Supplemental materials

For "Issue yield: a model of party strategy in multidimensional space"

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Proof 1) Constraints for *f* based on the method of bounds

Given the definitions of *p*, *i*, *f* and *d* provided in the text, and by additionally defining $b = \frac{f}{p}$

(i.e., the propensity of a party's supporters to also support the examined policy), the expressions summarized by King (1997, 79) yield the following constraints for *b*:

$$b \in \left[\max\left(0, \frac{i - (1 - p)}{p} \right), \min\left(\frac{i}{p}, 1 \right) \right]$$

which, when multiplied by *p*, yield constraints for *f*:

$$f \in \left[\max(0, i - (1 - p)), \min(i, p) \right]$$

Given that $d = f - ip$, constraints for dots representing policies in the SP diagram can be derived (see Proof 2), and these constraints still depend only on *p* (fixed in any single diagram) and *i* (which varies on the *y* axis: for each level of support we obtain minimum and maximum possible values, identified by the diamond in the SP diagram).

Proof 2) Minimum and maximum values of differential support

Given the definitions of p, i, f and d provided in the text, we showed (see Proof 1) that $f \in [\max(0, i-(1-p)), \min(i, p)]$. But since

$$d = f - ip\,,$$

constraints for d can be directly obtained by subtracting ip from the constraints for f:

$$d \in [\max(-ip, i-(1-p)-ip), \min(i-ip, p-ip)]$$

In the SP diagram, the x axis represents d, and the y axis represents i. Beginning with the constraint for the maximum value of d as a function of i, the equations can be obtained by first substituting, in the above constraint, $\max(d)$ with x, and i with y: $\mathrm{x = min(y - yp, p - yp)}$, which corresponds to two different equations for values of y that are lower or higher than p (as visible in Figure 1 in the paper):

$$\begin{cases} x = y - yp & [\text{when } y \le p] \\ x = p - yp & [\text{when } y > p] \end{cases} \Rightarrow \begin{cases} y(1-p) = x & [\text{when } y \le p] \\ yp = p - x & [\text{when } y > p] \end{cases} \Rightarrow \begin{cases} y = \dfrac{x}{1-p} & [\text{when } y \le p] \\ y = \dfrac{1-x}{p} & [\text{when } y > p] \end{cases}$$

Constraints for min(d) are obtained analogously. Substitution in the above constraint for the minimum value of d yields $x = \max(-yp, y-(1-p)-yp)$. Thus we have two different equations for the two cases when y is above or below $(1 - p)$:

$$\begin{cases} x = 0 - yp & [\text{when } y \le 1-p] \\ x = y-(1-p)-yp & [\text{when } y > 1-p] \end{cases} \Rightarrow \begin{cases} yp = -x & [\text{when } y \le 1-p] \\ y(1-p)-(1-p) = x & [\text{when } y > 1-p] \end{cases} \Rightarrow$$

$$\Rightarrow \begin{cases} y = \dfrac{-x}{p} & [\text{when } y \le 1-p] \\ y = \dfrac{x}{1-p} + 1 & [\text{when } y > 1-p] \end{cases}$$

Proof 3) Derivation of issue yield

We first define:

$$\text{general issue yield} = (\text{vector length}) \cdot \cos(\theta)$$

The length of a vector of coordinates (x,y) originating from a point (0,0) is given by $\sqrt{x^2 + y^2}$ (Pythagoras' theorem).

Regarding cos(θ), let us assume that we measure angles from the horizontal line departing from O to the right. This implies that the reference line (exemplified in Figure 2 in the paper) corresponds by definition to an angle of $\pi / 4$ (45°). Thus, the angle θ shown in Figure 2 can be obtained by first calculating the angle δ between the horizontal line (not shown in Figure 2) and the OT segment, and then subtracting the reference angle $\frac{\pi}{4}$: $\theta = \delta - \frac{\pi}{4}$

Given that our quantity of interest is cos(θ), and that, in general, cos(A−B) = cos(A) cos(B) + sin(A) sin(B), we obtain:

$$\cos(\theta) = \cos(\delta)\cos\left(\frac{\pi}{4}\right) + \sin(\delta)\sin\left(\frac{\pi}{4}\right)$$

Given that both $\cos\left(\frac{\pi}{4}\right)$ and $\sin\left(\frac{\pi}{4}\right)$ are equal to $\frac{\sqrt{2}}{2}$,

$$\cos(\theta) = \frac{\sqrt{2}}{2}\left(\cos(\delta) + \sin(\delta)\right)$$

Now, if the issue emphasis vector is between the origin and coordinates (x,y), the angle δ is such that:

$$\cos(\delta) = \frac{x}{\sqrt{x^2 + y^2}}, \text{ and } \sin(\delta) = \frac{y}{\sqrt{x^2 + y^2}}$$

