Voting behaviour and party movement in elections with an uneven population preference distribution: The cost of winning

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Abstract

In this paper, I will study the effects of an uneven or unequal distribution of voter preferences combined with the electors benefitting from winning on voting behaviour and party positions in a majority rules election. This means that one side of the political spectrum has more supporters than the other, when split down the middle. Most existing political economy models do not include a value for this winning feeling, even though both psychological and economic analyses find that this feeling does influence people choices. To fill the gaps in knowledge, this paper examines a model where the voters gain utility based on both the distance to the candidates and a value that represents their gain from winning. Having an uneven distribution means that one of the parties is advantaged and will win the election due to having more supporters. To analyse the effect on voting behaviour, this paper will compare the point where the indifferent voter is located with either even or uneven distributions. The shift in this point should be the effect of the benefit of winning. Party positions will be studied by working out the optimal distance that a party should move before analysing the subgame that the parties play to decide whether to commit to this movement or not. The analysis shows that voting behaviour shifts in favour of the already winning party, granting that party an even larger share of the votes. Furthermore, it can explain both convergence or divergence between party positions, depending on the relationship between the costs of moving and the benefit of winning, as well as whether there is an even or uneven distribution of voter preferences.

Introduction

Political economics is one of the most important fields of economics we know today. Understanding human voting behaviour is incredibly difficult, yet extremely important. It helps in predicting election outcomes and, possibly even more crucial, can explain how the electorates preferences will influence other aspects of the economy. Being able to predict matters such as monetary and fiscal policy, economic growth and even social norms is key for policymakers, along with politicians and not to mention regular citizens.

People have been trying to explain voting behaviour for almost a century. In the 1950's Downs (1957) and Black (1958) made some of the most influential papers in the field of political economics. Numerous theories were written, each with different assumptions and reasoning, however none of them have succeeded in completely explaining every complicated part of modern elections. Nowadays, we have a good understanding of the basics, yet current elections are some of the most complicated systems we have known. More and more models are created to explain as many factors as possible, such as the pivotal voter model (Palfrey & Rosenthal, 1985; Borgers, 2004) which takes two parties that can move on a two-dimensional plane of political preferences. These models can change drastically when looking at three-dimensional models, where candidates not only choose between left and right, but also between progressive and conservative (Levy, 2004).

In spite of all these papers being written, there are still some gaps in these studies. Previous papers have written about running candidates gaining utility from winning the election though things like gaining power (Downs, 1957), however very few models include a utility gain on the voters side for winning. Humans enjoy the feeling of winning (Herbst, 2016), meaning that it is worth looking into the role that this feeling has on people casting votes in an election. Especially since electors who are close to being indifferent could be swayed by this sudden gain in utility, assuming that one side is predicted to be more likely to win. This paper will therefore question:

"How do an uneven distribution of population preferences and the feeling of winning influence voting behavior and party policy?"

This paper will seek to create a greater understanding of the effect described by Herbst (2016) in an election situation. Finding and isolating individual effects is mandatory for generating a cohesive model. Therefore, this model will attempt to lay out the basis for a general model that includes the factors included in this simple model. Furthermore, if this thesis provides itself useful, it might inspire further analysis on this topic, helping the creation of the aforementioned future general model.

As stated before, creating a cohesive voter model is crucial in the field of political economics. Since there has not been a substantial amount of research on this specific topic, the results of this paper will provide a significant benefit to the current literature. Irrespective of whether the results of this investigation find significant proof for merging this hypothesis with existing theories or not, having knowledge on the effects described in this paper will certainly be important to the field of political economics. After all, even if the effect is proven to be insignificant in the future, knowing what not to utilize in the theories also brings us a step closer to the desired general model.

Finally, this paper will begin with a detailed review of previous literature, detailing the origins, key insights and gaps in the existing papers. Next, I will outline the concepts behind the model. Here, both the assumptions made in this paper, as well as the logic behind the model will be clarified. Afterwards, an extensive analysis of the key components in the model and the equilibrium that arises because of them will be written. Subsequently, I will include a discussion of the results, implications and drawbacks of this analysis, together with possibilities for future research projects. Finally, I will summarize the main findings and contributions before writing the closing remarks.

