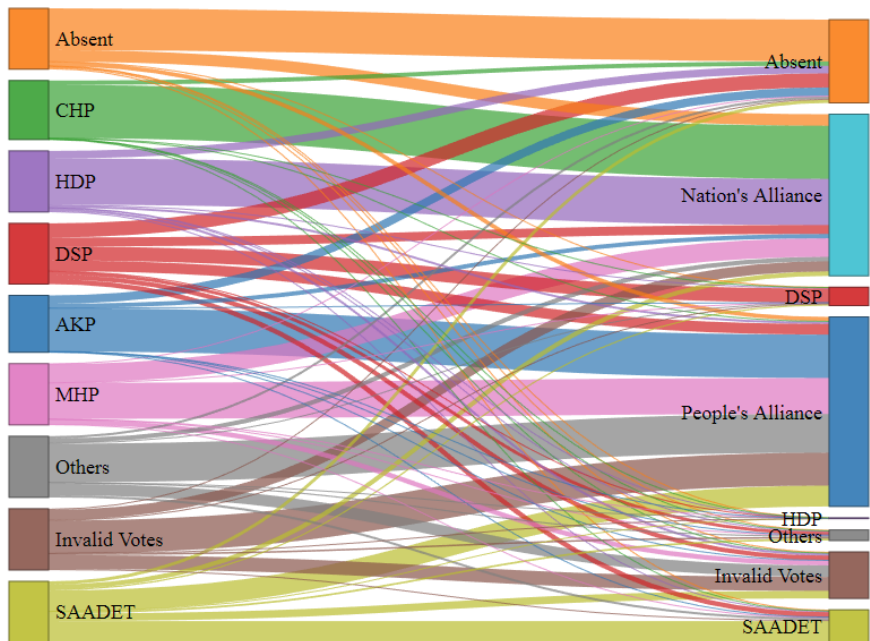
APPENDIX B

SANKEY PLOTS OF VOTE TRANSITION PROBABILITIES FROM 2014 TO 2019

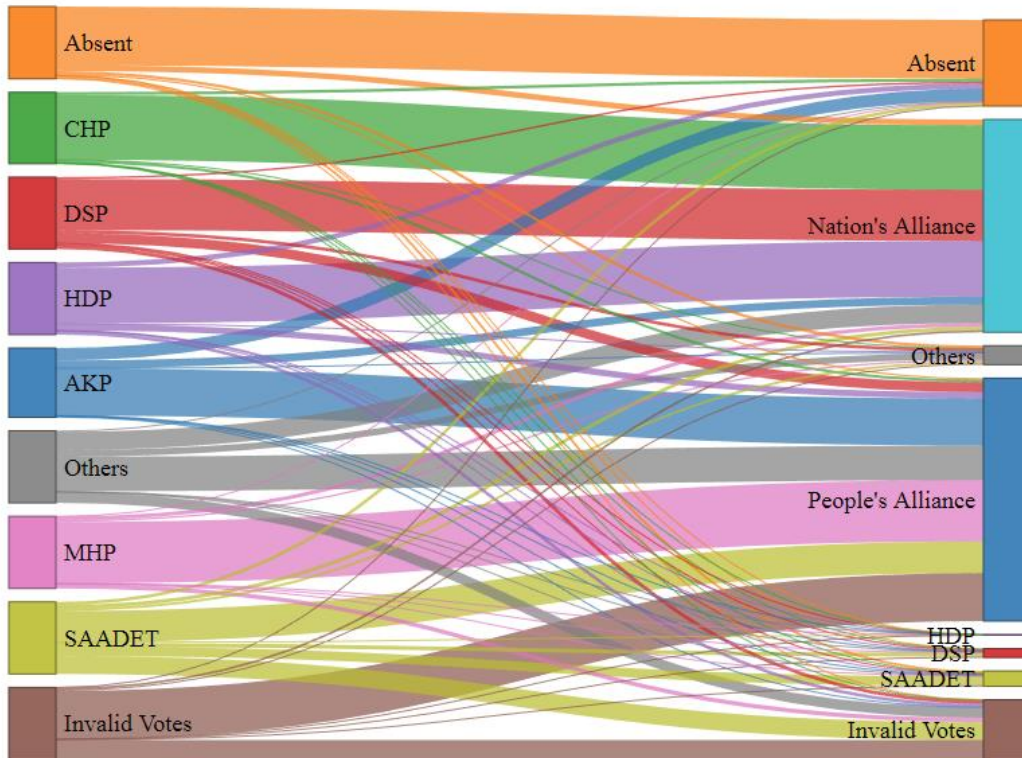
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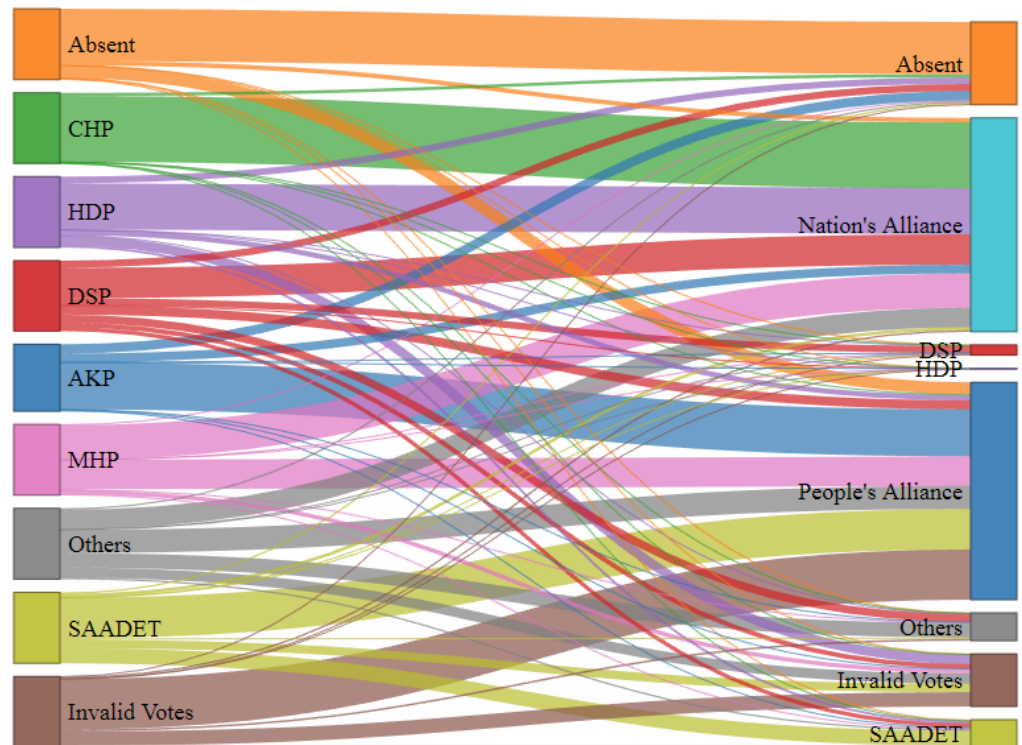
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