So that

$$\cos(\theta) = \frac{\sqrt{2}}{2} \cdot \frac{x + y}{\sqrt{x^2 + y^2}}$$

As a result,

$$\text{general issue yield} = (\text{vector length}) \cdot \cos(\theta) = \sqrt{x^2 + y^2} \cdot \frac{\sqrt{2}}{2} \cdot \frac{x + y}{\sqrt{x^2 + y^2}} = \frac{\sqrt{2}}{2}(x + y) \quad [1]$$

This simple formula applies to generic coordinates *x* and *y* from origin *O*. So a first step is to obtain *x* and *y* in terms of our basic quantities *p*, *i* and *f*, given that *O* lies in (0,*p*), and policy location *T* in ($f - ip$, *i*). Secondly, we normalize these coordinates so that all policies are in the (0,1) range on both axes. This is done by dividing both coordinates by their maximum possible values. For the ordinate, Figure 2 in the paper shows that its maximum value (maximum possible distance from origin O) is $1 - p$; for the abscissa, the maximum possible value is observed when $y = p$ (see Figure 2), from which follows (see proof 1) a maximum of $p - p^2 = p(1 - p)$.

Thus, policies are located in the normalized coordinate system by first subtracting the coordinates of *O* (0,*p*) from the original coordinates of $T(f - ip, i)$ and then dividing the results by the maximum possible values stated above:

$$x = \frac{f - ip}{p(1 - p)}$$
$$y = \frac{i - p}{1 - p}$$

By placing these values in equation [1], we obtain

$$\text{general issue yield} = \frac{\sqrt{2}}{2}\left(\frac{f - ip}{p(1 - p)} + \frac{i - p}{1 - p}\right),$$

which is the length of the projection of the vector on the reference line *r*. Given the normalized coordinate system above, the maximum possible length of this projection corresponds to the distance between *O* and the intersection of *r* with the upper left boundary line, which by definition lies at (0.5,0.5). Thus, $\max(\text{general issue yield}) = \frac{\sqrt{2}}{2}$. We then obtain a scaled measure of issue yield with a maximum value of 1 by dividing it by its maximum:

$$\text{scaled issue yield} = \frac{\frac{\sqrt{2}}{2}\left(\frac{f-ip}{p(1-p)}+\frac{i-p}{1-p}\right)}{\frac{\sqrt{2}}{2}} = \frac{f-ip}{p(1-p)}+\frac{i-p}{1-p}.$$

Due to the asymmetry of the SP diagram, the minimum value of scaled issue yield is not necessarily –1. For $p < 0.5$ the minimum lies between -1 and 0, while for the (mostly hypothetical) case of $p > 0.5$ it is lower than –1.

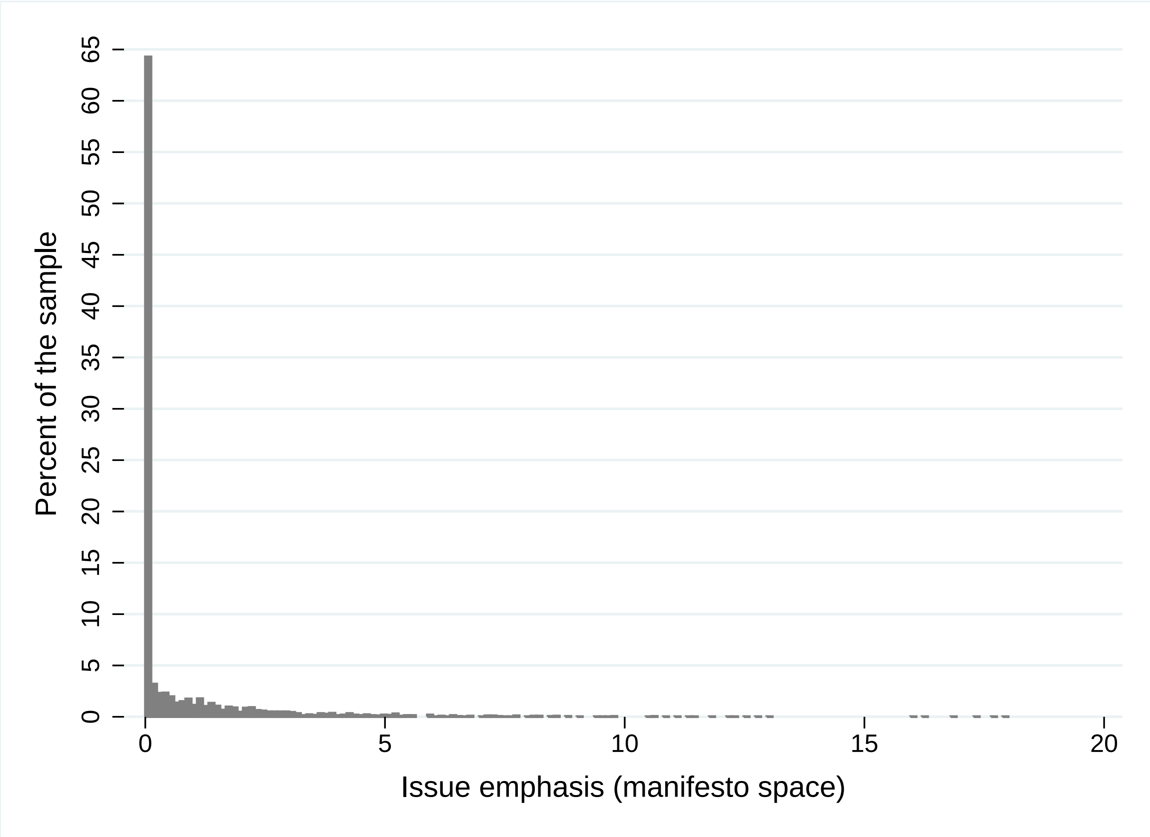
Matching of survey questions and manifesto items

