Rethinking the Measurement of Party Nationalization

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Abstract

Party nationalization is measured by a variety of indices, none of which is considered fully satisfactory. This paper considers the problem as one of association between vote and territory, and proposes a general latent class based framework for measurement of party system attributes. New indices are formulated in the framework, which relate to other existing indices in party research, are easy to interpret and use, and allow comparisons across electoral systems and theories. For these indices, frequentist and Bayesian uncertainty estimates are available where desirable.
Bigfoot is blurry, that’s the problem. It’s not the photographer’s fault.

– Mitch Hedberg

1 Introduction

In party research, party nationalization is understood as the homogeneity of party support and competition across territorial divisions within countries. Despite this consensus, there is no equally consensually adopted measure of it. Although there are now at least a dozen measures available, none is considered fully satisfactory, a state of affairs summarized in section 2. This paper argues that the measurement of party nationalization can be rethought as one of association between territory and electoral behavior. Section 3 shows how this renders certain features of existing indices that are seen as problematic appropriate, and others that are seen as desirable less so. The main contribution of this paper is a general framework for measurement of party system attributes. Within this framework, indices are proposed which are easy to interpret and use, and allow comparisons across elections and theories. The framework and the indices are presented in section 4 and compared with selected existing ones in section 5.

2 Party nationalization

Comprehensive accounts of the history of the concept or party nationalization and its measurement are offered by Caramani (2004), Bochsler (2010), and Golosov (2014). This paper focuses on the measurement of the concept, and from this perspective three features of the extant literature are salient. First, it is seen as highly desirable by most of the literature to have a one-number summary that captures how nationalized a party or a party system is, and sets of desirable properties for this summary are proposed. Second,
there is a consensus on the observable implications of a perfectly nationalized party or a system thereof. Under perfect nationalization, each party receives within each territory the same fraction of local votes as is its national share. Third, there is no such consensus on what should we observe under the perfect opposite of nationalization. The latest literature on the measurement of the concept (Bochsler, 2010; Golosov, 2014) defines this state as one of perfect concentration, under which each party receives all its votes from a single territory, and some texts (Golosov and Ponarin, 1999; Golosov, 2014) label it as ‘perfect regionalization.’ This notion, explicitly or not, is not shared by all. For this reason, different measures are used that appear to give different answers to the same question. Under some of these measures, different states are further from nationalization than the one of ‘perfect regionalization.’ In other words, different concepts of party nationalization are being used by alternative measures, and can be defined by what they consider as the opposite of nationalization. To understand why this state of affairs persists, and resolve it, it is useful to rethink the measurement of party nationalization as one of association between territory and vote, and consider party nationalization indices as distance measures between the observed distribution of votes and a distribution that belongs to a model of substantive interest.

3 Needs name

Measures of party nationalization typically use electoral data that can be represented as a two-way table that cross-classifies voters by territory and behavior. The set of behaviors usually consist of party choices, but can also include non-voting, casting of invalid ballots, or, in the context of referenda, answers to questions. Data of this type can come also from sample surveys, but is relatively rare in the literature given its limited availability compared to that of electoral returns. Hereafter, it is assumed that the data comes in
the form of territory-by-choice matrices with $N$ territories and $J$ choices, and $v_{i,j}$ is the number of votes cast for $j^{th}$ choice in $i^{th}$ territory, as shown in table 1. The national share for $j^{th}$ choice is referred to as $s_j$ and the territorial share in $i^{th}$ territory as $p_{i,j}$. The rank of $p_{i,j}$ within $j^{th}$ column is referred to as $r_{i,j}$. The fraction of votes for $j^{th}$ choice that comes from $i^{th}$ territory is referred to as $c_{i,j}$. In some instances where only a single choice is considered, the $j$-index is omitted.

