

# Modeling Elections in Poland\*

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## Abstract

We model elections in Poland in 1997, 2001 and 2005. In contrast to the result for the U.S. elections in 2000, 2004 and 2008, presented in Schofield et al. (2011a,b) we find that in Poland the valence differences are sufficiently large to force low valence parties to adopt divergent positions.

We argue that this implies a fundamental difference between an electoral system based on plurality rule in contrast to one based on proportional representation.

Key words: stochastic electoral model, valence, electoral perceptions, local Nash equilibrium.

## 1 Introduction: Modeling Elections

Recent work has argued that institutional characteristics of political systems, such as presidentialism versus parliamentarianism, or majoritarianism versus proportionality, will have significant effects on the stability of government and the nature of redistributive politics (Bawn and Rosenbluth, 2006; Persson and Tabellini, 2000, 2003). these arguments have been based on cross country empirical analyses and relatively simple one dimensional spatial models (Acemoglu and Robinson, 2006). The formal underpinning of these models has often been based on the assumption that parties or candidates adopted positions in order to win, and has inferred that parties will converge to the electoral median (under

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deterministic voting in one dimension, as in Downs, 1957, Riker and Ordeshook, 1973) or to the electoral mean in stochastic models (Banks and Duggan, 2005; McKelvey and Patty, 2006). Within the context of the spatial model, there has been controversy over whether rational candidates will indeed converge to an electoral center or whether elections will be fundamentally chaotic (Riker (1980, 1982, 1986)

These various spatial models treat vote choice as a function of voters' policy preferences only. Yet, in almost every polity we witness electoral or policy outcomes that are difficult to explain in terms of the pure spatial model. An example would be the apparent increase in "polarization" even in mature democracies such as the United Kingdom and the United States. There has also been evidence of the occurrence of unusual coalitions spreading across the ideological spectrum in many eastern European countries.<sup>1</sup> These observations suggest that the models are missing something fundamental: neither chaos nor equilibrium can be defining properties of democratic politics.

The analysis presented here suggests that the differences in political configurations may result from the very different incentives that activist groups face in the various institutional environments. In this paper we contrast electoral models for a proportional electoral system used for Parliamentary elections in Poland with the plurality electoral system used for presidential elections in the United States, as analysed in Chapter 1.

The technique we use to compare elections in such different polities is a formal stochastic model of elections that emphasizes the importance of *valence*. The standard spatial model is based on the assumption that it is only candidate *positions* that matter to voters. However, as Stokes (1963, 1992) emphasized many years ago, the non-policy evaluations, or valences, of candidates by the electorate are just as important as electoral policy preferences. Based on the empirical and theoretical work presented here, we argue that neither the Downsian convergence result nor the "social choice chaos theorems" (Saari, 1997) give an accurate picture of democratic elections. Instead, both position and valence matter in a fundamental way. We then use this model to suggest that the nature of the electoral system influences the calculations of the leaders of the activist groups who provide the resources that are critical for political success.

Our strategy is to model the relationship between electoral response and party positions on the basis of a mixed logit stochastic model. On the basis of such an empirical electoral model, we then use the results of a general formal model to determine how changes in party position effect election results. It is then natural to seek the existence of "Nash equilibria" in the empirical model—a set of party positions from which no party may deviate to gain advantage in terms of its vote share. Since the "utility functions" of parties are, in fact unknown, it is possible to use such "counterfactual experiments" to make inferences about the political game. That is, after modeling the relationship between candidate positions and election outcome (for a given electoral distri-

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<sup>1</sup>See Markowski and Tucker (2010a) and de Vries and Edwards (2009) on "extremist" Euroskeptic parties.

bution), we may make assumptions about the utility functions of leaders and examine the Nash equilibria under these assumptions, to determine whether the Nash equilibria so determined correspond to the actual positions of the parties or candidates.

As in Chapter 1, we consider an empirical stochastic model, denoted  $\mathbb{M}(\boldsymbol{\lambda}, \beta)$ , where  $\boldsymbol{\lambda}$  is the vector of party valences, and  $\beta$  is the spatial parameter. Then there exists a “convergence coefficient”, denoted  $c(\boldsymbol{\lambda}, \beta)$ , defined by  $(\boldsymbol{\lambda}, \beta)$  and the covariance matrix of the voter preferred positions. A previous theorem (Schofield, 2007a) discussed on Chapter 1, asserts that if the dimensionless coefficient,  $c(\boldsymbol{\lambda}, \beta)$ , exceeds 2, then according to the pure spatial model, under any vote maximizing Nash equilibrium, all parties should diverge away from the electoral origin.

To illustrate this result, we examine a sequence of elections in the multiparty polity of Poland for 1997, 2001 and 2005. In these three election models, the  $\beta$  coefficients are all highly significant and take values about 1.5. Indeed the convergence coefficients are calculated to lie in the range  $c(\boldsymbol{\lambda}, \beta) \simeq [5.92, 6.82]$ . Moreover, the Hessian of the lowest valence party at the joint origin is shown to have both eigenvalues positive in each election. This implies that the origin is a vote *minimizing* position for such a party. As a consequence we infer that any Nash equilibrium under the vote maximizing spatial model is one where *all* parties *diverge* from the origin.<sup>2</sup> We verified this inference by simulating these models to determine the equilibria in the spatial models, with and without sociodemographic variables, and confirmed their divergent nature.

The considerable difference between Nash equilibria in elections under plurality and proportional rule suggests that that the difference may be due to a very different logic governing the influence of activist groups in these different polities.

Based on a comparison of estimated and simulated equilibrium positions for the three elections in Poland, we argue that the difference between the estimated party positions and the equilibrium positions is much less dramatic, suggesting that the influence of activists is less pronounced in Poland than in the United States. In the conclusion we hypothesize that this follows because small activist groups can still expect to influence policy outcomes, through party membership of coalition government. Thus there is little tendency for activist groups to coalesce under proportional electoral rule. and political fragmentation will be maintained.

In the conclusion we discuss results on other polities with proportional electoral systems such as Israel and Turkey, and comment that calculations of convergence coefficients for recent elections in these polities also have high convergence coefficients. In contrast, Parliamentary polities with fairly majoritarian electoral systems, like Canada and the United Kingdom, have convergence coefficients in the medium range [1.0, 2.0]. Other work has also obtained a value for the convergence coefficient for the 2007 Duma election in Russia of 1.7. These

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<sup>2</sup>Similar results have been obtained for Israel (Schofield and Sened, 2006) and Turkey (Schofield, Gallego, Ozdemir and Zakharov, 2011b). See also the formal model by Serra (2010) and an empirical model of the 2004 election by Jessee (2010).

values are very different from the low values for  $c$  obtained for the United States. We suggest that the convergence coefficient of a polity is a theoretically useful way of classifying the fundamental properties of an electoral system. The model we present suggest a reason for divergence of small parties in polities with proportional electoral systems.<sup>3</sup> Indeed the model suggests why fragmentation is a persistent phenomenon in such polities

## 2 Elections in Poland 1997-2005

Poland held regular elections in 1997, 2001, and 2005. For all of these elections Poland used an open-list proportional representation (OLPR) electoral system with a threshold of 5% nationwide vote for parties and 8% for electoral coalitions. The rules of the 1997 elections were slightly different from the ones used since 2001: the number of districts was larger (52 compared to 41) and in addition to districts there was a 69-seat national list. In 1997 and since 2005 votes are translated into seats by the D'Hondt method rather than the more proportional modified Saint-Leaguë method used in 2001.

The party system in Poland is relatively unstable – in each election new parties emerge and some existing ones die, and the vote shares fluctuate considerably for those parties that manage to survive multiple elections. Table 1 lists, by election year, the names of the parties, their seat shares (Table 1a), and vote shares (Table 1b). Usually about five or six parties win seats in the Sejm (lower house).

[Insert Tables 1a, 1b, 1c here]

The main political parties during the time period under consideration include the following. The left-wing ex-communist Democratic Left Alliance (SLD) and the agrarian Polish Peoples' Party (PSL), both of which have participated in all three elections considered here and been the most frequent governing parties in the post-communist period. In 1997 Solidarity Election Action (AWS) and the Freedom Union (UW) were also important players. Both parties had grown out of the Solidarity movement. AWS combined various mostly right wing and Christian groups under one label, while UW was formed based on the liberal wing of Solidarity. After the 2001 election, Civic Platform (PO), Law and Justice (PiS), League of Polish Families (LPR), and Self-Defense (SO) emerged as significant new parties. The first three parties were formed on the ruins of AWS and UW. PO combines the liberals from both parties, while PiS represents the conservatives. LPR's ideology combines nationalism with Catholic fundamentalism and the party is sometimes considered a far-right entity. SO is a leader-centered agrarian party that is left-wing on economic policy but very right-wing religious on values. Both LPR and SO did not survive as significant political players and are no longer represented in the Polish Sejm.

Existing literature suggests that the two main axis of Polish electoral politics along which both voters and parties align are the economic dimension and social values dimension (Kitschelt et al. 1999; Markowski 2006). This has remained

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<sup>3</sup>See Adams and Merrill (2005).

true for the entire post-communist era. The first dimension encompasses issues related to economic transition and economic performance such as the speed and nature of privatization, reducing unemployment, and increasing social security. The social values' dimension includes attitudes towards communist past, the role of church in politics, moral issues, and nationalism (Grzymala-Busse 2002; Szczerbiak 1998). Over the years, these social issues have gained increasing prominence in political rhetoric and as determinants of vote choice (Markowski and Tucker 2010a). The relevance of social issues is further underlined by the significant influence of the Catholic church on Polish party politics (Markowski 2006) and the high salience of the divide between the anti-communists and ex-communists.