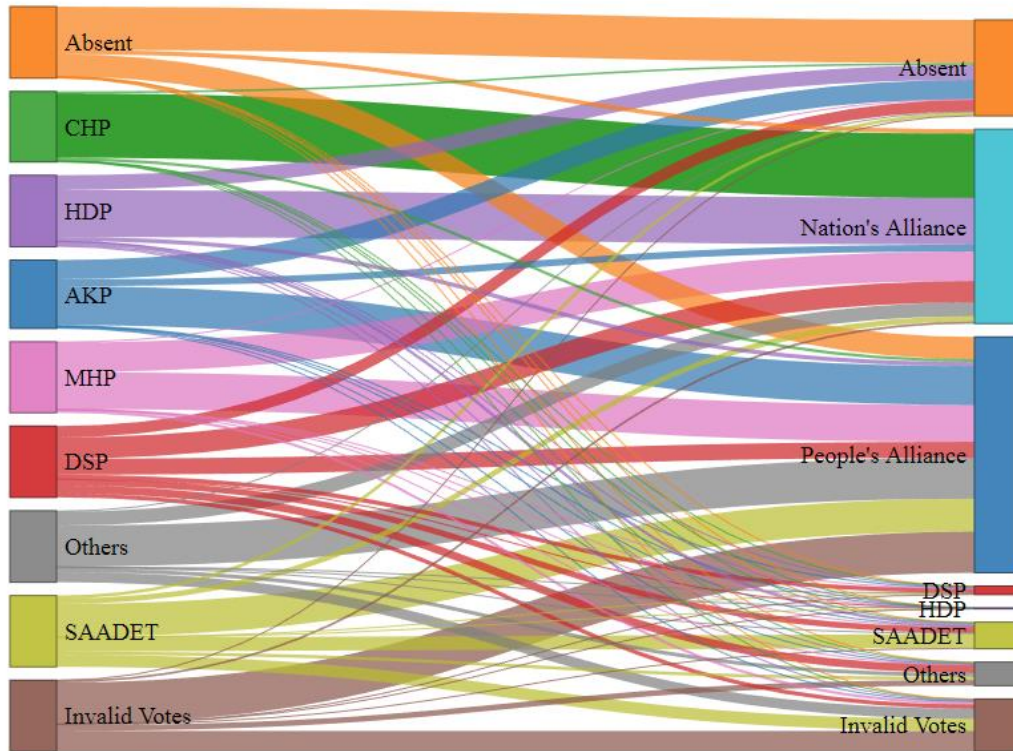
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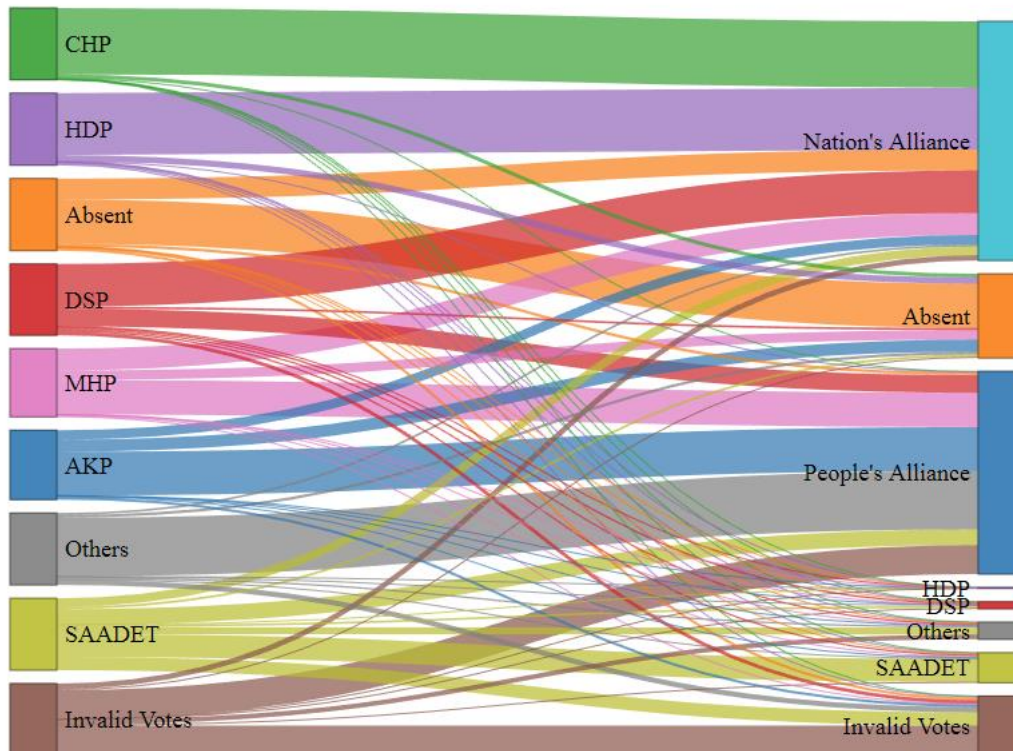
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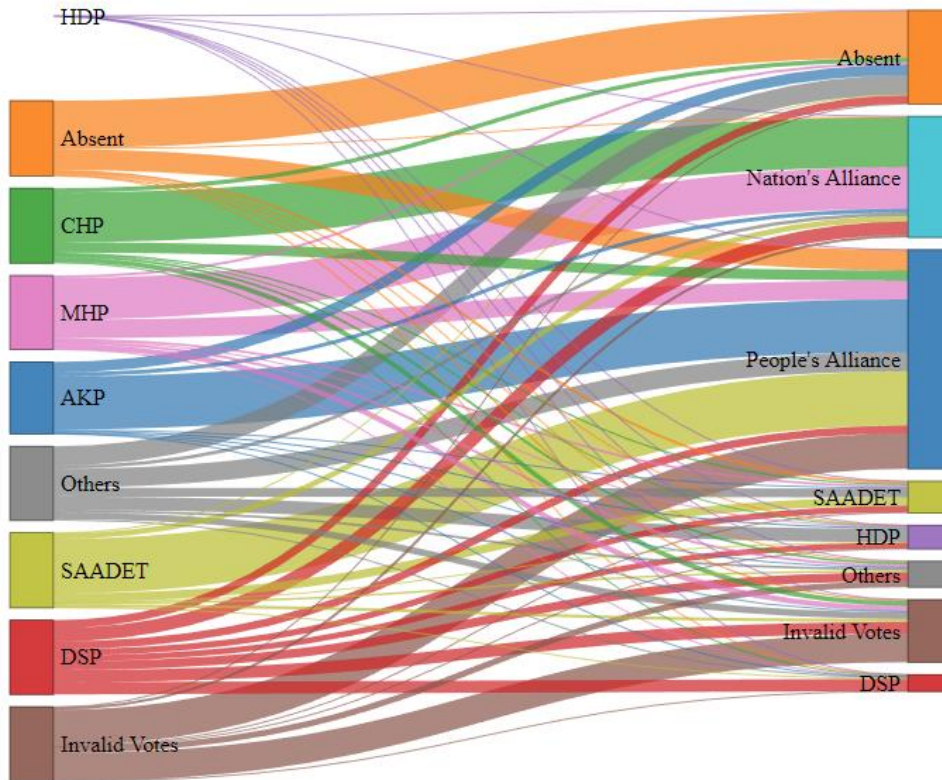
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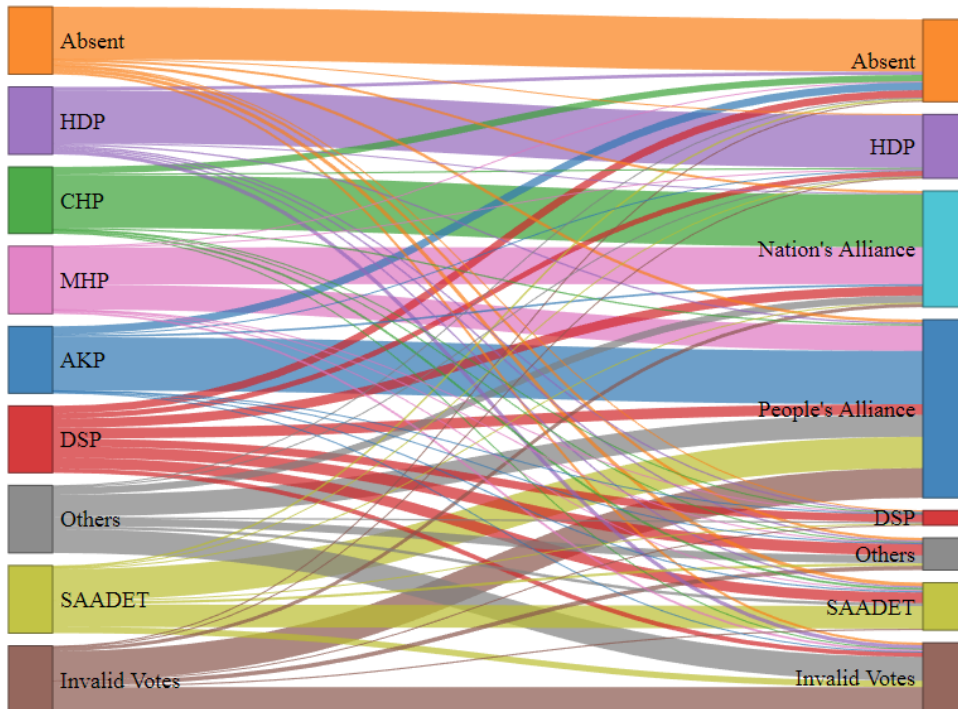