<table>
<thead>
<tr>
<th>Territory</th>
<th>$C_1$</th>
<th>$C_2$</th>
<th>...</th>
<th>$C_J$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_1$</td>
<td>$v_{1,1}$</td>
<td>$v_{1,2}$</td>
<td>...</td>
<td>$v_{1,J}$</td>
</tr>
<tr>
<td>$T_2$</td>
<td>$v_{2,1}$</td>
<td>$v_{2,2}$</td>
<td>...</td>
<td>$v_{2,J}$</td>
</tr>
<tr>
<td>$T_N$</td>
<td>$v_{N,1}$</td>
<td>$v_{N,2}$</td>
<td>...</td>
<td>$v_{N,J}$</td>
</tr>
</tbody>
</table>

A fictitious example of such data is shown in table 2, which reports returns from an election in which two parties competed across four territories. Because of the consensus on the observable implications of perfect nationalization, under all measures of party nationalization we would for the same party and territory totals as in table 2 consider only the distribution in table 3 as perfectly nationalized. This distribution uniquely describes independence of territory and vote for the given set of marginals. In short, under perfect party nationalization vote is not associated with territory.
Table 2: Example of electoral returns from a fictitious election.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Territory</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>111</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>111</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>81</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>93</td>
<td>87</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Distribution of votes (rounded) under perfect nationalization for fictitious elections in table 2.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Territory</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>104</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>110</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>91</td>
<td>89</td>
<td></td>
</tr>
</tbody>
</table>

But what distribution corresponds to the perfect opposite of nationalization? This question might seem easy, but deceivingly so. An even simpler example, shown in table 4, can demonstrate this. For a two-by-two table, it might appear intuitive that association would be perfect if $x = y$ or $x = 1 - y$, i.e., if $b = c = 0$ or $a = d = 0$, respectively. If $x$ stands for territory and $y$ for party, this corresponds to the notion of perfect regionalization, defined by some (Golosov and Ponarin, 1999; Golosov, 2014) as the opposite of perfect nationalization. However, there are many measures of association based on different concepts of it. (see e.g. Goodman and Kruskal, 1954, 1959) Some distributions correspond to perfect association under some, but not all measures, but the lack of association corresponds to the same distribution under all. For instance, under a well-known measure of association in cross-classifications, the odds ratio, the value of the statistic ($or = \frac{ad}{bc}$) reaches the lowest or the highest possible value and the association is perfect if any of the four cells is 0.
Table 4: An example two-by-two table.

<table>
<thead>
<tr>
<th></th>
<th>y = 0</th>
<th>y = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>x = 0</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>x = 1</td>
<td>c</td>
<td>d</td>
</tr>
</tbody>
</table>

The same situation, that is the availability of multiple measures that give different answers, is found in the measurement of party nationalization. Party nationalization is formulated as homogeneity, uniformity or equality of vote. Yet, although these concepts have clear definitions, their opposites do not. If the existing measures of party nationalization differ not necessarily because some or all of them would be biased or invalid, but simply because they measure different concepts.

Another perspective on the issue might be provided by considering any measure of party nationalization as a measure of distance $d$ from the observed distribution $O$ to the hypothetical distribution under perfect nationalization $N$,

$$d(O, N).$$

(1)

In this formulation, $N$ can be considered as a model, and $d$ as a measure of its fit to data from $O$. Thus, a more general statement of (1) is

$$d(O, M),$$

(2)

where $M$ is a distribution that belongs to the model, and is either fixed, or selected to optimize $d$. On the most general level, $d$ summarizes of how the observed world differs from its hypothetical state in ways that are deemed important. From that perspective, both the choice of the model and the distance measure are crucial. If the measurements
are to be of any value, both have to be selected based on substantive concerns. The two notions—that perfect nationalization is equivalent to independence between vote and territory, and that any measure of nationalization measures the distance of the data from perfect nationalization—allow us to reconsider what features are desirable for a measure of party nationalization in the remainder of this section, and formulate new such measures in section 4.