We analyzed the three Polish elections based on data from the respective Polish National Election Studies (PNES). These are surveys of the adult population conducted after each national parliamentary election. We were able to use responses from samples of sizes 660, 657 and 1095, respectively for the pure and joint spatial models. The dependent variable in our analyses is the respondent's vote choice. We use the spatial distance between parties and voters, and voters' socio-demographic characteristics to explain this vote choice. See Appendix 2 for the question wordings

The PNES includes a battery of questions asking respondents' position on various issues. We identified issues pertaining to economic policy and social values and performed factor analysis to confirm the existence of the two dimensions in the data and obtain factor scores for each dimension. The following items loaded on the two dimensions (the items used depend on what was available in a given survey).

**Economic dimension** (all years): privatization vs. state ownership of enterprises, fighting unemployment vs. keeping inflation and government expenditure under control, proportional vs. flat income tax, support vs. opposition to state subsidies to agriculture, state vs. individual social responsibility.

**Social values dimension:** separation of church and state vs. influence of church over politics (1997, 2001, 2005), complete decommunization vs. equal rights for former nomenclature (1997, 2001), abortion rights regardless of situation vs. no such rights regardless of situation (1997, 2005)<sup>4</sup>.

The factor loadings for the two dimensions are given in Tables 2a,b,c.

[Insert Tables 2a,2b,2c here]

Party positions on these dimensions were obtained by taking the average of the positions of the voters for each party. In an alternative analysis, we obtained the information on the placement of political parties from Benoit and Laver (2006), which uses expert surveys to place parties on a variety of issues. Following Benoit and Laver, factor analysis was also used to locate parties on the two dimensions (economy and social values) based on their expert placement on a variety of issues. The results of these alternative analyses were substantively similar to the ones presented here. However, the Benoit and Laver data were

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<sup>4</sup>Respondent's opinion on each of these issues was recorded on an eleven-point scale with the first option given scored as zero and the second option scored as ten. See Appendix 5 for the exact question wording.

collected after the 2001 elections only. Using these placements to identify party positions in 1997 and 2005 may not be accurate because party positions may have changed. We therefore decided to use the more time-sensitive measures obtained from the PNES for the final analyses presented here.

Figures 1, 3 and 5 display the estimate of the density contours of the electoral distribution of voter bliss points for each election year, as well as the estimated party positions.<sup>5</sup> Figure 7 also gives a scattergram of the voter positions for 2005. Figures 2, 4 and 6 give estimated Nash equilibria for these elections.

[Insert Figures 1-7 here]

These party positions are given below.

$$\mathbf{z}_{1997}^* = \begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{UP} & \textit{UPR} & \textit{ROP} \\ x & 0.03 & -0.35 & 0.52 & 0.005 & 0.29 & 1.81 & 0.15 \\ y & -0.72 & -0.35 & -0.1 & 0.72 & -0.15 & -0.15 & 0.75 \end{bmatrix}$$

In 1997, Solidarity Electoral Action (AWS), with 201 seats and based on the Solidarity trade union, formed a coalition with the Freedom Union (UW), a party on the right, supporting classical liberalism, with 60 seats. Together the coalition controlled 261 seats, out of 460. The election was a major setback for the Democratic Left Alliance (SLD) and the Polish People's Party (PSL) which were forced out of government.

$$\mathbf{z}_{2001}^* = \begin{bmatrix} \textit{Party} & \textit{SLD,UP} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{SO} & \textit{PiS} & \textit{PO} & \textit{LPR} \\ x & -0.12 & -0.29 & 1.16 & 0.66 & 0.03 & 0.11 & 0.57 & 0.14 \\ y & -0.47 & -0.05 & 0.002 & 0.83 & 0.27 & 0.41 & 0.17 & 0.87 \end{bmatrix}$$

In the 2001 election, the coalition of SLD and UP won 216 of the 460 seats, and was able to form a government with the support of the Polish People's Party (PSL), with 42 seats, thus controlling 258 seats in all. The former ruling parties, the Solidarity Electoral Action (AWS) and the the Freedom Union (UW) only gained about 10% of the vote but no its seats. In its place several new parties emerged, including the center right LPR, SO, and PiS, and the further right PO. Figures 1 and 3 suggest that the AWS fractured into five factions, a small remnant AWS, and these four new parties.

$$\mathbf{z}_{2005}^* = \begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{DEM} & \textit{SDP} & \textit{SO} & \textit{PiS} & \textit{PO} & \textit{LPR} \\ x & 0.05 & -0.35 & 0.58 & 0.10 & -0.52 & -0.01 & 0.16 & -0.16 \\ y & -0.56 & 0.09 & -0.54 & -0.61 & -0.04 & 0.20 & -0.23 & 0.90 \end{bmatrix}$$

<sup>5</sup>For 2001, the positions of the LPR PO, PSL, SLD and UW are almost identical to those estimated by Benoit and Laver (2006), thus providing some justification for our method of estimating party positions.

After 2003 a variety of factors combined to bring about a collapse of support for the government of the SLD-UP-PSL coalition. Discontent with high unemployment, government spending cuts (especially on health, education and welfare), affairs related to privatizations was compounded by a series of corruption scandals, leading to the resignation of the Prime Minister Leszek Miller in May 2004, who was succeeded by Marek Belka.

The parties running in the 2005 election were similar to those running in 2001, with the addition of SDP (a left wing splinter group from the SLD), and the right wing Democratic Party (DEM). Figure 10 suggests that the DEM was formed from the Freedom Union (UW), the moribund Solidarity Electoral Action (AWS) and some right wing SLD dissidents. Both these new parties failed to win seats, though they took about 6% of the vote..

The two larger center right parties, Law and Justice (PiS) and Civic Platform (PO), did much better in 2005, gaining over 50% of the vote and 288 seats. They had splintered off from the anti-communist Solidarity movement but differed on issues such as the budget and taxation. Law and Justice, with 155 seats, had a policy of tax breaks and state aid for the poor, and pledged to uphold traditional family and Christian values, while being suspicious of economic liberalism. The Civic Platform, with 133 seats, supported free market forces and wanted to introduce a flat 15% rate for income tax, corporation tax and VAT. It promised to move faster on deregulation and privatisation, in order to adopt the euro as soon as possible.

Negotiations between PiS and PO about forming the new government collapsed in late October, precipitated by disagreement over who would be speaker of the Sejm. The PiS leader, Jarosław Kaczyński, declined the opportunity to become Prime Minister so as not to prejudice the chances of his twin brother, Lech Kaczyński, in the presidential election.<sup>6</sup> On 1 November, 2005, the PiS announced a minority government, with 155 seats, led by Kazimierz Marcinkiewicz as the Prime Minister.

A major stumbling block against the PiS forming a coalition with the PO was the insistence by the PO that it receive the Interior portfolio, if it were to enter a coalition government with the PiS, to prevent one party from controlling all three of the "power" ministries (Security, Justice and Interior), thus the police and security services. The PO also opposed a "tactical alliance" between the PiS and Samoobrona, who shared eurosceptic and populists sentiments, although differing on economic policy. The election campaign, in which both of these center-right parties had competed mainly against each other rather than parties on the left, accentuated differences and created an antagonistic relationship between the two parties.

The PiS minority government depended on the support of the radical Samoobrona, with 56 seats, and the conservative League of Polish Families (LPR), with 34 seats. On 5 May 2006 PiS formed a coalition government with Samoobrona and LPR, controlling 245 seats. In July 2006, Marcinkiewicz tendered his resig-

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<sup>6</sup> Lech Kaczyński became President after that election, but died in a tragic airplane crash on April 10, 2010, on his way to Russia to commemorate the Katyn massacre of Polish officers in 1940.

nation, because of disagreements with the PiS party leader, Kaczyński. Jarosław Kaczyński then formed a new minority government and was sworn-in on July 14, 2006. finally becoming prime minister. His party, Law and Justice, was defeated in 2007.<sup>7</sup>

Figure 5 indicates the policy differences that existed between the PiS and the more left-wing Samoobrona, and the conservative LPR on the one hand, and the more right-wing party, the PO, on the other.

As Tables 1a,b illustrate, the electoral system in Poland is highly proportional, though the SLD gained a higher seat share than vote share in 1997 and 2001.

For the joint model with demographic variables we chose age in years, regular monthly income, former communist party membership, and religiosity (believer vs. atheist or agnostic). This choice follows previous literature that identifies these demographics as important determinants of vote choice and party preference (Markowski 2006; Wade et al. 1995).

Tables 3a,b,c gives the valences for three pure spatial mixed logit models (one for each election year) based on the estimated positions of the parties. Appendix 7 gives the joint and pure sociodemographic models, while Table 3d gives the comparison of the log likelihoods for these models for 1997. Clearly the loglikelihoods for the joint models are superior to the pure spatial and sociodemographic models for all years. However, the AIC is superior for the pure spatial model in 2001. For all spatial models the  $\beta$ -coefficient is highly significant (at the 0.01 level). The high valence values are also significant in the pure spatial and joint models. Only a few of the sociodemographic variables are significant.