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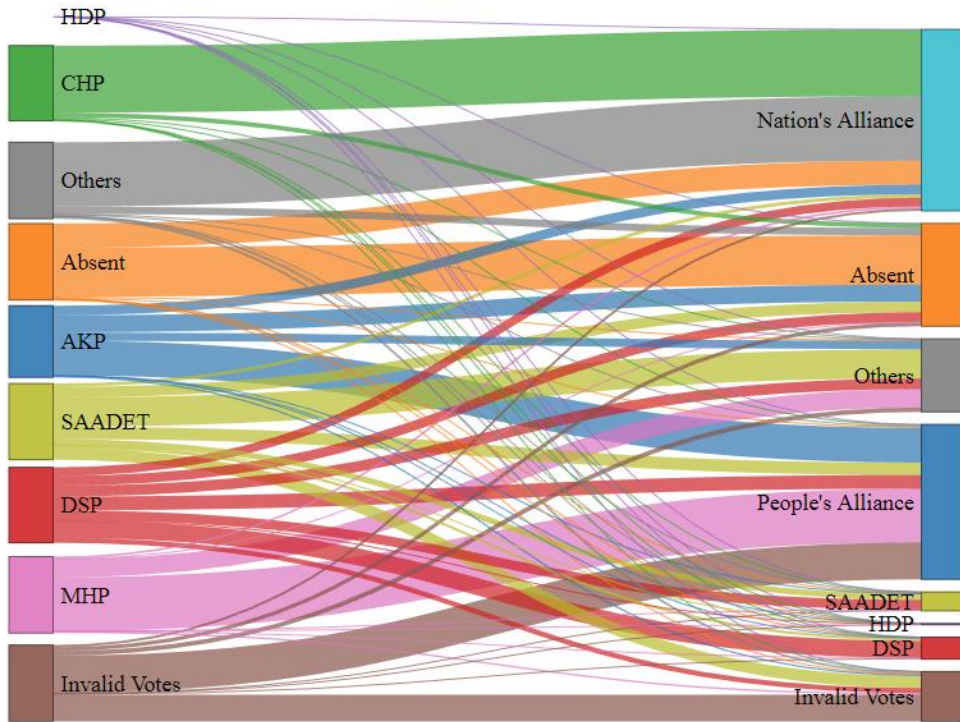
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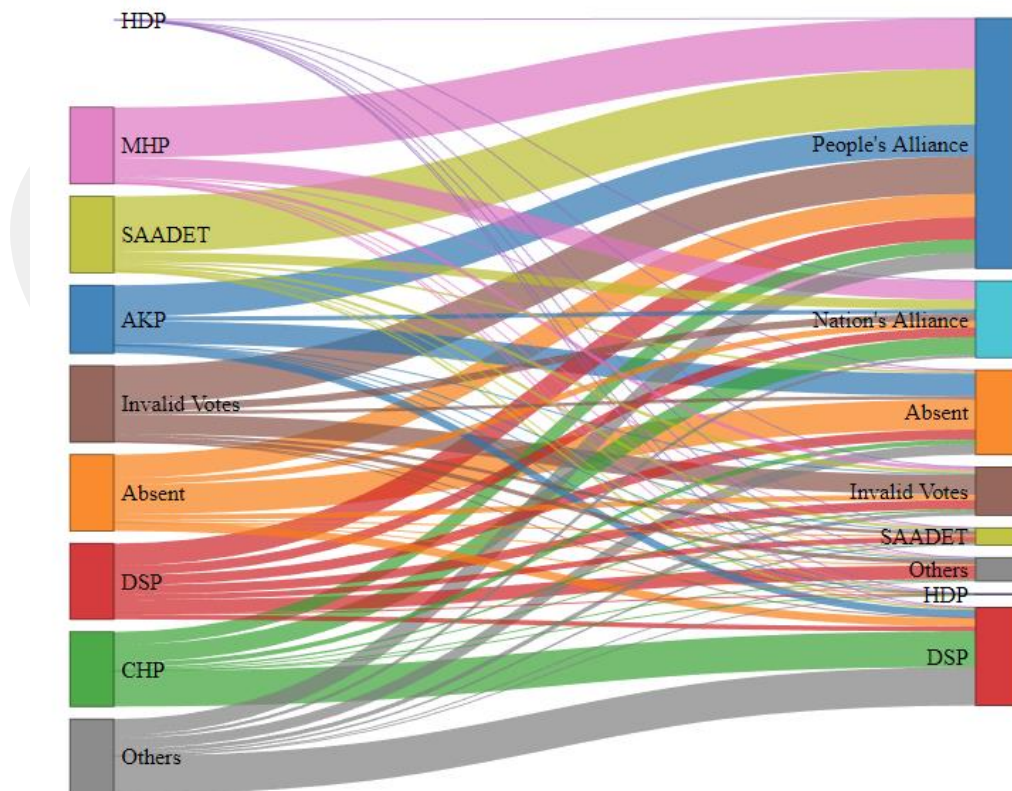
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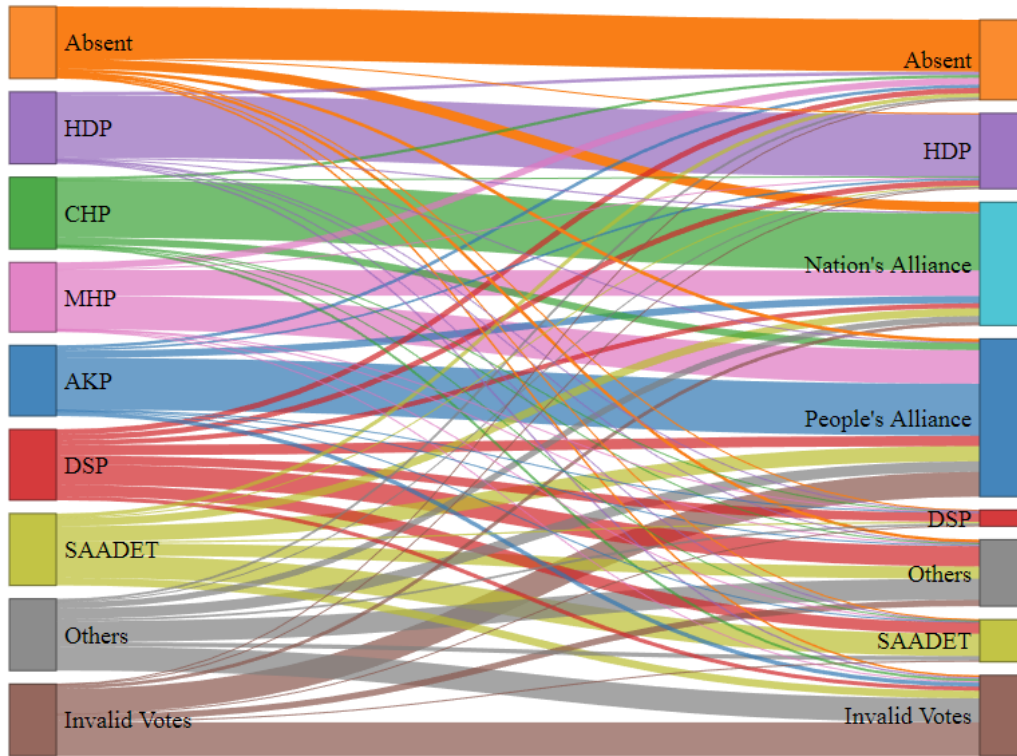