### 3.1 Concentration-based indices

To devise new measures of party nationalization, most effort has in the past decade been invested into concentration based indices, which rest on the notion that perfect concentration is the opposite of perfect nationalization. Examples are Party Nationalization Score (PNS) (Jones and Mainwaring, 2003), weighted PNS (WPNS) and standardized PNS (SPNS) (Bochsler, 2010), normalized PNS (NPNS) (Golosov, 2014), or indices of party nationalization and party system nationalization (IPN and IPSN) and (Golosov, 2014). These indices measure party nationalization as the complement of concentration,

\[ d(O, N) = 1 - d(O, C), \]

where \( C \) is a distribution that corresponds to perfect concentration. Under \( C \), each party receives all its votes in a single territory. While considerable progress has been made with these measures, at least in terms of making them sensitive to different unit sizes or scaling them to the \([0, 1]\) interval, two sets of issues hinder their use.

First, these measures are seen as appealing indices of regionalization, since regionalization is accompanied by concentration. Yet, concentration can occur also in the absence of regionalization. Consider the example of two parties that both receive support in three units only, collecting the same share of votes in each unit in a system with ten districts of
equal size and turnout. However, one of the parties receives its support in three neighboring units, the other from units scattered across the country. Their concentration-based scores are identical, but few would consider them as equally regionalized. This occurs under any measure that does not account for the location of the units. Measures that take location into account have been available in other disciplines for several decades. In short, the concentration-based indices do not fit well with the theory of party regionalization that motivates their choice, and alternatives superior in this respect are available.

Second, considering perfect concentration as a model, its usefulness is limited. If there are more territories than parties, and nowhere there will be no turnout, then perfect concentration is not possible. In most contexts the number of territories is much larger than the number of parties, and even the highest possible concentration within given constraints will be far from perfect according to standard measures. Consequently, perfect concentration is in many settings a model that is with high certainty known to be solidly false even before inspecting the data. As “[a]ll models are false, but some are useful” (Box, 1976), this of course is not a reason for discarding it. The question is, to what extent is the model of perfect concentration substantively useful. The answer to this question rests on the fact that concentration based indices of party nationalization build on research on wealth and income inequality.

The measures, as well as the criteria declared as desirable of them (Bochsler, 2010; Golosov, 2014) are taken from this research, based on the assumption that equality and inequality of territorial distributions of votes and of income and wealth share the relevant attributes. However, this assumption might be unwarranted. Income is in many societies redistributed through taxation in a process controlled by a redistributor. It is at best difficult to find an analogical process in elections. The closest analogues are party co-operation based on non-competition, and redistricting. Neither can be expected to

1 Interested reader can consult a concise review of these indices by Massey and Denton (1988).
result in transfers of the kind routinely observed in the distribution and redistribution of income and wealth. We are much more likely to observe voters changing parties than territories. The best argument for the income inequality analogy is that each party plays the role of a redistributing agent, and with changes to its strategy it can move its votes (not voters) from one territory to another. However, this is hardly the case empirically. It is true that parties might hope that a loss of voters in one territory will be compensated with a similar gain elsewhere. Yet, in this endeavor each party runs against its competitors, a concern rarely comparably important for a redistributor. In short, inequality does not have a clear and universal definition as has equality. Although some concepts of inequality have been highly useful in some contexts, there is no guarantee they will be comparably useful in others. In the case of the concept of inequality used in research on wealth and income, there are reasons for serious reservations with regards to their application to problems of ‘inequality’ of votes across territories.

3.2 Handling different levels of aggregation

It has been stated by Bochsler (2010) that it is desirable for a measure of party nationalization to be independent of the level of aggregation on which the votes are inspected. According to this view, a measure of nationalization should give similar answer for votes from the same election for all inspected levels, such as precincts, districts, or regions. This has a two-fold motivation. Some measures are sensitive to the number of territorial units. Also, nationalization is seen as independent of the specific territorial divisions. If the system is nationalized, the argument goes, then it is nationalized independently of the territorial level. Both of these motivations are problematic.