Voter survey	Manifesto data
Q56. Immigrants should be required to adapt to the customs of <country>.	080100 Multiculturalism (r)
Q57. Private enterprise is the best way to solve <country>'s economic problems.	050101 Free Enterprise
Q58. Same-sex marriages should be prohibited by law.	090403 Homosexuals (r)
Q59. Major public services and industries ought to be in state ownership.	050204 Publicly-Owned Industry; 050401 Nationalization
Q60. Women should be free to decide on matters of abortion.	090502 Women
Q61. Politics should abstain from intervening in the economy.	050201 Controlled Economy (r); 050600 Market Regulation (r)
Q62. People who break the law should be given much harsher sentences than they are these days.	080301 Law and Order
Q63. Income and wealth should be redistributed towards ordinary people.	070300 Social Justice
Q64. Schools must teach children to obey authority.	080200 Traditional Morality; 080301 Law and Order
Q65. EU treaty changes should be decided by referendum.	020200 Democracy; 030102 Transfer of Power to the EC/EU (r)
Q66. A woman should be prepared to cut down on her paid work for the sake of her family.	080200 Traditional Morality; 090502 Women (r)
Q67. Immigration to <country> should be decreased significantly.	080502 Immigration (r)

(r) = reversed, i.e. the negative side of the manifesto item is matched to the "agree" pole of the voter survey.

Alternative tests using tobit regression

Initial inspection of our dependent variable showed a clear deviation from the normal distribution. About 63% of the cases have a value of 0 because the policies were not mentioned at all by the respective parties. The following histogram shows the full distribution.



The observed pattern is in line with our expectations: parties seem to carefully select policies, and the positive/negative bifurcation of issues expands their choice. However, a methodological problem arises because the policies that are not selected may not be all the same. Some of them may reflect “true” zeros, i.e. the respective parties simply do not deem them relevant for their campaigns, while others may reflect “false” zeros in the sense that parties actually try to *de*emphasize them. If they could, they would put even less than 0 emphasis on these policies. This expectation is part and parcel of the heresthetics approach that our model is inspired by (Riker 1986). As outlined in the introduction of the paper, heresthetics as a strategy allows political actors to escape an unfavorable equilibrium by downplaying invidious dimensions.

An example of such dynamics is the issue of European integration. While the question of whether and to what degree European nation states should delegate powers to the European Union is quite controversial among EU citizens, disagreement is barely reflected on the party-system level (Van der Eijk and Franklin 2004). As the integration issue cuts across traditional alignments, mainstream parties systematically "muffle" public debate over the EU (Parsons and Weber 2011) while converging to an innocuous pro-integration position (Hix and Høyland 2011). Importantly, this implies active reduction of issue salience, not mere neglect of the issue.

While our theory provides for emphasis and de-emphasis of political issues, our measure of the dependent variable – the share of manifesto content – cannot take on values below 0. It thus fails to register aspects of party strategy that imply more sophisticated heresthetic maneuvering. In terms of a measurement issue, our dependent variable can be said to be a measure "censored" at 0 of a latent variable (party attitude towards emphasis on an issue) which could take on both negative and positive values.