Table 3a shows that the estimates for the pure spatial model in 1997 were:

$$\begin{aligned} & (\lambda_{UPR}, \lambda_{UP}, \lambda_{ROP}, \lambda_{PSL}, \lambda_{UW}, \lambda_{SLD}, \lambda_{AWS}; \beta) \\ = & (-2.3, -0.56, 0.0, 0.07, 0.73, 1.4, 1.92; 1.74 \end{aligned}$$

The covariance matrix is:

$$\nabla_0 = \begin{bmatrix} 1.0 & 0.0 \\ 0.0 & 1.0 \end{bmatrix}.$$

Thus, the probability,  $\rho_{UPR}$ , that a voter chooses the lowest valence party ,

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<sup>7</sup>After Lech Kaczyński's death in April, his brother, Jarosław Kaczyński, announced he would stand for president.

when all parties are at the joint origin, is given by the model  $\mathbb{M}(\lambda, \beta)$  as

$$\begin{aligned} \rho_{UPR} &\simeq \frac{1}{1 + e^{1.92+2.3} + e^{1.4+2.3}} \\ &= \frac{1}{1 + 66 + 40} \simeq 0.01 \\ \text{Thus } 2\beta(1 - 2\rho_{UPR}) &= 2 \times 1.74 \times 0.98 = 3.41 \\ \text{and } C_{UPR} &= (3.41) \begin{bmatrix} 1.0 & 0.0 \\ 0.0 & 1.0 \end{bmatrix} - I \\ &= \begin{bmatrix} 2.41 & 0.0 \\ 0.0 & 2.41 \end{bmatrix}, \\ \text{so } c &= 3.41 \times 2 = 6.82. \end{aligned}$$

Similar results for the elections of 2001 and 2005 show divergence for the pure spatial model.

In 2001, we find  $\beta = 1.482$ , so  $c \simeq 5.92$ , and in 2005,  $\beta = 1.548$ , so  $c \simeq 6.192$ . See Tables 3b and 3c.

[Insert Tables 3a,b,c here]

Computation, using a MATLAB simulation program, showed the vote maximizing local equilibrium for 1997 to be the vector

$$\mathbf{z}_{1997}^{el} = \begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{UP} & \textit{UPR} & \textit{ROP} \\ x & -0.47 & -0.11 & 1.01 & 0.04 & -1.18 & 2.14 & -0.12 \\ y & -0.39 & 1.61 & -0.07 & -0.24 & -0.59 & 0.18 & 1.64 \end{bmatrix},$$

as shown in Figure 2. Figures 4 and 6 give the equilibria in 2001 and 2005.<sup>8</sup>

Appendix 1 compares the estimated and equilibrium positions for the three elections. As indicated by the results on the convergence coefficients and the Hessians, all parties, in equilibrium, scatter away from the electoral origin. Note that in 1997, the two high valence parties, the AWS and the SLD, have equilibrium positions very close to the electoral origin. Similarly, in 2001 only the highest valence party, the SLD, and in 2005, only the highest valence party, the PIS, have equilibrium positions that are located at, or very close to, the electoral origin. The significant drop in the valence of the AWS between 1997 and 2001 should have forced it even further from the origin than the position that it did indeed adopt. A robust inference from these figures is that parties do not locate themselves at positions that maximise the vote shares, as estimated by the joint spatial model. We suggest that parties' positions are effectively decided by small activist groups whose preferred positions are adopted by the parties. For example, when the AWS fragmented in 2001, new parties like the PiS, SO,PO and LPR adopted positions in the upper right quadrant of the

<sup>8</sup>Note that a result of Schofield (2005) asserts that LNE generically exist. Because the Hessians have positive eigenvalues, the party preference correspondences are not convex valued, so no general argument can be used to assert existence of pure strategy Nash equilibria (PNE). If a PNE were to exist it would coincide with one of the LNE.

policy space. When the UW disappeared in 2005, its place was taken by the DEM, whose position was controlled by an activist faction that had controlled the UW. These observations are consistent with the hypothesis that the activist groups supporting the AWS and the UW fragmented in 2001, and this led to the creation of these new parties.

We also estimated joint spatial models involving sociodemographics variables, and pure sociodemographic models for the three years. These estimates are given in Appendix 3. A comparison of Log-likelihoods is given in Table 3d for 1997. The comparisons for 2001 and 2005 are very similar.

[Insert Table 3d here]

We can see the nature of bargaining over coalition governments in these three elections by constructing the “median lines” between pairs of parties that pivot between majority coalitions, as in Figures 8 to 10. When these medians do not intersect, then they bound a finite, star shaped set known as the “heart.” Schofield (1999) has suggested that each election heart gives a heuristic estimate of the set of possible coalition policy outcomes.

[Insert Figures 8-10 here]

For example, note that the coalition government of AWS, and the small party, the UW, in 1997 can be represented by the upper right median in Figure 8.

The coalition of the SLD and the small party, the PSL, in 2001, can be represented by the median line on the lower left in Figure 9.

Finally, the complex negotiations involving the PiS, the PO, and the small party, the SO, in 2005 all refer to the the triangular heart bounded by these party positions in Figure 10. If we are correct in our inference that the break-up of the AWS activist group led to the creation of the smaller SO, PiS and LPR parties, we may infer that the the minority PiS government, supported by the SO and LPR provided policy benefits of some kind for the activist groups supporting these parties.<sup>9</sup> It is interesting to note that according to the spatial model, the PiS could have located itself at the electoral origin, in which case it would have been a core party, in the sense of Laver and Schofield (1990). To do so however, it would have had to change its policy position by moving “south” on the policy axis.

These figures suggest that even small parties can hope to belong to government. It follows that activist groups supporting these parties can aspire to influence government policy. We hypothesize that such activist groups have little incentive to coalesce in a highly proportional electoral system. Indeed, some of these activist groups may have every incentive to fragment. The logic of such maneuvering would seem to involve both analysis of the stochastic model, in order to gauge electoral response, coupled with coalition bargaining theory to make sense of the formation of government.

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<sup>9</sup>We may refer to the logic of these choice as “hunting the heart.”

### 3 Concluding remarks

The discussion of elections in Schofield et al (2011a,b,c,d,e,f) and in this paper suggests the electoral models are very different in a majoritarian political system such the United States and one based on a proportional electoral system such as Poland.

The convergence coefficients for the United States elections in 2000 and 2004 were only 0.37 and 0.45, respectively. According to our model, this implies that the electoral effect dominates, so that the candidates should converge to the electoral origin.

In contrast, the empirical analyses presented here show that the convergence coefficient for the 1997, 2001 and 2005 elections in Poland were 6.82, 5.92 and 6.19 respectively.. Related work has shown that the convergence coefficients were 5.94 for the 2002 election in Turkey (Schofield et al. 2011d) and 3.98 for the 1996 election in Israel (Schofield et al. 2011b). In these polities with electoral systems based on proportional representation (PR), the convergence coefficients are very high because both the spatial coefficient ( $\beta$ ) and the terms in the electoral covariance matrix are large. As a result, under PR, the pure electoral motive is sufficient to pull parties away from the center. We suggest that in the United States, the activist gradient dominates over the electoral gradient, and activist groups therefore exert a considerable influence on candidate positions. In proportional representative systems, this activist influence is much weaker.

A standard way of estimating political fragmentation is in terms of the *effective number of party vote strength (env)* or *effective number of party seat strength (ens)*.<sup>10</sup> For example, in Poland in 1997 the *env* increased from about 5.5 in 1997 to 7.7 in 2005, while the *ens* increased from 3.1 to 5.0. In Israel in 1996 the *env* and *ens* were both about 7.0, and in Turkey in 2002 the *env* was about 7.5. The *env* and *ens* are convenient measures, intended to capture the nature of the distribution of electoral preferences and how these are turned into political configurations. We propose that the convergence coefficient is a theoretically consistent way of measuring political fragmentation based as it is on the underlying political preferences and political response. These estimates for fragmented polities suggest that high convergence coefficients are associated with high estimates of the *env* and *ens*. Consider the following examples of polities with different electoral systems.

Canada has a Parliamentary polity with a plurality electoral system, giving two large parties, the Conservatives and Liberals. However, small parties, the Bloc Québécois and the New Democratic Party, can survive because of regionalism, so its electoral system is not as majoritarian as the United States. In the elections of 2004 and 2008, the *env* was about 4.0 while the *ens* increased from about 3.1 to 3.5. Schofield et al. (2011f) found that the convergence coefficient for Canada in the 2004 election was 1.94. This estimate is greater than that

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<sup>10</sup>Fragmentation can be identified with the *effective number* (Laakso and Taagepera, 1979). That is, let  $H_v$  (the Herfindahl index) be the sum of the squares of the relative vote shares and  $env = H_v^{-1}$  be the *effective number of party vote strength*. In the same way we can define *ens* as the effective number of party seat strength using shares of seats.

of the US but less than that of fragmented polities such as Poland, Israel or Turkey.

Similarly, the United Kingdom has two large parties, Labour and Conservative, and three small parties, Liberal Democrats, Scottish Nationalists and Plaid Cymru, as well as small factional parties from Northern Ireland. The results of Schofield et al. (2011c) give a convergence coefficients of 0.84 and 0.98 for the 2005 and 2010 elections in Britain. The difference between Canada and the Britain was the lower  $\beta$  in the election in the United Kingdom. The *env* for these two election in the United Kingdom were 2.7 and 3.8, while the *ens* increased from 2.5 to 3.3, indicating that the electoral system is more majoritarian than that of Canada.