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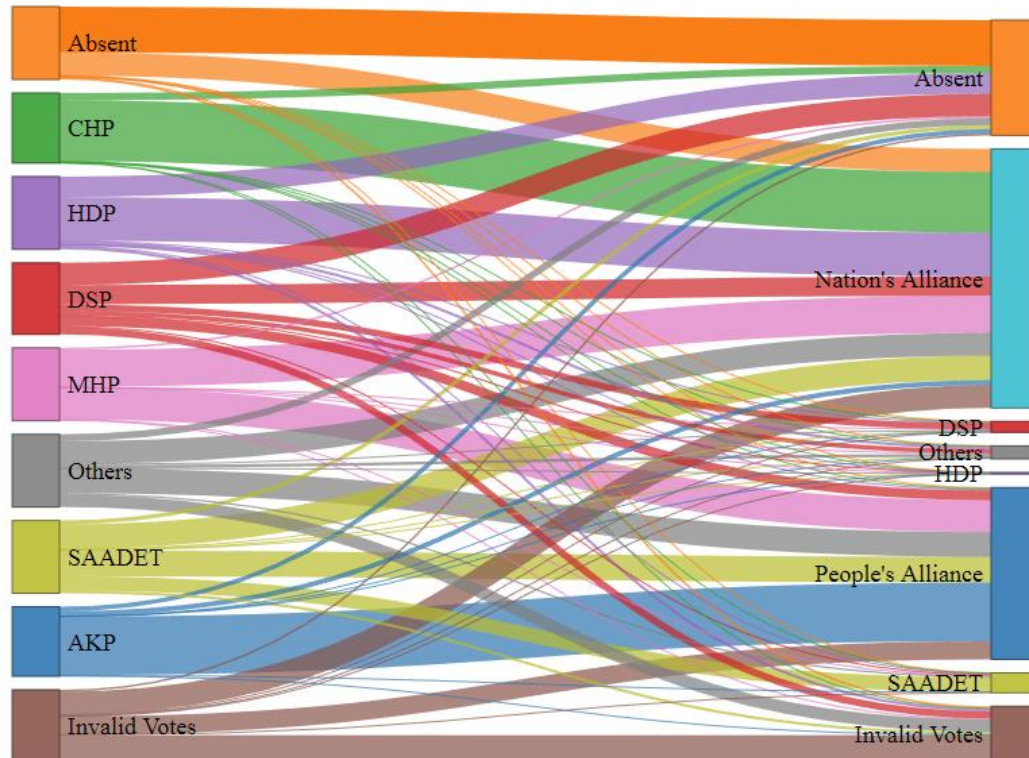
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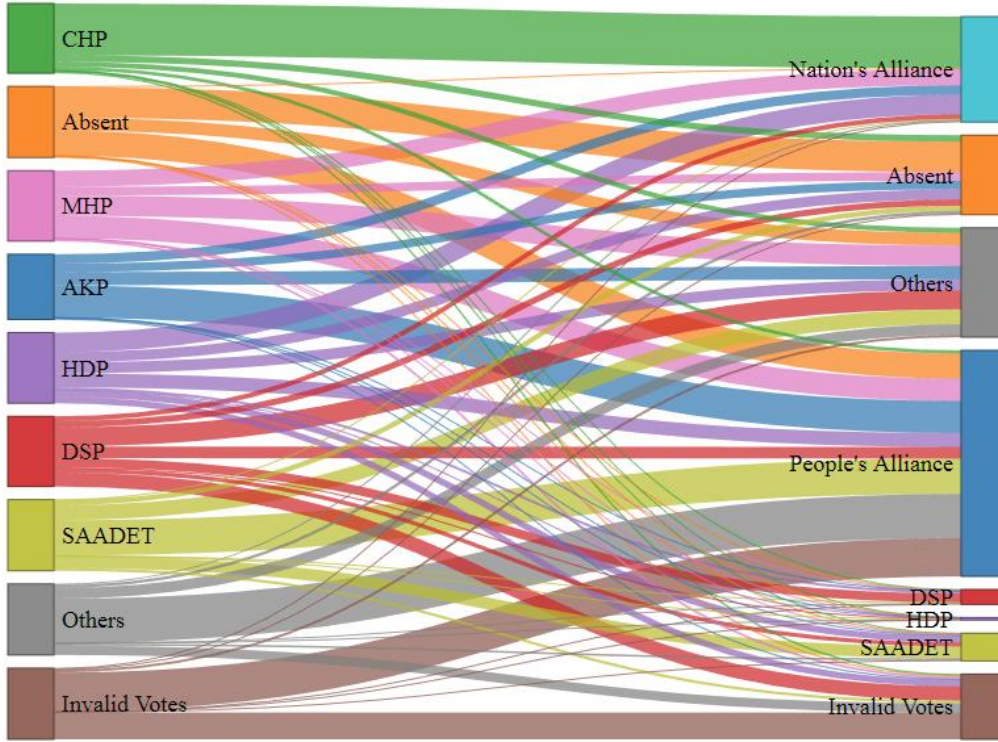
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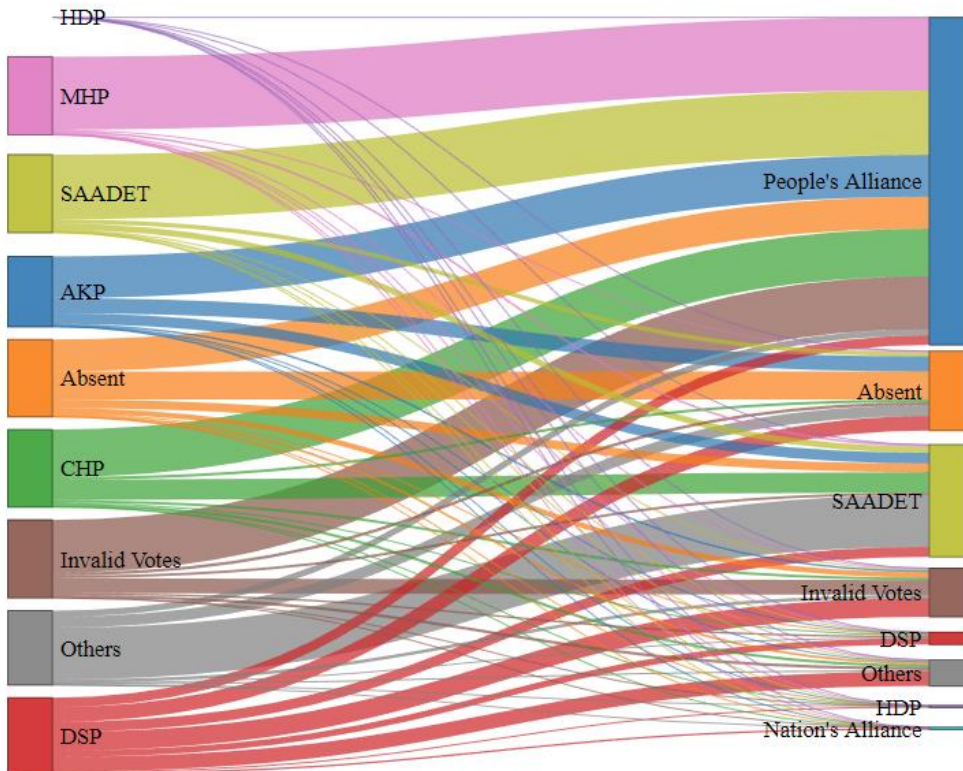