Literature review

First of all, the basis for this analysis lies with the early studies of the two party system by both Downs (1957) and Black (1958). These papers are often regarded as the ground layers of the convergence theory in the elections. Black’s (1958) median voter theorem predicts that the median policy point, given single-peaked preferences, will be the Condorcet winner of the elections. Single-peaked preferences means that every voter has a clear preference for a policy point, and as the policy moves further away from that point, it is less preferred than any point closer to the peak. Then, a Condorcet winner is a candidate that wins in a head to head contest against any other candidate, if such a candidate exists. With these assumptions, Black (1958) predicts that the winning candidate is the candidate most preferred by the median voter, since they would satisfy the Condorcet condition. Similarly, Downs (1957) found that the median position would be crucial for a party to win the elections. While he did miss the single-peaked preferences requirement, Downs (1957) argued that parties would converge on the median point, ending in an equilibrium where both parties would be on the same median policy point, assuming that there is complete information. Downs introduced some new principles in his model however, adding a value representing a benefit for candidates if they got voted into office make sure that these candidates want to win the election and will try to do so by adjusting their proposed policy platform and giving electors an opportunity cost of voting. Electors will then cast a vote based on whose policy is their most preferred platform. Parties know the way voters decide who to cast their vote for, and will adjust their policy to gain most of the votes, ending up at the point where both parties gain half of the votes, which is at the median voter’s platform, assuming a symmetrical distribution. Finally, the added variable of the opportunity costs was chosen as a way to represent the reason that a turnout of 100 percent is unrealistic in practice. Downs (1957) modelled voter behaviour in a way that they gain utility from casting a vote that changes the outcome of the election, naming it a pivotal vote. The chances of this happening are so small that even a minor cost of voting would make it not worthwhile to do so, leading to very low turnout rates in an election.

These papers fail to mention a very human factor however. Namely that winning itself grants a person increased utility (Herbst, 2016). In his paper, Herbst (2016) took a more economic approach, describing how winning a contest makes it more likely that an individual wants to take part in this contest again. This vote eliminates the payoffs from the previous game, leaving the enjoyment from winning as the primary reason for the vote. He (Herbst, 2016) concluded that people who won the previous round were bidding much more to play the second round compared to those who lost the first round. A more psychological analysis where heart rate and skin conductance were measured while subjects were participating in an auction shows that there is an increased response when the person wins the auction compared to when they lose the auction (Adam, Astor, Jähnig & Seifer, 2013). This is associated with higher levels of joy and is seen as good measurement to conclude the effect. Similarly, this phenomenon can be explained medically, as seeing a group that a person supports win or a group that the person detests lose will increase brain activity in the regions that are associated with joy (Aue, 2014). Considering multiple different fields or research find similar conclusions, there is ample evidence to include this effect in current research to analyse the results of this effect on matters such as political economy models.

Even though the difference between sincere and strategic voting has been studied extensively in multiple different voting systems, there is a key difference between strategic voting and what will be presented in this paper. Strategic voting, as described by Duverger (1954), ultimately starts with people having a single-peaked preference for a political party and then voting for a candidate that grants their preferred option the highest chance of winning. In practice however, there is a possibility for people to switch their vote to a party that is not quite their preferred candidate, but does enjoy a higher chance of winning the election. In larger elections, people often vote for a party that is larger, and thus has a higher chance of winning, compared to a smaller party that is closer to their ideals.

This phenomenon, where people seem to collectively chose to vote for a seemingly large party after public opinion polls have been released, has been examined before. The effect was dubbed the bandwagon effect, which has been studied empirically before. Irwin and Holsteyn (2000) describe the history of this bandwagon effect, showing that it has occurred more often after the 1980's compared to before. Already, relatively conclusive evidence has been found for the existence of the bandwagon effect by studies such as those by Klor and Winter (2007) and Agranov, Goeree, Romero and Yariv (2018), finding a significant effect of the polls being published on the turnout rate of the leading candidates voters. Theory has a difficult time in fully explaining this occurrence however. Grillo (2017) tried to explain this by looking at a pivotal voter model and modifying it to fit the bandwagon effect. He (Grillo, 2017) did this by assuming voter preferences to be concave to demonstrate a form of risk aversion. The benefits a voter enjoys is the increase probability that they vote for a winning candidate and the cost is an opportunity cost. The decreasing marginal benefits property of a concave utility function implies that the cost of voting has a stronger negative effect on the voter's utility if it is more likely subtracted from a small election outcome benefit (as that of a supporter of the likely loser) than from a large one (as that of a supporter of the likely winner). Hence, for any fixed increase in the probability of electing the preferred candidate generated by the act of voting, the supporters of the expected loser will find electoral participation more costly (Grillo, 2017). This is similar to the model I will use. The difference however, lies in the way people vote. In Grillo's (2017) model, people have a set preference for a party and the expected winner and loser of the election is determined by the probability of supporters of the party actually casting their vote. In contrast, my model will include a value for the utility gained from winning, which ultimately shifts the equilibrium in a way that could mean that those who would support the losing party in Grillo's (2017) model, now vote for the winning party in this model.