The Russian polity in 2007 had a single dominant party, United Russia, with 64% of the vote and 70% of the seats, and two smaller parties with representation in the Duma. There were also a number of parties with very small vote share and no seats. The degree of majoritarianism can be inferred from the *env* of 2.3 and *ens* of 2.0. The convergence coefficient for that election was estimated to be 1.7 (Schofield and Zakharov, 2010). Empirical analysis of the 2008 election in Georgia found a convergence coefficient of 2.40. Georgia is similar to Russia in the sense that its president is able to gain close to a majority in any election.

In the winner take-all presidential election of 2004 in the United States, the *env* was about 2.0 and the *ens* can be taken to be 1.0, corresponding to the low convergence coefficient of about 0.40 (See Table 4).

[Insert Table 4 here]

These observations suggest a variation of the Duverger (1954) and Riker (1953) hypotheses regarding the difference between plurality and proportional electoral rule. We hypothesize that in an election based on proportional electoral methods, if the convergence coefficient derived from the spatial model is high, then there will be very little motivation for interest groups to coalesce. Consequently, the fragmentation of interest groups will lead to a degree of fragmentation in the polity. Without a dominant centrally located party, there may be coalitional instability resulting from a fragmented polity and a complex configuration of parties.

Indeed, we hypothesize that the difference between proportional representation and plurality rule can be summed up as follows:

- Under *proportional electoral methods*, the convergence coefficient will tend to be large ( $>2.0$ ). Bargaining to create winning coalitions occurs *after* the election, and there need be no strong tendency forcing activist groups to coalesce, in order to concentrate their influence. Indeed, there can exist incentives for activist groups to fragment. If activist groups respond to this impulse, then activist fragmentation will result in party fragmentation. Parties can be scattered throughout the policy space. Activist groups, linked to small parties, may aspire to affect policy outcomes, by gaining access to the governing coalition. This is indicated by the observation that the bargaining domain in the legislature (the heart) will depend on the location of small parties. Party strengths will fluctuate in response to

exogenous shocks, and the structure of the heart will be affected by these changes. We conjecture that activist groups will attempt to maneuver the party, partly with a view to gaining votes, but more importantly, to be positioned in the heart.

- Under the strong version of plurality rule, as in the United States, the convergence coefficient will be low ( $<1.0$ ). If interest groups do not form a coalition *before* the election, then they will have little impact on political outcomes. Consequently, small, third parties cannot obtain representation. Unlike the situation in a polity based on proportional rule, an activist group linked to a small party in a plurality polity has little expectation of influencing government policy. Thus activist groups face “increasing returns to size.” In the United States, presidential candidates must balance the centripetal electoral effect against the centrifugal activist effect, and plurality rule induces what is essentially a two party system, through this effect on activist groups. Although the two party configuration may be in equilibrium at any time, the tension within the activist coalitions can induce a slow transformation of party positions, and thus political realignment.
- In Parliamentary systems based on plurality rule, such as Britain, Canada and Russia, the convergence coefficient will tend to take intermediate values (between 0.8 and 2.0). Large and small parties can co-exist, and the influence of activist groups will depend on the degree of regional orientation of the parties.

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## 5 Appendices

### 5.1 Computation of Equilibria for Poland

We can compare  $\mathbf{z}^*$  and  $\mathbf{z}^{el}$  for various years as follows.

$$\mathbf{z}_{1997}^* - \mathbf{z}_{1997}^{el} =$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{UP} & \textit{UPR} & \textit{ROP} \\ x & 0.03 & -0.35 & 0.52 & 0.005 & 0.29 & 1.81 & 0.15 \\ y & -0.72 & -0.35 & -0.1 & 0.72 & -0.15 & -0.15 & 0.75 \end{bmatrix} -$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{UP} & \textit{UPR} & \textit{ROP} \\ x & -0.47 & -0.11 & 1.01 & 0.04 & -1.18 & 2.14 & -0.12 \\ y & -0.39 & 1.61 & -0.07 & -0.24 & -0.59 & 0.18 & 1.64 \end{bmatrix} =$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{UP} & \textit{UPR} & \textit{ROP} \\ x & 0.50 & -0.22 & -0.49 & -0.035 & 1.47 & -0.33 & 0.15 \\ y & -0.33 & -1.96 & -0.03 & 0.48 & 0.44 & -0.33 & -0.89 \end{bmatrix}$$

Now  $\sigma = 1.41$ , so

$$\frac{1}{2\beta\sigma} \frac{d\boldsymbol{\mu}}{d\mathbf{z}}(\mathbf{z}) = \begin{bmatrix} \textit{Party} & \textit{SLD} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{UP} & \textit{UPR} & \textit{ROP} \\ x & 0.35 & -0.16 & -0.34 & -0.02 & 1.04 & -0.23 & 0.10 \\ y & -0.23 & -1.39 & -0.02 & 0.34 & 0.31 & -0.23 & -0.63 \end{bmatrix}$$

is a dimensionless estimate of activist influence. These estimated influences are significant for the PSL and UP, both small parties. The electoral mean in 1997 is (0.09,0.09) so the closest equilibrium position to this is that of the AWS.

Similarly

$$\mathbf{z}_{2001}^{el} =$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD,UP} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{SO} & \textit{PiS} & \textit{PO} & \textit{LPR} \\ x & -0.29 & 0.25 & 1.97 & 1.70 & -0.65 & -0.26 & 0.69 & -0.48 \\ y & -0.36 & 1.25 & -0.98 & -0.84 & -0.96 & 1.055 & 0.15 & 0.99 \end{bmatrix}.$$

In 2001, the electoral mean is (0.08,-0.04) so the SLD equilibrium is close to the mean. We obtain

$$\mathbf{z}_{2001}^* - \mathbf{z}_{2001}^{el} =$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD,UP} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{SO} & \textit{PiS} & \textit{PO} & \textit{LPR} \\ x & -0.12 & -0.29 & 1.16 & 0.66 & 0.03 & 0.11 & 0.57 & 0.14 \\ y & -0.47 & -0.05 & 0.002 & 0.83 & 0.27 & 0.41 & 0.17 & 0.87 \end{bmatrix} -$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD,UP} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{SO} & \textit{PiS} & \textit{PO} & \textit{LPR} \\ x & -0.29 & 0.25 & 1.97 & 1.70 & -0.65 & -0.26 & 0.69 & -0.48 \\ y & -0.36 & 1.25 & -0.98 & -0.84 & -0.96 & 1.06 & 0.15 & 0.99 \end{bmatrix} =$$

$$\begin{bmatrix} \textit{Party} & \textit{SLD,UP} & \textit{PSL} & \textit{UW} & \textit{AWS} & \textit{SO} & \textit{PiS} & \textit{PO} & \textit{LPR} \\ x & 0.17 & -0.04 & -0.81 & -1.04 & -0.68 & 0.37 & -0.12 & 0.62 \\ y & -0.11 & -1.3 & 0.98 & 1.67 & 1.23 & -0.65 & 0.02 & -0.12 \end{bmatrix}$$

Also

$$\mathbf{z}_{2005}^{el} = \begin{bmatrix} Party & SLD & PSL & DEM & SDP & SO & PiS & PO & LPR \\ x & -0.80 & 1.13 & -0.30 & -1.00 & -0.26 & -0.31 & 0.27 & -0.22 \\ y & -0.57 & -0.03 & 2.00 & -0.47 & 0.85 & -0.42 & -0.42 & 1.42 \end{bmatrix}.$$

The electoral mean in 2005 is (-0.04,-0.02) so the equilibrium position of the PiS is very close to the mean. We obtain

$$\mathbf{z}_{2005}^* - \mathbf{z}_{2005}^{el} = \begin{bmatrix} Party & SLD & PSL & DEM & SDP & SO & PiS & PO & LPR \\ x & 0.05 & -0.35 & 0.58 & 0.10 & -0.52 & -0.01 & 0.16 & -0.16 \\ y & -0.56 & 0.09 & -0.54 & -0.61 & -0.04 & 0.20 & -0.23 & 0.90 \end{bmatrix} - \begin{bmatrix} Party & SLD & PSL & DEM & SDP & SO & PiS & PO & LPR \\ x & -0.80 & 1.13 & -0.30 & -1.00 & -0.26 & -0.31 & 0.27 & -0.22 \\ y & -0.57 & -0.03 & 2.00 & -0.47 & 0.85 & -0.42 & -0.42 & 1.42 \end{bmatrix} = \begin{bmatrix} Party & SLD & PSL & DEM & SDP & SO & PiS & PO & LPR \\ x & 0.85 & -1.48 & 0.88 & 1.10 & -0.26 & 0.30 & -0.11 & 0.06 \\ y & 0.01 & 0.12 & -2.54 & -0.14 & -0.89 & -0.62 & 0.19 & -0.52 \end{bmatrix}$$

These estimates appear to be particularly significant for the AWS in 2001 and the PSL in 2005, both small, radical right wing parties,

## 5.2 Appendix 2. Question wording for Poland and Factor Loadings

These question wordings are based on the 2001 PNES. We have also indicated any noteworthy differences in question wording for the other years.