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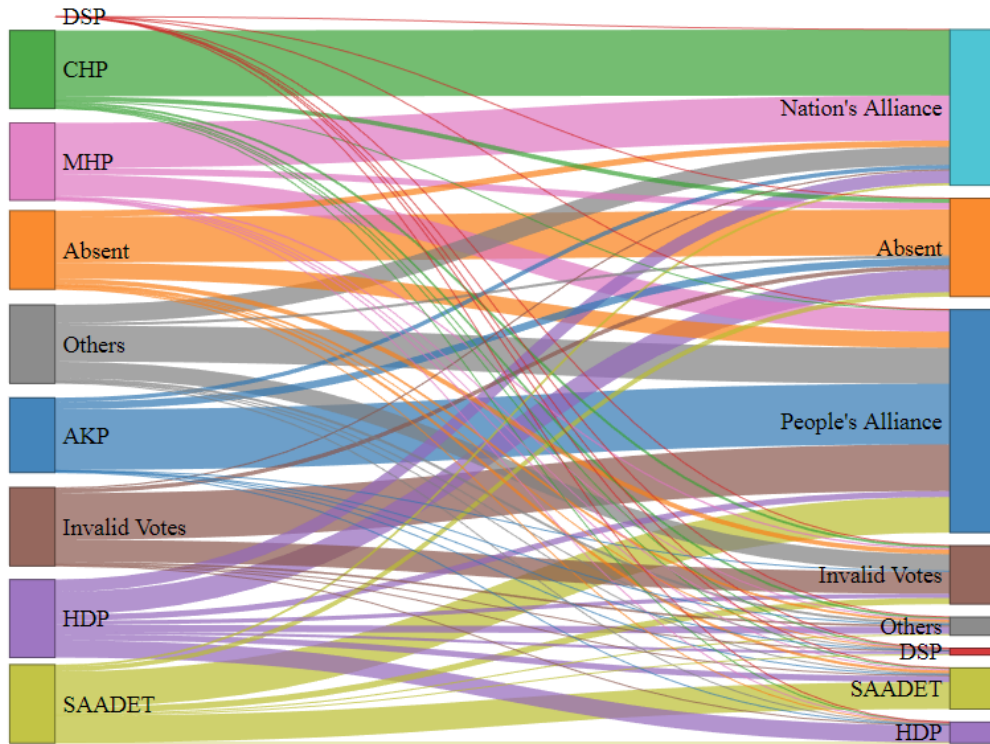
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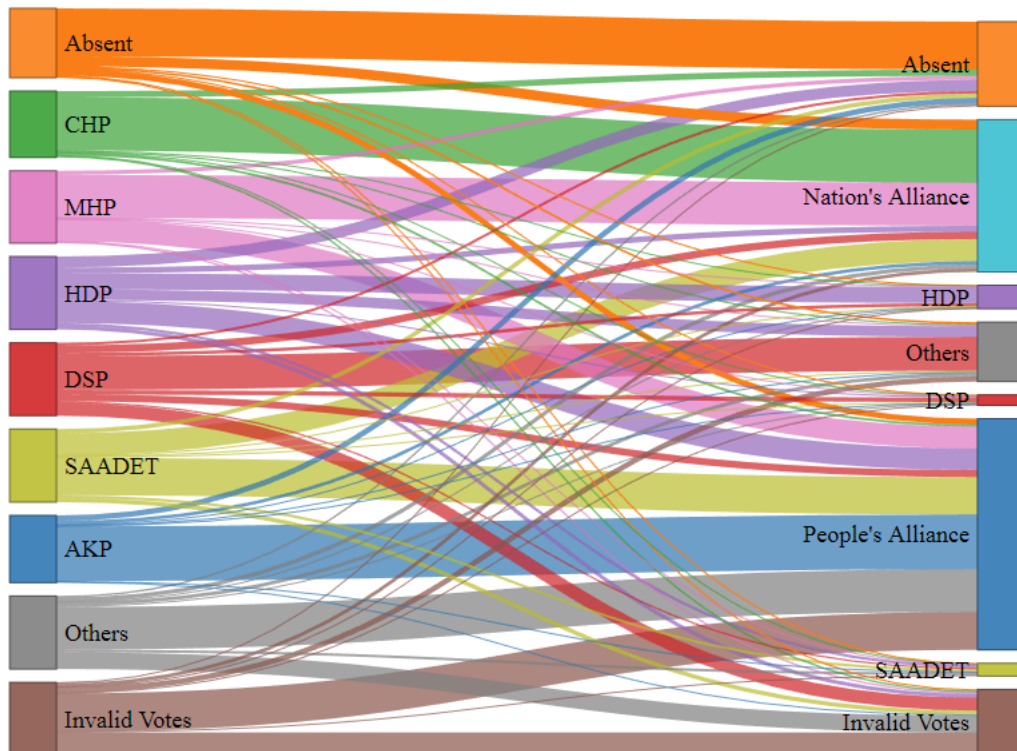
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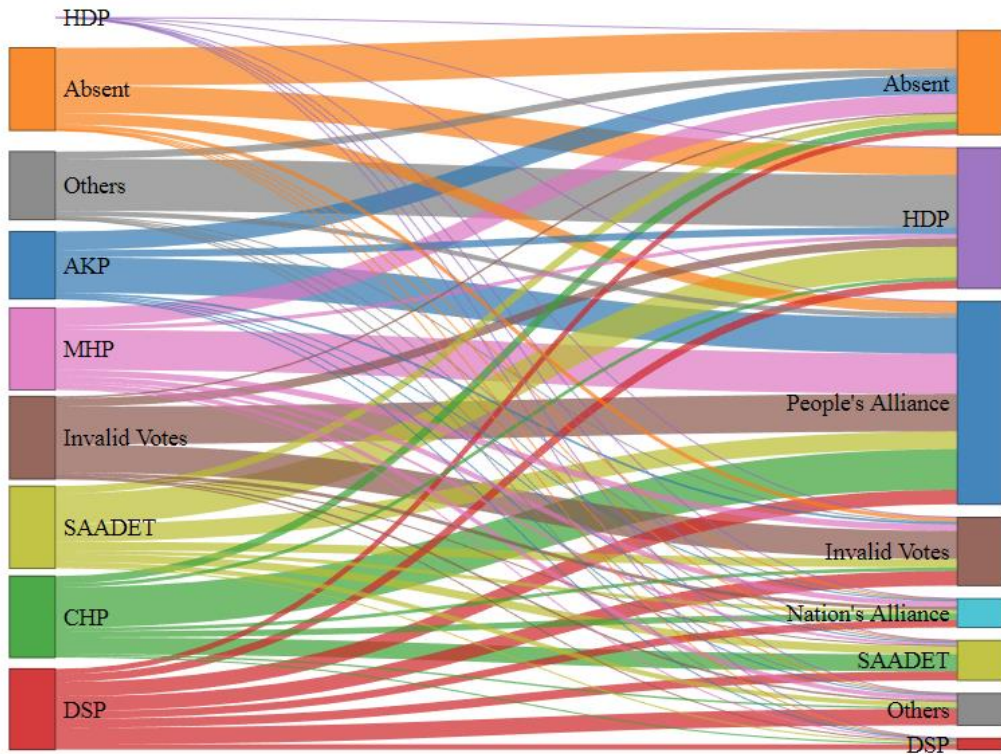
KAYSERİ