The number of territories constrains the range of values of some measures. The Gini coefficient has an $1 - 1/N$ limit for maximum concentration, and consequently a $1/N$ for its smallest possible complement. Thus, a party with a perfectly concentrated
score will have a different score under systems with different $N$s. This is seen as a hindrance to comparisons across levels of aggregation or systems. (Bochsler, 2010) This sensitivity can be removed by rescaling the score. (Golosov, 2014) If we consider the statistic as a distance measure from the observed distribution to one that belongs to the model, this does not really hinder comparisons. The sensitivity simply means that the measure preserves a piece of information about the system, and both the scaled and unscaled measures are comparable across cases, but contain different information. For the usefulness of the measurement, the choice should be made on substantive concerns.

Different nationalization scores are given for the same party by some indices if the results are inspected on different levels of aggregation even if these are not sensitive to the number of units. (Bochsler, 2010) From the perspective of association between territory and vote, this is an appropriate feature of the measure. Two different levels of aggregation can be differently associated with unobserved variables associated with vote. Consider the example of a party supported exclusively by a group that composes an equal share of inhabitants in each of the regions, but lives in segregated communities that correspond to electoral wards. The party is likely to receive a similar level of support across regions, but its support across wards will be much less even. While the upper level units of aggregation are not associated with support for the party, the lower level units are, because they are associated with the membership in the group.

From the substantive point of view, another problem is apparent—not all available levels of aggregation are equally interesting. Suppose that the data would be available on the level of households, a unit of aggregation common in the social sciences. Would we expect under perfect nationalization households to be split between the parties the same way as the electorate? Hardly. In short, substantive concerns should drive the choice of the level of aggregation, and the quest for a measure that would be independent of it is misguided. Voting behavior is—at least in the cases typically examined in party
research–individual level behavior. If this behavior is driven by individual level factors, and we tend to think it is, then if territories are associated with these factors, they can appear associated with voting behavior. Accordingly, concepts of party nationalization that see it as independent of the type of territories (precincts, wards, districts, regions) are of questionable usefulness.

3.3 What to do?

The present paper argues that the quest for a single universal measure of party nationalization is misguided, and offers a framework for examining the territorial patterns of party support that gives precise answers to precise questions, as opposed to precise answers to vague questions.

4 A new framework

A variety of measures of party nationalization has been proposed, none of which is deemed satisfactory. This stands in marked contrast with a similar problem from party research–electoral volatility–where a consensually adopted measure has been proposed by Pedersen (1979). (see also Powell and Tucker, 2014) The Pedersen index of electoral volatility is computed for pairs of elections as

\[
P_I = \frac{1}{2} \sum_{j=1}^{J} |s_{j,k} - s_{j,k-1}|,
\]

where the \( k \) index represents elections. The index can be considered as a special case of the \( \Delta \) index of dissimilarity (Gini, 1914). (Johnston, 1980) It measures the distance in terms of the smallest fraction of voters that would have to behave differently in order for the parties to have the same national shares in both elections. This measure appeals with
its ease of interpretation, and can be generalized to the problem of party nationalization measurement. To do so, it is useful to consider an alternative to (4) for calculation of the index. Specifically, the index can be obtained by fitting the loglinear model of independence

$$
\log v_{j,k} = \lambda + \lambda_j^P + \lambda_k^E
$$

(5)

to a table that cross-classifies votes by party and election, and dividing the sum of the absolute values of the residuals by twice the sum of the votes, as shown in (6), where \( m_{j,k} \) is the number of votes for \( j \)th party in \( k \)th election.

$$
\Delta = \frac{\sum_{j=1}^{J} \sum_{k=1}^{K} |v_{j,k} - m_{j,k}|}{2 \sum_{j=1}^{J} \sum_{k=1}^{K} v_{j,k}}
$$

(6)

This formulation allows to calculate the value of the index for any number of elections.