### **Vote choice**

“For which party or coalition candidate did you vote in the Sejm elections?”

The issue positions of voters

“A variety of solutions and policies aimed at solving the above mentioned issues are conceivable. On subsequent CARDS we present opposite solutions to each issue. Please read them carefully and tell me, where would you place your own opinions and stances. In doing so, please use the 11-point scale, where: 0 – means full acceptance of the statement (solution) proposed on the left side of the CARD, 10 – means full acceptance of the statement (solution) – on the right side, 5 – means that you favor solutions lying in between both opposite ones, and the remaining scale points indicate different levels of acceptance of each of those opposite statements.”

### **Economic dimension**

1) Privatization

00) State owned enterprises should be privatized quickly; the inefficient ones should be liquidated

10) Enterprises should remain state property and their modernization financed from the state budget

2) Unemployment

00) Fighting unemployment should be an absolute policy priority of the government, even if it leads to higher spending and inflation

10) Many other - more important than unemployment -issues should be governmental priority, i.e. balanced budget, fighting inflation, etc.

3) Income tax

00) The higher one’s income, the higher the percentage it should be taxed

10) Everyone should be taxed the same percentage of his/her income, irrespectively of the income level

4) Subsidies to agriculture

00) Agriculture should receive subsidies from the budget, otherwise many farms will go bankrupt

10) Agriculture should not receive subsidies from the budget, because no single social group should live at the expense of society

5) State vs. individual responsibility for social welfare

00) The state should grant its citizens the widest possible social safety net, i.e. health care, social welfare, free education, etc.

10) Citizens should take care and responsibility of their health, self-help, children’s education, etc on their own

### **Social values dimension**

6) Church and state

- 00) The Church should be completely separated from the state and should not interfere with politics
- 10) The Church should exert influence over politics and state policies
- 7) Decommunization
- 00) Individuals occupying high positions under communism ('nomenclatura') should now be forbidden to perform responsible state functions
- 10) These individuals ('nomenclatura') should have the same rights as all others in competing for public offices and state positions
- 8) Abortion
- 00) Women should have abortion right regardless of situation
- 10) Abortion should not be allowed regardless of situation

We reversed the coding on Privatization and Decommunization so that (00) could be regarded as a more left wing, or pro-communist response.

We used factor analysis to obtain the positions of voters on the economic and social values dimension.

### **Sociodemographics**

For the sociodemographic variables we used the responses to the following questions.

- 1) Income

"What was your average monthly income last year?"

The measure is recorded in Polish zloty.

- 2) Age

"Your year of birth. . ."

We subtracted respondent's year of birth from the year of election to obtain respondent's age in years.

- 3) Communist party membership

"Did you ever happen to be a member of PZRP, ZSL, or SD?"

- 1) yes

- 2) no

The 2005 survey had an additional option (3) "Was too young." We collapsed this with "no" in order to maintain a dichotomous measure.

The 2005 survey asked about membership in PZRP only and not in the other two communist regime satellite parties. The 1997 survey asked about membership in each of the ex-communist parties separately. We only used the information about former PZRP membership because this was the main communist party whereas the others were satellites that cooperated with the regime.

- 4) Religion

"How would you describe your attitude towards religion? Are you:

- 1) atheist

- 2) agnostic

- 3) believer

- 4) devout believer."

We collapsed the first two and last two categories to obtain a dichotomous measure of 1=religious, 0=not religious.

**Table 1a** Factor loadings from the Polish National Election Survey, 1997.

Question	1.Economic	2.Social
1.Privatization	<b>0.45</b>	0.003
2.Unemployment	<b>0.701</b>	-0.074
3.Income Tax	<b>0.529</b>	-0.04
4. Subsidies	<b>0.650</b>	-0.17
5.Social Welfare	<b>0.763</b>	0.021
6.Church and State	0.069	<b>0.799</b>
7.Decommunization	-0.010	<b>0.523</b>
8.Abortion	0.14	<b>0.802</b>
Eigenvalues	2.00	1.59

**Table 1b** Factor loadings from the Polish National Election Survey, 2001.

Question	1.Economic	2.Social
1.Privatization	<b>0.537</b>	0.266
2.Unemployment	<b>0.656</b>	-0.133
3.Income Tax	<b>0.555</b>	-0.225
4. Subsidies	<b>0.695</b>	-0.166
5.Social Welfare	<b>0.737</b>	-0.176
6.Church and State	0.31	<b>0.538</b>
7.Decommunization	0.186	<b>0.795</b>
Eigenvalues	2,185	1.119

**Table 1c** Factor loadings from the Polish National Election Survey, 2005.

Question	1.Economic	2.Social
1.Privatization	<b>0.528</b>	-0.069
2.Unemployment	<b>0.691</b>	0.032
3.Income Tax	<b>0.584</b>	-0.138
4. Subsidies	<b>0.612</b>	-0.301
5.Social Welfare	<b>0.742</b>	-0.033
6.Church and State	0.281	<b>0.746</b>
8.Abortion	0.117	<b>0.801</b>
Eigenvalues	2.115	1.315

**Table 2a.** Seats in Polish Sejm elections

Party	1997 (%)	2001 (%)	2005 (%)
Democratic Left Alliance (SLD)	164 (35.6)	200* (43.4*)	55 (12.0)
Polish People's Party (PSL)	27 (5.8)	42 (9.1)	25 (5.4)
Freedom Union (UW)	60 (13.0)	0	
Solidarity Election Action (AWS)	201 (43.6)	0	
Labor Party (UP)	0	16* (3.5*)	
Union of Political Realism (UPR)	0		
Movement for Reconstruction of Poland (ROP)	6 (1.3)		
Self Defense, Samoobrona (SO)		53 (11.5)	56 (12.1)
Law and Justice (PiS)		44 (9.5)	155 (33.7)
Civic Platform (PO)		65 (14.1)	133 (29.0)
League of Polish Families (LPR)		38 (8.2)	34 (7.4)
Democratic Party (DEM)			0
Social Democracy of Poland (SDP)			0
German minority	2	2 (0.4)	2 (0.4)
<b>Total</b>	<b>460</b>	<b>460</b>	<b>460</b>

\* Coalition of SLD with UP

**Table 2b.** Vote shares in Polish Sejm elections

	1997	2001	2005
Democratic Left Alliance (SLD)	27.1	41.0*	11.3
Polish People's Party (PSL)	7.3	9.0	7.0
Freedom Union (UW)	13.4	3.1	
Solidarity Election Action (AWS)	33.8	5.6	
Labor Party (UP)	4.7		
Union of Political Realism (UPR)	2.0		
Movement for Reconstruction of Poland (ROP)	5.6		
Self Defense (SO)		10.2	11.4
Law and Justice (PiS)		9.5	27.0
Civic Platform (PO)		12.7	24.1
League of Polish Families (LPR)		7.9	8.0
Democratic Party (DEM)			2.5
Social Democracy of Poland (SDP)			3.9

\* Coalition of SLD with UP

**Table 3a.**Poland 1997 Pure Spatial Model (Base=ROP)

Variable	Party	Coefficient	Std.Error	t-value
$\beta$		1.739	0.116	15.04***
$\lambda$ valence	UP	-0.558	0.262	2.134
	UW	0.731	0.199	3.667***
	AWS	1.921	0.174	11.046***
	SLD	1.419	0.19	7.47***
	PSL	0.073	0.222	0.328
	UPR	-2.348	0.501	4.685***
$n=660$	LL=-855	AIC=1725		

\*:*prob*<0.1; \*\*:*prob*<0.05; \*\*\*:*prob*<0.01; LL=loglikelihood.

**Table 3b.**Poland 2001 Pure Spatial Model (Base=LPR)

Variable	Party	Coefficient	Std.Error	t-value
$\beta$		1.482	0.118	12.61***
$\lambda$ valence	SLD	1.989	0.174	11.407***
	AWS	-0.369	0.248	1.485
	UW	-0.998	0.308	3.242***
	SO	0.411	0.202	2.038*
	PIS	0.433	0.2	2.163*
	PSL	0.089	0.218	0.407
	PO	0.803	0.192	4.189***
$n=657$	LL=-1004	AIC=2024		

\*:*prob*<0.1; \*\*:*prob*<0.05; \*\*\*:*prob*<0.01.

**Table 3c** Poland 2005 Pure Spatial Model (Base=LPR)

	Party	Coefficient	Std.Error	t-value
$\beta$		1.548	0.115	13.405***
$\lambda$ valence	SO	0.819	0.161	5.091***
	DEM	-1.04	0.26	4.006***
	SDP	-0.34	0.205	1.663
	PIS	1.954	0.146	13.401***
	SLD	0.466	0.172	2.715***
	PO	1.503	0.152	9.882***
	PSL	-0.168	0.196	0.858
$n=1095$	LL=-1766	AIC=3549		

\*:*prob*<0.1; \*\*:*prob*<0.05; \*\*\*:*prob*<0.01.