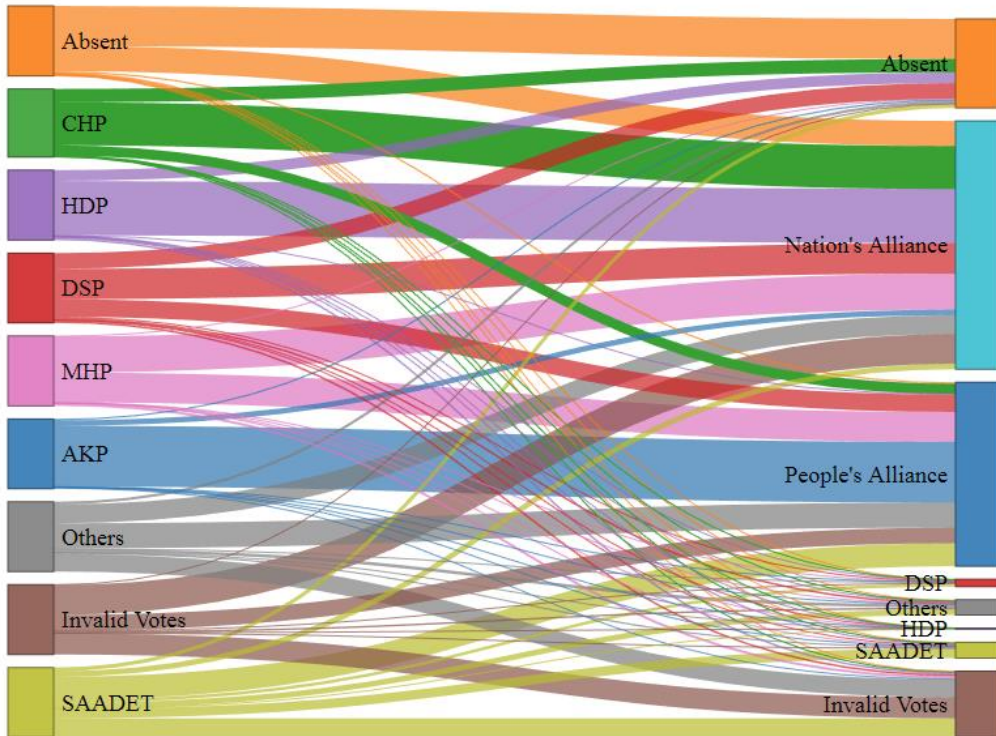
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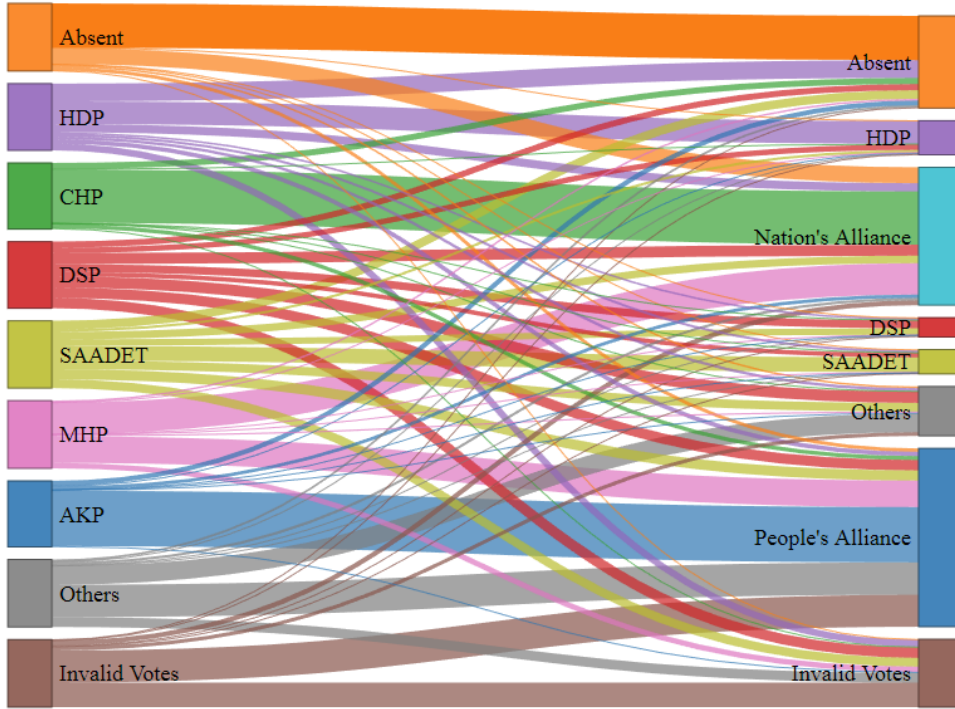
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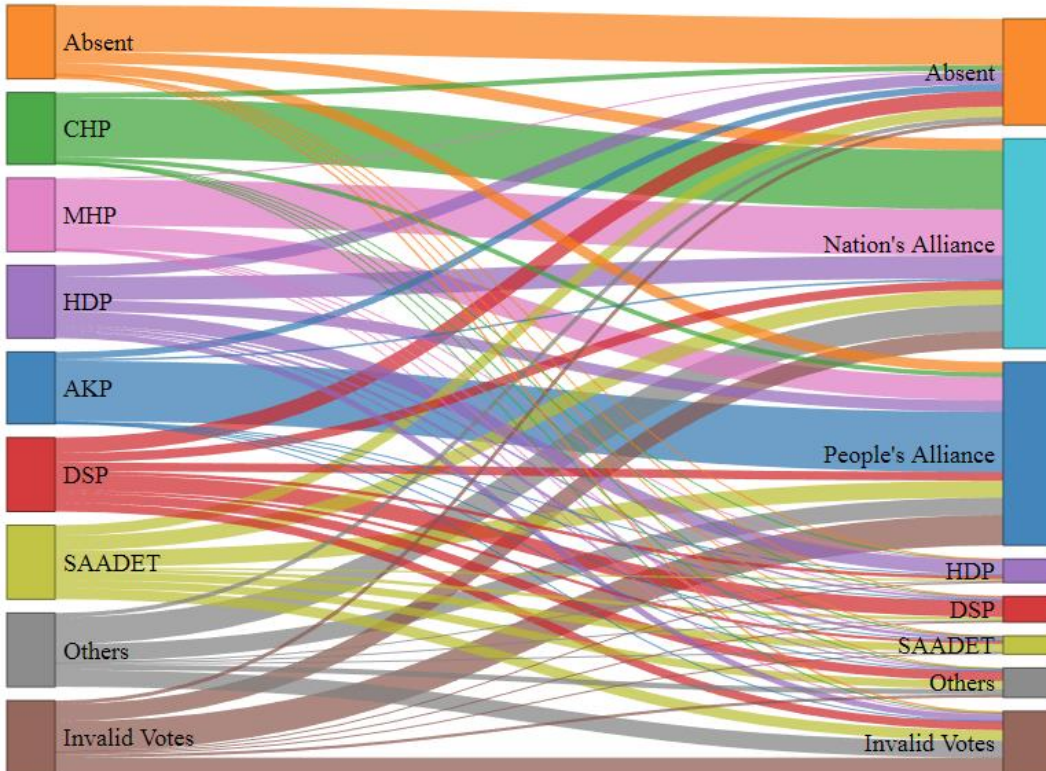
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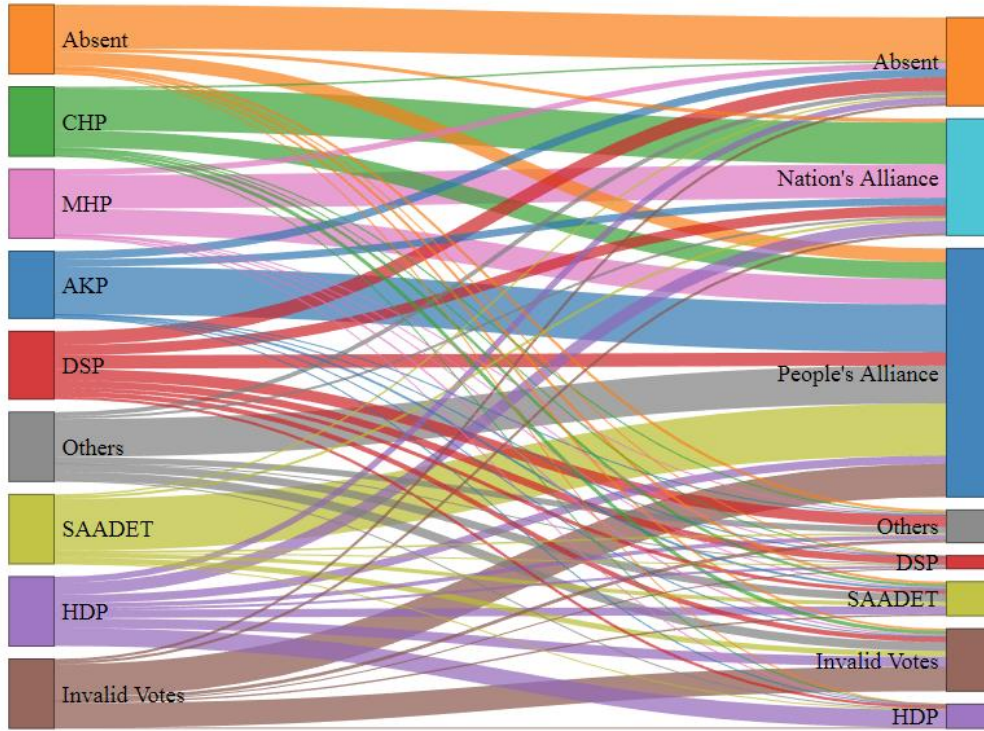