An similar measure can be constructed for the model of no association between territory and vote choice, which corresponds to perfect nationalization. In that case it is the smallest fraction of voters that would need to vote differently and/or elsewhere for all parties to record the same shares locally as they did nationally. This index can be given an interpretation as a measure of residential segregation of voters. Under this interpretation the measure gives a clear answer to a clear question. The index can be calculated by fitting to table the loglinear model of independence

$$
\log v_{i,j} = \lambda + \lambda_i^T + \lambda_j^P,
$$

(7)
and dividing the sum of the absolute values of the residuals by twice the sum of the votes, as shown in (8)

\[
\Delta = \frac{\sum_{i=1}^{N} \sum_{j=1}^{J} |v_{i,j} - m_{i,j}|}{2 \sum_{i=1}^{N} \sum_{j=1}^{J} v_{i,j}}
\]  

(8)

The value of the index for \(x^{th}\) party can be obtained with

\[
\Delta = \frac{\sum_{i=1}^{N} |v_{i,j=x} - m_{i,j=x}|}{2 \sum_{i=1}^{N} v_{i,j=x}}
\]

(9)

and for \(z^{th}\) territory with

\[
\Delta = \frac{\sum_{j=1}^{J} |v_{i,z,j} - m_{i=z,j}|}{2 \sum_{j=1}^{J} v_{i,z,j}}
\]

(10)

5 Comparison

5.1 Slovakia

6 Limitations

7 Conclusion
References


14


A.1 Indices of party nationalization
Table 5: Indices defined only for the whole party system.

<table>
<thead>
<tr>
<th>Index</th>
<th>Source</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator of Party Aggregation</td>
<td>Chhibber and Kollman (1998)</td>
<td>$\frac{1}{s^2} - \frac{1}{N} \sum_{i=1}^{N} \frac{1}{p_i^2}$</td>
</tr>
<tr>
<td>Inflation Score</td>
<td>Cox (1999)</td>
<td>$100 \left( \frac{1}{s^2} - \frac{1}{N} \sum_{i=1}^{N} \frac{1}{p_i^2} \right)$</td>
</tr>
<tr>
<td>Index of Party Aggregation</td>
<td>Allik (2006)</td>
<td>$1 - \frac{1}{s^2} (\frac{1}{s^2} - \frac{1}{N} \sum_{i=1}^{N} \frac{1}{p_i^2})$</td>
</tr>
<tr>
<td>Inflation Index</td>
<td>Moenius and Kasuya (2004)</td>
<td>$\frac{100}{N} \sum_{i=1}^{N} \frac{1}{p_i^2} \left( \frac{1}{s^2} - \frac{1}{N} \sum_{i=1}^{N} \frac{1}{p_i^2} \right)$</td>
</tr>
</tbody>
</table>
Table 6: Indices defined for both individual parties and systems.