Linear regression is inconsistent in this case because it takes censored data at face value (Wooldridge 2002, 524f.).[1] A superior alternative is the tobit link function that treats censored values as elements of a latent continuous variable (Tobin 1958). This transformation has important advantages in both a statistical and a theoretical sense. Statistically, it allows

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[1] Also note another implication of the way our dependent variable is measured: Percentage of manifesto space is theoretically constrained to a sum of 100% within each party. This might result in negative autocorrelation between policies because the more a party emphasizes one policy, the less it can emphasize others (cf. Katz and King 1999 for the similar case of election results). Empirically, the problem proved negligible because we only use 14 out of the 90 issues in the coding scheme, with an average correlation of .004.

consistent estimation of the highly skewed dependent variable. This issue ought to be addressed notwithstanding any theoretical considerations. Theoretical considerations do suggest, however, that there is also substantive reason for a tobit transformation. The latent construct does not merely reflect whether or not party officials typed certain sentences in a document, but it also teases out more information about the underlying mechanisms of party competition.

The following table shows tobit results for our preliminary test using data from the two major parties in Spain.

Replication of Table 3 using the tobit link function instead of linear regression

Issue yield	5.66**	(1.85)
Constant	-2.86*	(1.08)
N	48	
Nagelkerke's R-squared	0.19	
Chi-squared statistic	9.62**	

Tobit coefficients with standard errors in parentheses.
** significant at .01; * significant at .05

Mixed effects tobit models can be estimated using Stata's -gllamm- (Rabe-Hesketh and Skrondal 2008). However, computational difficulties require a simplification of the crossed-level structure. We chose issue (which shows the highest variances in our linear analysis) as top level and party family as second level nested within issue. Country effects are not modeled explicitly, but robust standard errors clustered by country are reported to prevent t-value inflation. We also present a "residual country R-squared" to evaluate country variance *ex post*. This measure expresses the predictive power of country dummies (along with their interactions with issue yield) in regressions of issue emphasis on the *predictions* of each previously estimated model.

The following table shows tobit results for all our multilevel models.[2]

[2] Issue yield does not have random slopes in Model 3 because an interaction can hardly vary across nesting units independently of its components. Random slopes for all three terms proved computationally infeasible.

Replication of Table 4 using the tobit link function instead of linear regression

	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects (coefficients)					
Issue yield		4.25**	3.93**	4.36**	2.30*
		(0.98)	(0.43)	(0.59)	(0.97)
Vector direction (cos *θ*)			0.25		
			(0.32)		
Vector magnitude			0.26		
			(1.67)		
Issue support (*i*)				0.18	
				(1.22)	
Party support (*p*)				2.65	
				(2.74)	
Issue-party support (*f*)				-1.16	
				(3.74)	
Effective number of competitors					-0.32*
					(0.13)
Issue yield*ENC					0.62**
					(0.18)
Constant	-1.37**	-3.27**	-3.40**	-3.62**	-2.31**
	(0.49)	(0.72)	(1.00)	(0.72)	(0.69)
Random effects (variances)					
Level 1 (party, N=3,600)					
Residual	9.38	6.70	7.78	6.70	6.65
	(2.44)	(1.67)	(1.90)	(1.58)	(1.65)
*Level 2 (party family, N=10*12)*					
Intercept	0.37	0.66	0.38	0.61	0.52
	(0.19)	(0.41)	(0.17)	(0.47)	(0.33)
Issue yield		4.31		4.14	3.83
		(1.53)		(1.72)	(1.11)
Covariance		-1.39		-1.32	-1.14
		(0.63)		(0.70)	(0.42)
Level 3 (issue, N=12)					
Intercept	2.07	3.07	2.10	3.02	3.14
	(1.12)	(1.41)	(0.77)	(1.55)	(1.10)
Issue yield		6.96		6.82	6.79
		(4.90)		(5.53)	(3.09)
Covariance		-2.70		-2.62	-2.55
		(2.16)		(2.12)	(1.64)
Model performance					
Log likelihood	-4,543	-4,158	-4,302	-4,154	-4,148
R^2 (overall) [i]	0.099	0.233	0.173	0.235	0.237
R^2 (nesting) [i]	0.099	0.009	0.096	0.010	0.010
Residual R^2 (country) [i]	0.109	0.030	0.032	0.030	0.028

Robust standard errors clustered by country in parentheses.
Significances for fixed effects: ** .01 * .05
[i] The R^2 measures report squared correlations of original and predicted values. The nesting R^2 derives from the random intercepts only. The residual country R^2 is the difference in R^2 that results from adding country dummies and their interactions with issue yield to regressions of issue emphasis on the predictions of each model.

References

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