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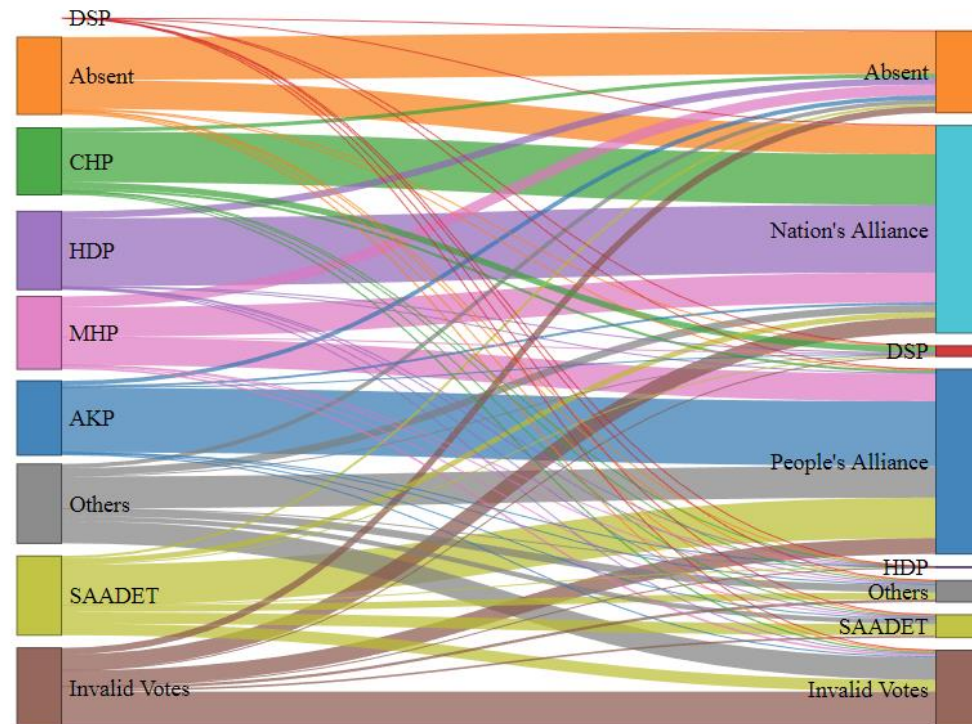
TEKİRDAĞ



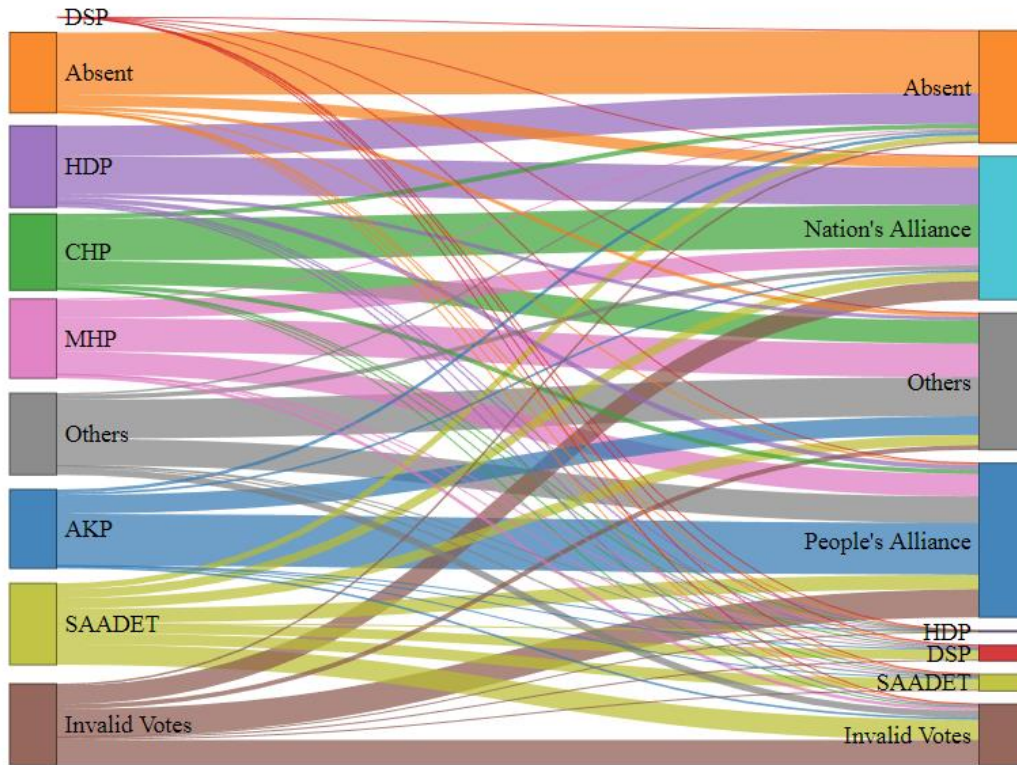
SAKARYA



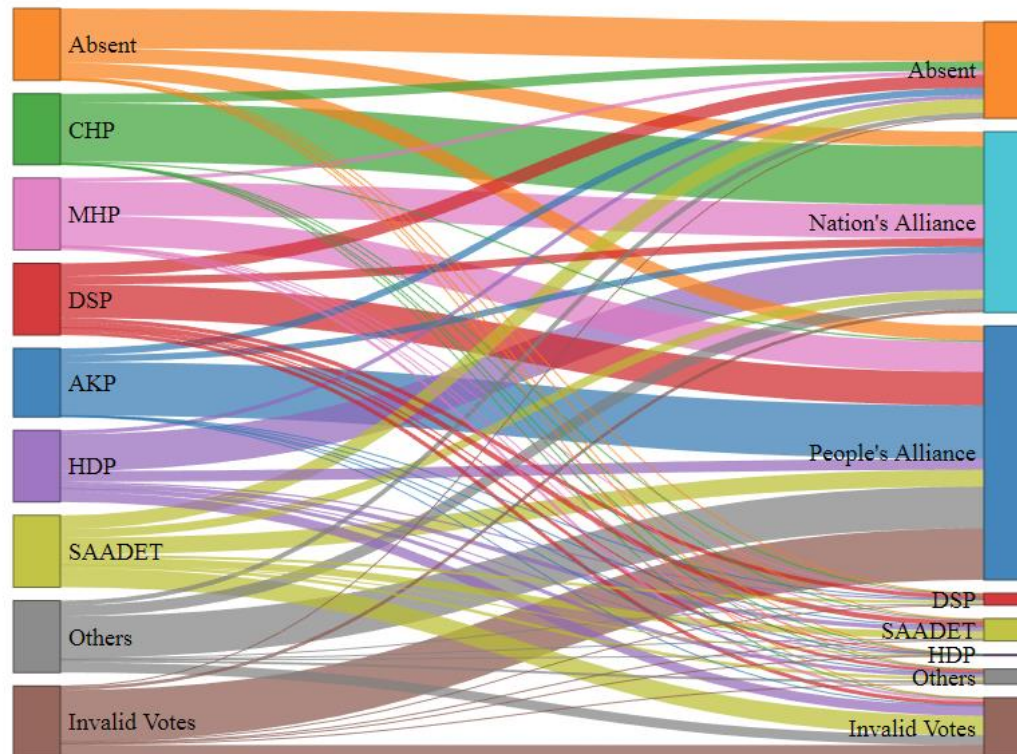
KAHRAMANMARAŞ



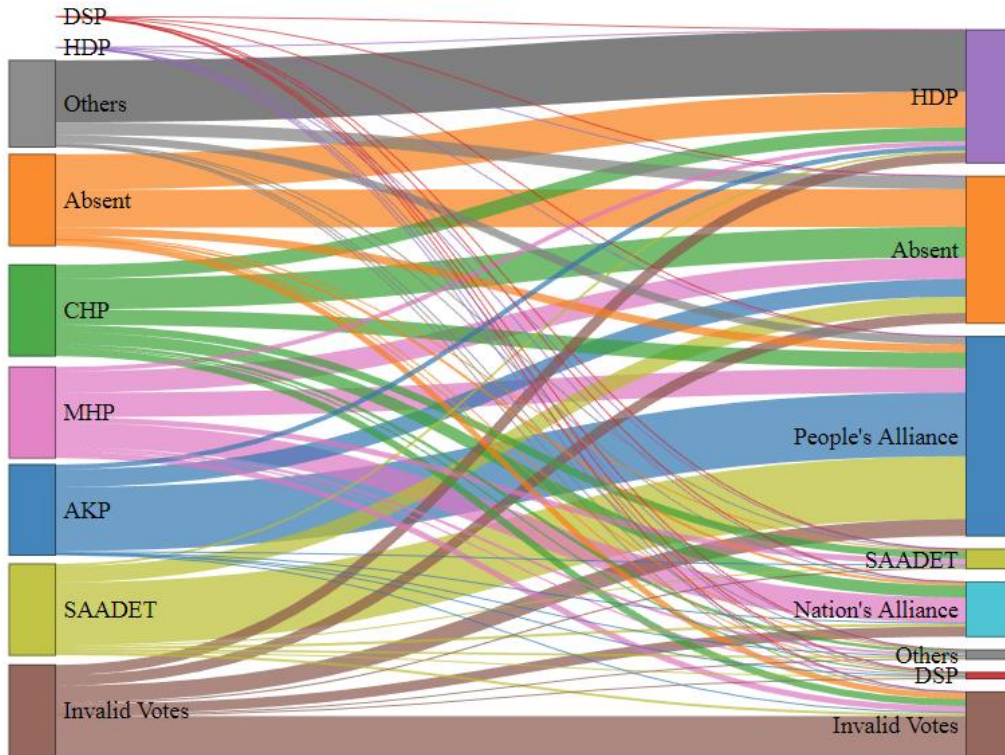