An additional fundamental part of this analysis is the distribution of political preferences. In earlier papers, it is calculated that political parties would move closer to the median voter, since this would result in the greatest chance of winning (Downs, 1957; Black, 1958). In newer studies, such as The Spatial Voting Model (Adams, Merrill & Zur, 2020), attention has been given to empiric results showing that convergence does not appear as often as predicted (Dalton & McAllister, 2015). Adams, James, Green and Milazzo (2012) found a sudden polarization in British politics at the end of the 1970's. Adams et al. (2020) analysed this phenomenon, giving a party's failure to accurately communicate its position to the electorate, a party leader having a certain reputation regardless of the party's position and party positions being relatively fixed in the short term as reasons for this occurrence.

Furthermore, Miller (1991) also looked into reasons for the disaggregation between parties. He (Miller, 1991) did this by examining voting preferences between different groups and subgroups. The groups were split based on electoral participation, race, region and gender. With respect to region, Miller (1991) found no significant change in voting behaviour. Gender on the other hand, did show significant differences. Similarly, the analysis of the effects of race showed changes as well. Interestingly, the group that showed the most differences was the group of black females, almost implying an interaction effect between race and gender.

Another important factor to bring up is the recent rise in right wing politics (Sandrin, 2021). This itself does not discredit the median voter theory (Black, 1958), nevertheless it does shift the position of this median voter. When taking into account that moving policy positions is often costly for a political party (Adams et al., 2020), it could explain why convergence has not been seen as much as originally predicted. It is therefore crucial to include a variable in the model that gauges the costs of moving on the political spectrum.

The current rise of the political right wing is not the first occurrence of this phenomenon. Rodden (2010) analysed data from as far back as the 1950's, showing that the distribution in the 1950's, 1972, the 1980's and the 2000's have seen a preference for right wing politics. Interestingly, only 1964 and the 1990's showed clear preference for left wing political parties. This analysis lines up with the statements from Sandrin (2021), as it shows that the distribution of political preferences has steadily become more skewed to the left since 1996.

Methodology

To start my analysis I will make a very simple two party model. In this first model, a game will be played where only the voters can decide their action. The parties will have a set policy point, after which the electors will vote for one of the parties, depending on which party is closest to their own preferred policy, thus granting the most utility. This game will be a complete information game, as each voter knows how every other person decides who to cast a vote for and also knows the distribution of voter preferences. The voters are only allowed to vote once, and the party with the highest number of votes wins the election. The model will have a uniform distribution of voters on $\theta \in [0, 1]$. In the analysis, the equilibrium point will be indicated with θ_E. The two parties will start at $P_i = 0$ and $P_j = 1$. For simplicity I will assume that every person votes, and does so sincerely. Here lies the greatest difference from earlier models, since most studies assume sincere voting, except a person can decide not to cast their vote if the costs become to large (Palfrey & Rosenthal, 1985; Borgers, 2004). My assumption of complete turnup is made to more clearly establish the effect of wanting to be part of the winning group. This implies that a voter can cast a vote for a candidate that is technically further from their preferred policy if that increases ones utility. Furthermore, I will assume that, when parties have an equal amount of votes, their probability of winning is $p = \frac{1}{2}$. This model will show where the indifferent voter is placed in a case with even distribution, which will be important to find the effect in the next models.

Next, I will transform the model to fit different voter distributions. For the remainder of this paper, I will describe the distributions as even or uneven, even meaning a distribution that has the same amount of voters to the left and right of $\theta = \frac{1}{2}$ and uneven meaning that one side has more supporters than the other. Note that an even distribution does not necessarily have to be a symmetrical distribution, though it does have to comply with the assumption that there is at least one voter at any point on the preference spectrum. The game will still have the same information structure and players. New is the voting behaviour of the electors. Since an uneven distribution means that one side of the old indifference point can have more supporters than the opposition, which grants that side the win. The parties will still be locked at the same points and the voters will still have complete information, since I assume that the distribution is known to everyone. The utility function of the electors changes a bit here however, by adding a value that is gained when winning the election. This extra utility is gained with probability $1, \frac{1}{2}$, or 0, depending on whether the party wins, draws or loses respectively. I will describe how these probabilities are affected by the distribution with the help of graphs showing example distributions. Winning is still decided by whoever gains more votes, or a coinflip in the case of a draw. The voters are still only allowed to vote once, and I will assume that there is a voter on every point along $\theta \in [0, 1]$, to guarantee there are always voters at the extreme ends of this range. Considering that the parties are still located at $P_i = 0$ and $P_j = 1$, having no supporters at this point would deem the policy platform of this candidate as irrational. Finally, I will also assume that the gain in utility from winning is greater than 0, as losing utility due to winning the election is in conflict with the existing literature.