<table>
<thead>
<tr>
<th>Index</th>
<th>Source</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Absolute Deviation</td>
<td>Rose and Urwin (1975)</td>
<td>$\frac{1}{N} \sum_{i=1}^{N}</td>
</tr>
<tr>
<td>Mean Squared Deviation</td>
<td></td>
<td>$\frac{1}{N} \sum_{i=1}^{N} (p_i - s)^2$</td>
</tr>
<tr>
<td>Variance</td>
<td></td>
<td>$\frac{1}{N-1} \sum_{i=1}^{N} (p_i - s)^2$</td>
</tr>
<tr>
<td>Lee index</td>
<td>Lee (1988)</td>
<td>$\frac{1}{2} \sum_{i=1}^{N}</td>
</tr>
<tr>
<td>Variability Coefficient</td>
<td>Ersson et al. (1985)</td>
<td>$\frac{1}{N-1} \sum_{i=1}^{N} (p_i - \bar{p})^2$</td>
</tr>
<tr>
<td>Normalized Variability Coefficient</td>
<td>Golosov (2014)</td>
<td>$\sqrt{\frac{1}{N} \sum_{i=1}^{N} (p_i - \bar{p})^2}$</td>
</tr>
<tr>
<td>Standardized and Weighted Variability Coefficient</td>
<td>Ersson et al. (1985)</td>
<td>$\frac{1}{N} \sqrt{\sum_{i=1}^{N} (p_i - \bar{p})^2}$</td>
</tr>
<tr>
<td>Index adjusted for Party size and number of Regions</td>
<td>Caramani (2004)</td>
<td>$\sqrt{\frac{N \sum_{i=1}^{N}</td>
</tr>
<tr>
<td>Cumulative Regional Inequality</td>
<td>Rose and Urwin (1975)</td>
<td>$\frac{1}{200} \sum_{i=1}^{N}</td>
</tr>
<tr>
<td>Territorial Coverage Index</td>
<td>Caramani (2004)</td>
<td>$\frac{1}{N} \sum_{i=1}^{N} 1(v_i \neq 0)$</td>
</tr>
<tr>
<td>Index of Party Regionalization</td>
<td>Golosov and Ponarin (1999)</td>
<td>$\sqrt{\frac{N \sum_{i=1}^{N}</td>
</tr>
<tr>
<td>Coefficient of Party Regionalization</td>
<td>Golosov (2014)</td>
<td>$\frac{1}{N-1} \left( N - \left( \frac{\sum_{i=1}^{N} p_i}{\sum_{i=1}^{N} p_i^2} \right) \right)$</td>
</tr>
<tr>
<td>Index of Party Nationalization</td>
<td>Golosov (2014)</td>
<td>$1 - \frac{1}{N-1} \left( N - \left( \frac{\sum_{i=1}^{N} p_i}{\sum_{i=1}^{N} p_i^2} \right) \right)$</td>
</tr>
<tr>
<td>Normalized Gini Coefficient</td>
<td>Golosov (2014)</td>
<td>$\frac{2 \sum_{i=1}^{N} (p_i r_i)}{(N-1) \sum_{i=1}^{N} p_i} - \frac{N+1}{N-1}$</td>
</tr>
<tr>
<td>Party Nationalization Score</td>
<td>Jones and Mainwaring (2003)</td>
<td>$\frac{2N+1}{N} - \frac{2 \sum_{i=1}^{N} (p_i r_i)}{N \sum_{i=1}^{N} p_i}$</td>
</tr>
<tr>
<td>Weighted Party Nationalization Score</td>
<td>Bochsler (2010)</td>
<td>?</td>
</tr>
<tr>
<td>Scaled Party Nationalization Score</td>
<td>Bochsler (2010)</td>
<td>?</td>
</tr>
</tbody>
</table>
A.2 stan code for $\Delta$

```r
library(rstan)

tcm4stan <- function(x)
{
  if (length(dim(x))!=2) stop('x must be 2-dimensional')
  l <- list()
  l$nr <- nrow(x)
  l$nc <- ncol(x)
  l$N <- l$nr*l$nc
  g <- expand.grid(1:l$nr, 1:l$nc)
  l$rid <- g[,1]
  l$cid <- g[,2]
  l$s_total <- sum(x)
  l$s_column <- colSums(x)
  l$y <- as.vector(x)
  return(l)
}

delta_data <- tcm4stan(K)

data {
  int<lower=0> N;
  int<lower=0> nr;
  int<lower=0> nc;
  int<lower=0,upper=nr> rid[N];
  int<lower=0,upper=nc> cid[N];
  int<lower=0> s_total;
  int<lower=0> s_column[nc];
}
```

int<lower=0> y[N];
}
parameters {
  real b0;
  real br[nr];
  real bc[nc];
}
transformed parameters {
  real<lower=0> lambda[N];
  for (i in 1:N)
    lambda[i] <- exp(b0 + br[rid[i]] + bc[cid[i]]);
}
model {
  y ~ poisson(lambda);
}
generated quantities {
  real<lower=0> res[N];
  real<lower=0> delta_total;
  real<lower=0> delta_column[nc];
  real<lower=0> aux[N];
  for (i in 1:N)
    res[i] <- fabs(y[i] - lambda[i]);
  delta_total <- get_delta(res, s_total);
  for (j in 1:nc) {
    for (i in 1:N) {
      aux[i] <- if_else(cid[i]==j, res[i], 0);
    }
    delta_column[j] <- get_delta(aux, s_column[j]);
  }
}

# Compile the model.
f1 <- stan(model_code=delta_code, data=delta_data, iter=1, chains=1)
# Continue with the estimation with the standard rstan procedures.