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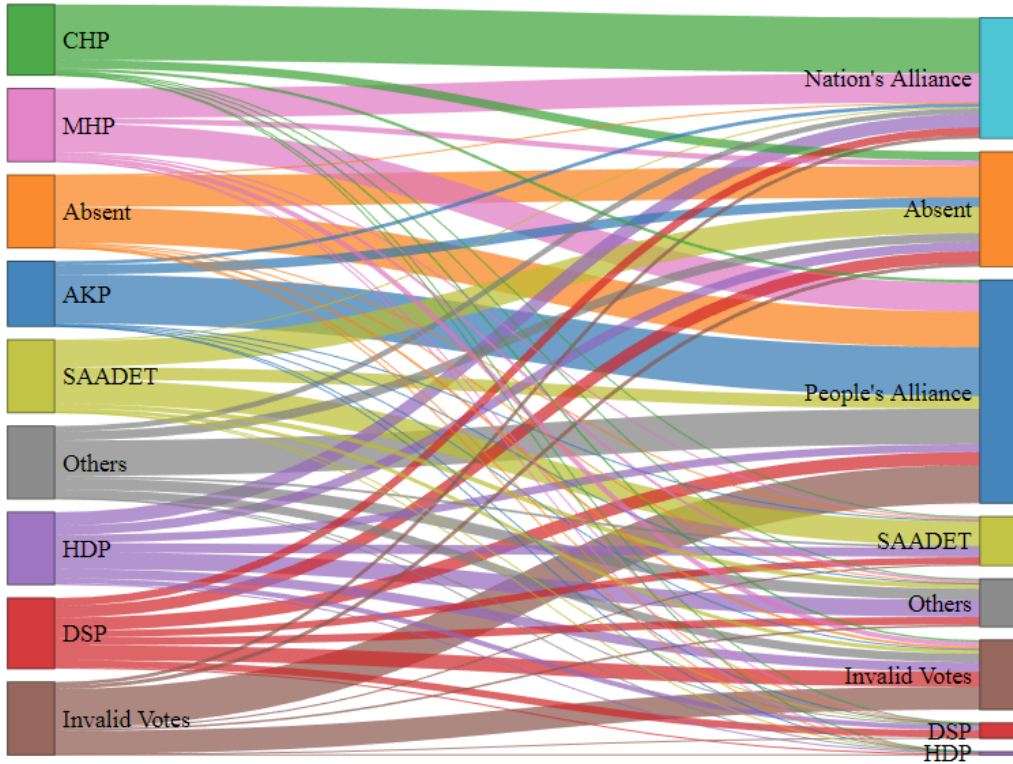
ESKİŞEHİR



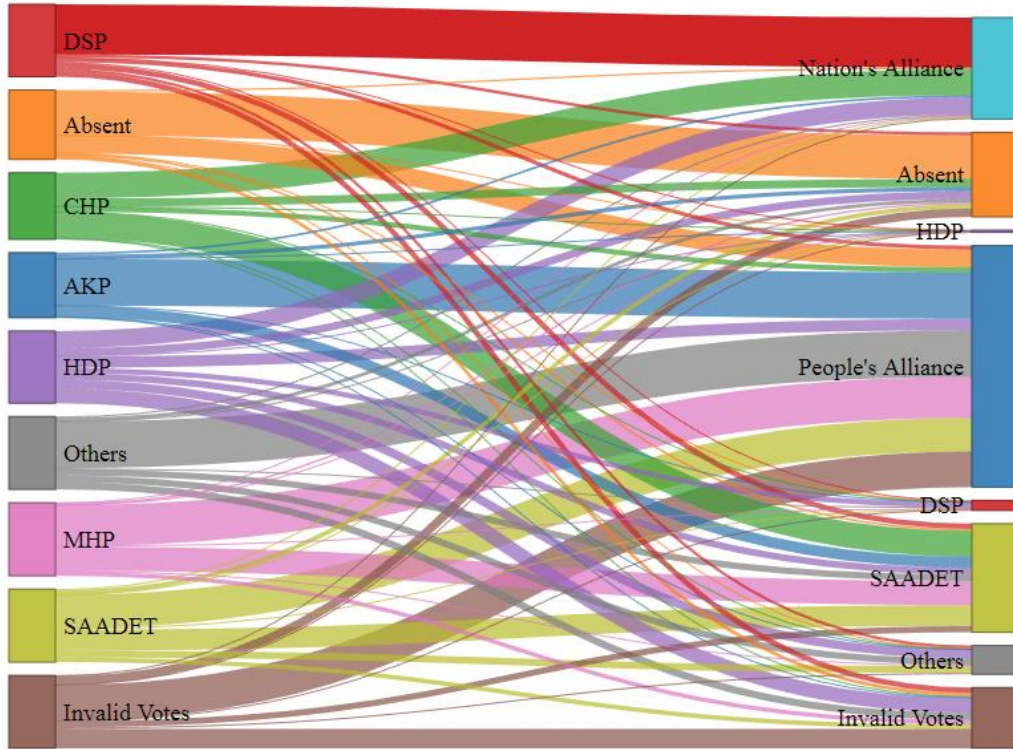
VAN



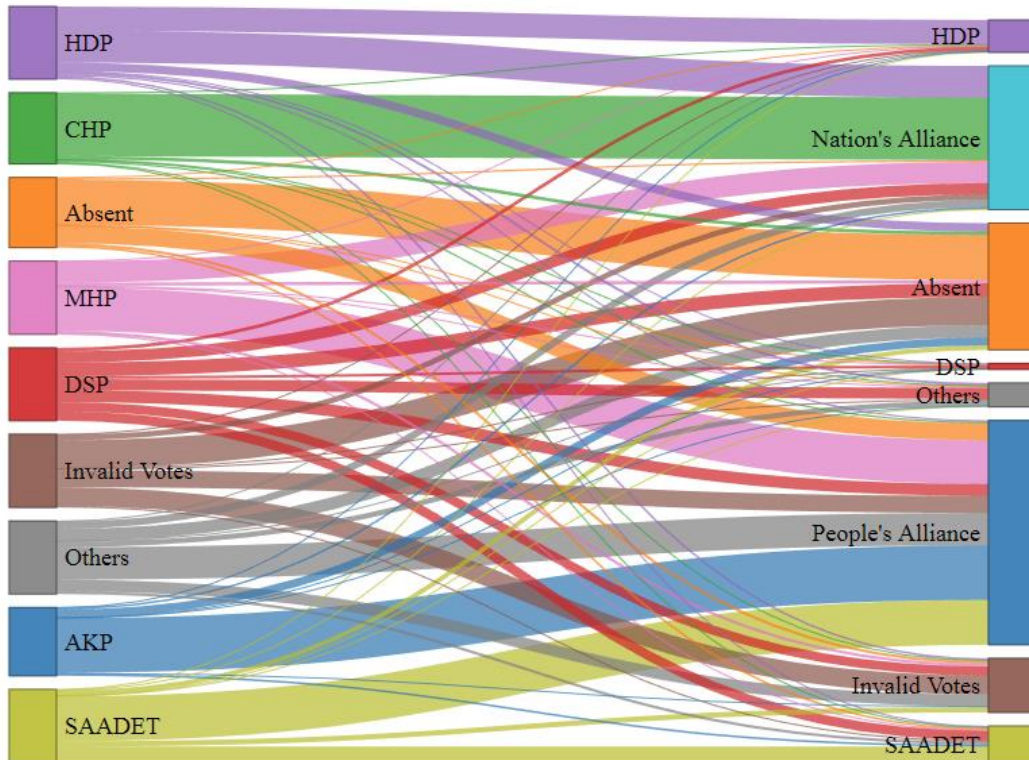
TRABZON



ORDU



MALATYA



APPENDIX C

SANKEY PLOTS OF VOTE TRANSITION PROBABILITIES FROM MARCH TO JUNE 2019

İSTANBUL