**Table 3d.** Comparisons of LL for Poland in 1997

	$M_2$	Joint	Spatial	Socio-Dem.
$M_1$	Joint	na	34	629
	Spatial	-34	na	595
	Socio-Dem.	-595	-629	na

**Table 4 Convergence coefficients and Fragmentation**

	<b>Country</b>		
<b>Variable</b>	<b>US</b>	<b>Britain</b>	<b>Canada</b>
<b>Conv. Coef.</b>	[0.40,1.1] (2000-08)	[0.84,0.98] (2005-2010)	1.94 (2004)
<b>Political system</b>	Pres. <sup>a</sup> PL. <sup>b</sup>	Parl. <sup>a</sup> PL. <sup>b</sup>	Parl. <sup>a</sup> PL. <sup>b</sup>
<b>env</b>	2.0	2.7 (2005)	4.0 (2004)
<b>env</b>		3.8 (2010)	4.1 (2008)
<b>ens</b>	1.0	2.5 (2005)	3.1 (2004)
<b>ens</b>		3.3 (2010)	3.5 (2008)
	<b>Russia</b>	<b>Georgia</b>	<b>Azerbaijan</b>
<b>Conv. Coef.</b>	1.7 (2007)	2.4 (2008)	2.89 <sup>c</sup> (2010)
<b>Political system</b>	Anoc Pres. <sup>d</sup> PL. <sup>b</sup>	Anoc Pres. <sup>d</sup> PL. <sup>b</sup>	Anoc Pres. <sup>d</sup> PL. <sup>b</sup>
<b>env</b>	2.3	2.9 (2008)	2.27
<b>ens</b>	2.0	1.0 (2008)	1.3
	<b>Israel</b>	<b>Turkey</b>	<b>Poland</b>
<b>Conv. Coef.</b>	3.98 (1996)	5.94 (2002)	6.82 (1997)
<b>Political system</b>	Frag. <sup>e</sup> PR <sup>b</sup>	Frag. <sup>e</sup> , PR <sup>b</sup> , cut off	Frag. <sup>e</sup> PR <sup>b</sup>
<b>env</b>	6.5 (1996)	7.7 (1999)	5.5 (1997)
<b>env</b>	10.0 (2009)	4.0 (2007)	7.7 (2005)
<b>ens</b>	6.5 (1996)	5.0 (1999)	3.1 (1997)
<b>ens</b>	10.0 (2009)	2.3 (2007)	5.0 (2005)

<sup>a</sup> Parl= parliamentary; Pres.= presidential. <sup>b</sup> PL=plurality; PR= proportional representation.

<sup>c</sup> Convergence coefficient modified for two dim <sup>d</sup> Anoc.Pres=Anocratic presidential.

<sup>e</sup> Frag. = fragmented

### 5.3 Appendix 3

**Table 4a** Poland 1997 Joint Model (Base=ROP)

Variable	Party	Coefficient	Std.Error	t-value
$\beta$		1.652***	0.121	13.70
$\lambda$ valence	UP	1.652	3.503	0.472
	UW	0.894	2.79	0.32
	AWS	2.321	2.637	0.88
	SLD	2.323	2.709	0.857
	PSL	-0.831	3.632	0.229
	UPR	5.032	5.681	0.886
Age	UP	0.005	0.019	0.268
	UW	0.007	0.015	0.461
	AWS	0.014	0.013	1.123
	SLD	0.026	0.014	1.857
	PSL	0.023	0.016	1.466
	UPR	-0.053	0.047	1.133
CPMemb	UP	-0.046	0.753	0.062
	UW	-0.857	0.644	1.331
	AWS	-0.964	0.56	1.72
	SLD	0.697	0.541	1.287
	PSL	0.115	0.631	0.183
	UPR	0.947	1.392	0.68
Religion	UP	-0.678	0.933	0.727
	UW	-0.442	0.811	0.545
	AWS	0.679	0.846	0.803
	SLD	-0.66	0.786	0.839
	PSL	1.197	1.262	0.948
	UPR	-0.498	1.421	0.351
Income	UP	-0.182	0.4	0.454
	UW	0.061	0.304	0.2
	AWS	-0.358	0.274	1.309
	SLD	-0.165	0.296	0.557
	PSL	-0.404	0.358	1.128
	UPR	-0.674	0.697	0.968
$n=660$	LL=-821	AIC=1704		

\*: $prob < 0.05$ ; \*\*: $prob < 0.01$ ; \*\*\*: $prob < 0.001$ .

**Table 4b.** Poland 2001 Joint Model (Base=LPR)

Variable	Party	Coefficient	Std.Error	t-value
$\beta$		1.451***	0.119	12.16
$\lambda$ valence	SLD	1.378	0.939	1.467
	AWS	-1.391	1.418	0.981
	UW	-0.35	1.622	0.216
	SO	-0.099	1.033	0.096
	PIS	-1.346	1.29	1.043
	PSL	-0.325	1.096	0.297
	PO	0.936	0.96	0.975
Age	SLD	0.001	0.011	0.036
	AWS	0.005	0.016	0.299
	UW	-0.004	0.021	0.184
	SO	0.012	0.013	0.882
	PIS	-0.001	0.013	0.105
	PSL	-0.001	0.014	0.079
	PO	-0.016	0.012	1.255
CPMemb	SLD	1.541*	0.763	2.02*
	AWS	1.545	0.895	1.726
	UW	1.305	1.086	1.202
	SO	1.057	0.824	1.283
	PIS	0.19	0.902	0.211
	PSL	1.64	0.832	1.972*
	PO	0.856	0.833	1.028
Religion	SLD	-0.467	0.463	1.008
	AWS	0.154	0.516	0.298
	UW	-1.249	0.799	1.564
	SO	0.003	0.508	0.007
	PIS	0.008	0.492	0.017
	PSL	0.318	0.447	0.71
	PO	0.183	0.436	0.419
Income	SLD	0.129	0.104	1.24
	AWS	0.069	0.165	0.422
	UW	0.082	0.183	0.446
	SO	-0.029	0.111	0.259
	PIS	0.277	0.155	1.789
	PSL	-0.002	0.125	0.019
	PO	0.06	0.108	0.555
$n=657$	LL=-983	AIC=2039		

\*: $prob < 0.05$ ;  $prob < 0.01$ ; \*\*\*: $prob < 0.001$ .

**Table 4c.** Poland 2005 Joint Model (Base=LPR)

Variable	Party	Coefficient	Std.Error	t-value
$\beta$		1.406***	0.12	11.73
$\lambda$ valence	SO	1.311	2.265	0.579
	DEM	-9.996**	3.553	2.813
	SDP	-4.994	2.874	1.738
	PIS	-0.352	2.051	0.172
	SLD	-4.327	2.445	1.77
	PO	-3.742	2.15	1.741
	PSL	-0.312	2.737	0.114
Age	SO	0.012	0.01	1.207
	DEM	0.008	0.017	0.455
	SDP	0.011	0.013	0.795
	PIS	-0.001	0.009	0.096
	SLD	0.02	0.011	1.805
	PO	-0.007	0.009	0.73
	PSL	0.007	0.012	0.604
CPMemb	SO	0.129	0.535	0.241
	DEM	1.109	1.149	0.965
	SDP	-0.627	0.609	1.029
	PIS	0.107	0.484	0.221
	SLD	-0.237	0.546	0.434
	PO	0.569	0.531	1.072
	PSL	-0.171	0.621	0.276
Religion	SO	-0.449	0.79	0.568
	DEM	-0.88	0.936	0.941
	SDP	-1.128	0.825	1.368
	PIS	-0.085	0.758	-0.112
	SLD	-1.462	0.774	1.889
	PO	-0.614	0.758	0.81
	PSL	-0.019	0.944	0.02
Income	SO	-0.12	0.297	0.405
	DEM	1.201*	0.432	2.776
	SDP	0.822*	0.373	2.206*
	PIS	0.342	0.266	1.288
	SLD	0.767*	0.318	2.412
	PO	0.816**	0.278	2.934
	PSL	-0.011	0.36	0.03
$n=1095$	LL=-1722	AIC=3516		

\*: $prob < 0.05$ ; \*\*: $prob < 0.01$ ; \*\*\*: $prob < 0.001$ .

**Table 5a.** Polish Socio-demographic logit Model  
1997 Election (Normalized w.r.t. SLD)

Party	Variable	Coefficient	95% CI (Lower Bound)	95% CI (Upper Bound)
PSL	Valence	-1.932*	-3.027	-0.837
	Comm. Party Member	-0.635	-1.324	0.054
	Monthly Income	0.000005	-0.0003	0.0003
	Age	0.012	-0.005	0.03
UW	Valence	-0.263	-1.077	0.55
	Comm. Party Member	-1.529**	-2.229	-0.828
	Monthly Income	0.0003*	0.00004	0.00005
	Age	-0.009	-0.0002	0.0002
AWS	Valence	0.438	-0.255	1.103
	Comm. Party Member	-2.215**	-2.788	-1.642
	Monthly Income	0.00000	-0.0002	0.0002
	Age	0.004	-0.006	0.016
UP	Valence	-1.438**	-2.853	-0.023
	Comm. Party Member	-0.576	-1.604	0.452
	Monthly Income	0.0002	-0.00009	0.0006
	Age	-0.019	-0.047	0.007
UPR	Valence	-3.106***	-5.512	-0.701
	Comm. Party Member	-14.606	-1407.74	1378.5
	Monthly Income	-0.00008	-0.001	0.0009
	Age	-0.004	-0.023	0.015
ROP	Valence	-1.258	-2.358	-0.158
	Comm. Party Member	-1.243*	-2.152	-0.333
	Monthly Income	0.00007	-0.0002	0.0004
	Age	-0.004	-0.023	0.015
LL=-1450		***:prob<0.001		
n=858		** :prob<0.01		

**Table 5b.** Polish Socio-demographic logit Model  
2001 Election (Normalized w.r.t. SLD)

Party	Variable	Coefficient	95% CI (Lower Bound)	95% CI (Upper Bound)
PSL	Valence	-1.714*	-2.903	-0.525
	Comm. Party Member	-0.063	-0.816	0.689
	Monthly Income	-0.0006*	-0.001	-0.0001
	Age	-0.007	-0.025	0.01
	Religion	1.073**	0.415	1.73
UW	Valence	-2.714*	-4.572	-0.855
	Comm. Party Member	-0.837	-2.368	0.694
	Monthly Income	0.0001	-0.00003	0.0003
	Age	0.00001	-0.031	0.031
	Religion	-0.442	-1.613	0.729
AWS	Valence	0.438	-0.255	1.103
	Comm. Party Member	-2.215***	-2.788	-1.642
	Monthly Income	0.00000	0.00002	0.0003
	Age	0.004	-0.006	0.016
	Religion	1.094**	0.336	1.853
SO	Valence	-1.516**	-2.781	-0.412
	Comm. Party Member	-0.439	-1.146	0.267
	Monthly Income	-0.0008**	-0.001	-0.0003
	Age	0.007	-0.008	0.022
	Religion	0.656	-0.136	1.448
PIS	Valence	-2.306***	-3.421	-1.195
	Comm. Party Member	-1.516**	-2.570	-0.463
	Monthly Income	0.0001	-0.00006	0.0003
	Age	0.0007	-0.015	0.016
	Religion	0.831**	0.119	1.54
PO	Valence	-1.601**	-2.578	-0.635
	Comm. Party Member	-0.971**	-1.757	-0.184
	Monthly Income	0.0001	-0.00007	0.0002
	Age	-0.01	-0.024	0.004
	Religion	0.949	0.324	1.575
LPR	Valence	-2.431	-3.713	-1.118
	Comm. Party Member	-1.534**	-2.736	-0.332
	Monthly Income	-0.0004	-0.0009	0.00004
	Age	0.008	-0.008	0.026
	Religion	0.0855**	0.074	1.636
LL=-1279		***:prob<0.001		
n=781		**:prob<0.01		

**Table 5c.** Polish Socio-demographic logit Model  
2005 Election (Normalized w.r.t. SLD)

Party	Variable	Coefficient	95% CI (Lower Bound)	95% CI (Upper Bound)
PSL	Valence	-1.613	-4.107	0.881
	Comm. Party Member	0.171	-0.717	1.061
	Monthly Income	-0.0007**	-0.001	-0.0001
	Age	-0.002	-0.022	0.017
	Religion	1.885**	0.639	3.132
SO	Valence	-0.754	-2.617	1.108
	Comm. Party Member	-0.576	-0.143	1.296
	Monthly Income	-0.0008**	-0.001	-0.0004
	Age	-0.004	-0.019	0.01
	Religion	1.409**	0.686	2.131
PIS	Valence	-0.120	-1.659	1.419
	Comm. Party Member	0.582	-0.011	1.175
	Monthly Income	-0.0002**	-0.0005	-0.00001
	Age	-0.014**	-0.028	-0.001
	Religion	1.76***	1.176	2.343
PO	Valence	-0.499	-2.183	1.184
	Comm. Party Member	0.957**	0.273	1.641
	Monthly Income	0.00002	-0.0002	0.0002
	Age	-0.024**	-0.038	-0.010
	Religion	1.035**	0.472	1.597
LPR	Valence	-2.639	-5.303	0.025
	Comm. Party Member	0.632	-0.314	1.578
	Monthly Income	-0.001**	-0.001	-0.0004
	Age	0.002	-0.021	0.015
	Religion	2.496***	1.017	3.974
DEM	Valence	-5.016	-9.621	-0.411
	Comm. Party Member	1.557	0.536	3.651
	Monthly Income	0.0002	-0.00001	0.0005
	Age	-0.006	-0.036	0.022
	Religion	0.435	-0.76	1.632
SDP	Valence	-0.684	-2.980	1.61
	Comm. Party Member	-0.039	-0.912	0.833
	Monthly Income	-0.00004	-0.0004	0.0003
	Age	-0.004	-0.025	0.017
	Religion	0.285	-0.52	1.09
	LL=-2094	***:prob<0.001		
	n=1263	** :prob<0.01		

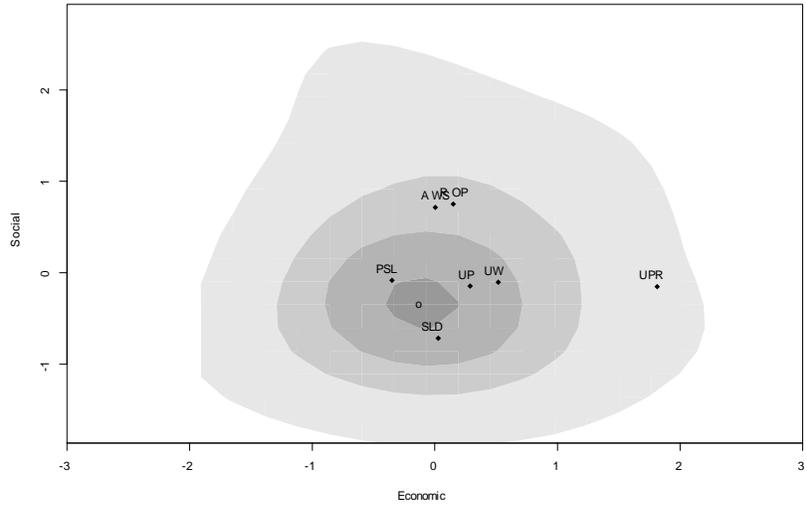


Figure 1: Voter distribution and party positions in Poland in 1997

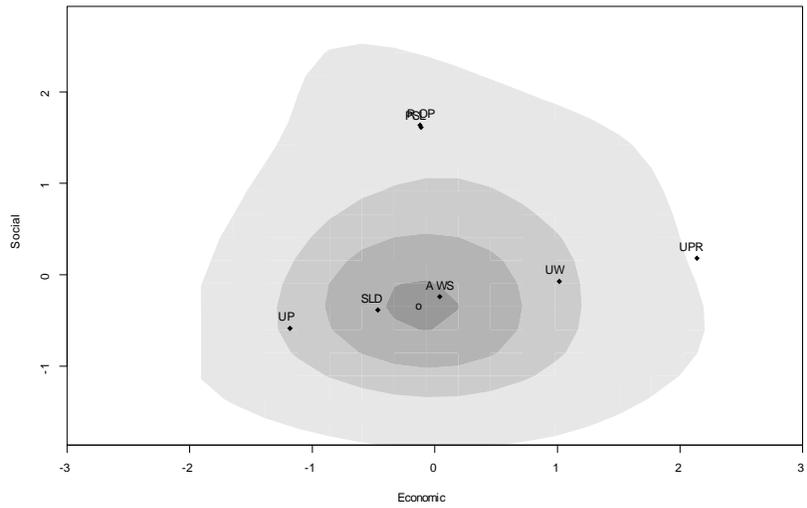


Figure 2: Equilibrium positions under the joint model in 1997

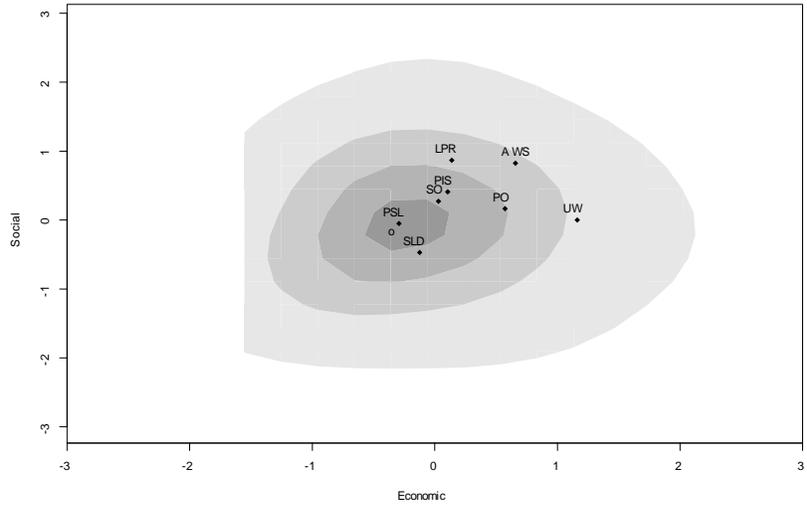


Figure 3: Estimated party positions in 2001

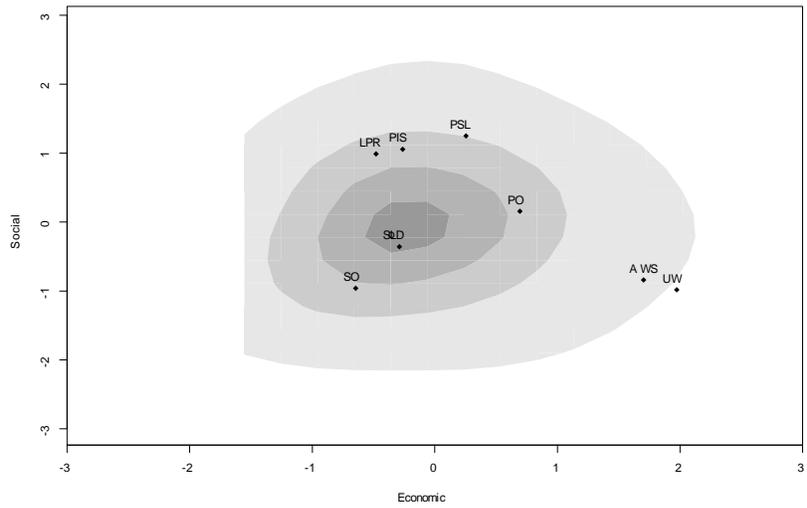


Figure 4: Equilibrium positions under the joint model in 2001

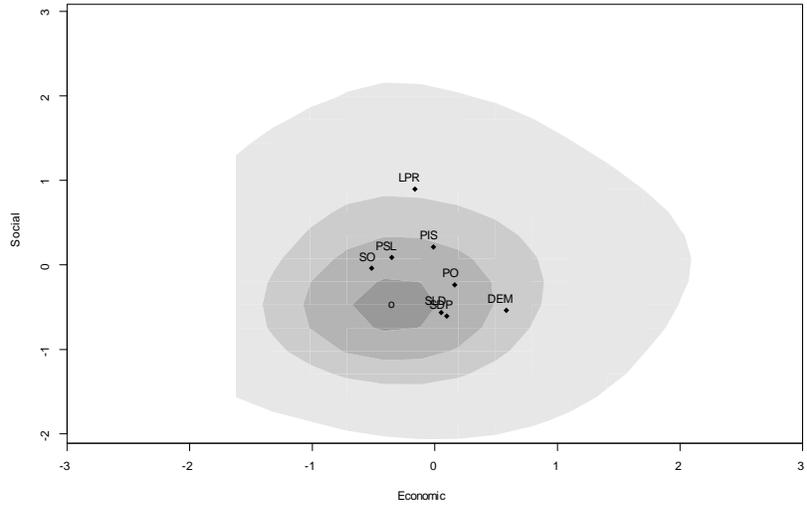


Figure 5: Estimated party positions in 2005

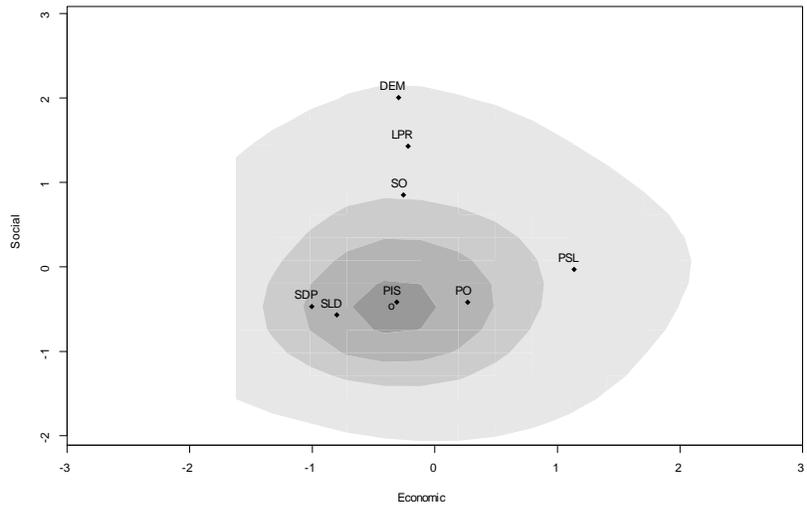


Figure 6: Equilibrium positions under the joint model in 2005

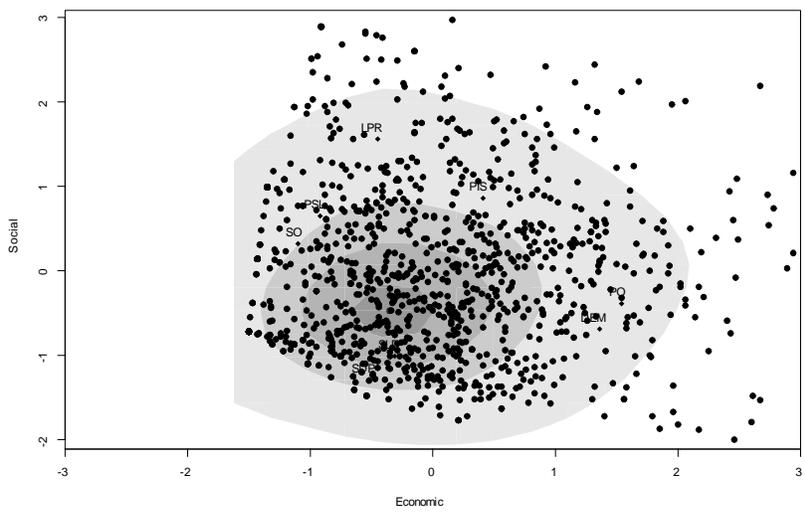


Figure 7: Scattergram of voter positions in 2005

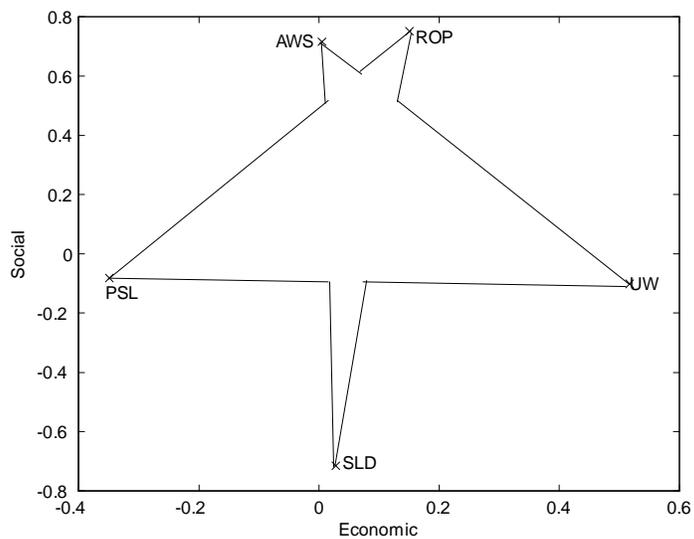


Figure 8: Estimate of the heart in 1997

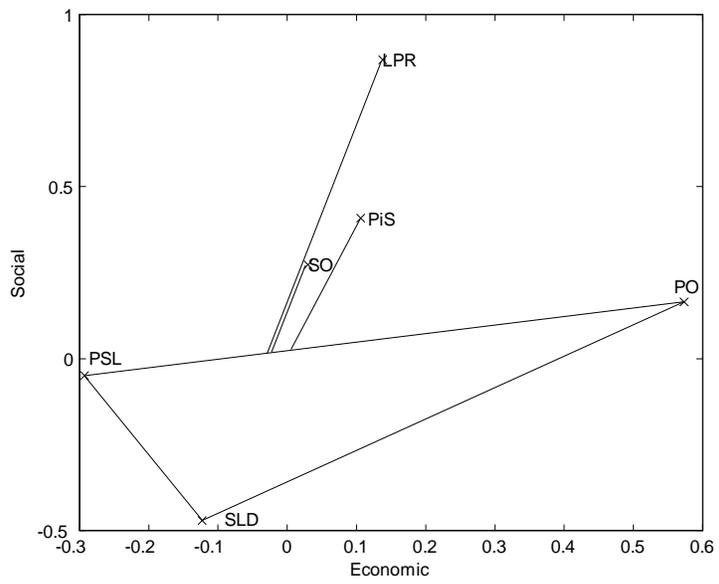


Figure 9: Estimate of the heart in 2001

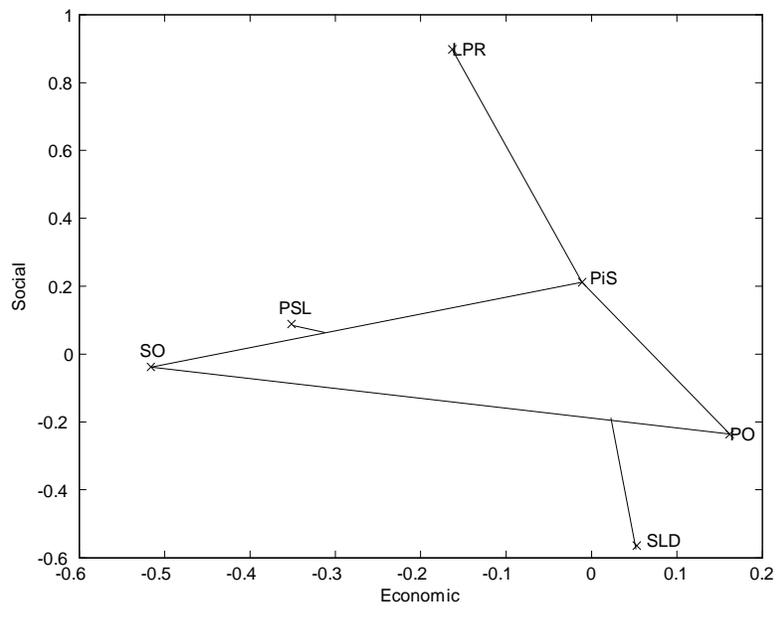


Figure 10: Estimate of the heart in 2005