Lastly, I will alter the model to include dynamic parties. This final model will still include the option for an uneven voter preference distribution. The game will change drastically however. The parties will first chose what their new policy point will be. This point can be anywhere on $\theta \in [0, 1]$. Since they start at $P_i = 0$ and $P_j = 1$, any chosen point that is not $P_i = 0$ or $P_j = 1$ will count as a party deciding to move. After the parties have chosen their platform, the electors decide who to cast a vote for based on the same voter utility function as in the second game. The voters can still only vote once and the game will still be decided by whoever gets more votes or a coinflip in the case of a draw. New here, is the party utility function, which is dependent on the cost of changing policy (Adams et al., 2020), together with the gain of winning the elections (Downs, 1957) multiplied with the probability of winning to simulate the expected gain of winning. The costs in question will be constant costs, meaning the party pays the same cost of moving irrespective of how far they move. This allows the parties to choose whatever policy point they believe is best, while still disincentivising movement as the single best strategy at all times. The parties will chose their platform at the same time, meaning they do not have complete information on the other candidates point. They do know the distribution, and thus the voting behaviour. The electors know the party positions and distribution. First, I will analyse the optimal distance that a party should move by working out the best responses to different party strategies to find the best approach. Afterwards, I will determine the Nash equilibria in cases with even and uneven distributions by examining an extensive form of the game. I will ignore any mixed strategies for simplicity, since the pure strategy equilibria are already dependent on multiple factors.

Analysis

Starting with the first version of the model, the parties are locked at the extremes of the preference spectrum and the electorate decides what candidate brings the most utility, which will decide their vote. The voters utility is based on the distance between the preferred policy point of the voter, compared to the policy point of the parties. To increase the weight of larger distances, I will use a quadratic loss function. The elector utility function will thus be:

$$U_e = \begin{cases} -(\theta - P_i)^2, & \text{when voting for } \mathrm{P_i} \\ -(\theta - P_j)^2, & \text{when voting for } \mathrm{P_j} \end{cases}$$

with θ being a representation of the electors preferred policy on $[0, 1]$ and P_i and P_j as a value for each parties policy points.

Proposition 1

Voters with a preference $\theta < \frac{1}{2}(P_i + P_j)$ *will vote for* P_i *and voters with* $\theta > \frac{1}{2}(P_i + P_j)$ *will vote for* P_j. *Voters with a preference* $\theta = \frac{1}{2}(P_i + P_j)$ *are indifferent between the two parties and vote based on a coinflip. The equilibrium ends up at the point of the indifferent voter, giving* $\theta_E = \frac{1}{2}(P_i + P_j)$.[1]

Equating both versions of the utility function gives $\theta_E = \frac{1}{2}(P_i + P_j)$. The equilibrium point is thus dependent on both parties positions on $\theta \in [0, 1]$, shifting to the right when P_i or P_j increases and to the left when they decrease. The probability of winning here is fully contingent on the parties positions. For example, if $P_i = 0.2$ and $P_j = 1$, P_i will win the election since they get 60 percent of the votes, whereas if $P_i = 0.2$ and $P_j = 0.6$, P_j will win with 60 percent of the votes.

For this analysis, I will start with parties that are locked at the extremes of the political spectrum to better visualize the effect in the next models. After setting the parties at $P_i = 0$ and $P_j = 1$, the indifference point of voter preference is found at $\theta_E = \frac{1}{2}(0 + 1) = \frac{1}{2}$. Every voter with $0 \leq \theta < \frac{1}{2}$ is closer to P_i and will thus vote for P_i, whereas every voter with a

[1] See appendix 1

preference of $\frac{1}{2} < \theta \leq 1$ will vote for P_j. Every voter that has a preference of $\theta = \frac{1}{2}$ is not closer to any of the two parties and is thus indifferent between them. Their vote will be decided by a coinflip. With the distribution of the population preferences being uniform over $[0, 1]$ and the assumption that every voter casts their vote, this gives both parties an equal amount of votes. Each party has a probability $p = \frac{1}{2}$ of winning the election in this scenario, as per the assumption that in the case of a tie, a coin is flipped to decide the election winner. This is the only equilibrium point and is thus also a subgame perfect equilibrium.

In the second model, I will look at a scenario where the distribution of votes for a party does not have to be uniform. The new utility function for the electors will still include the distance between preferred and party policy. In addition, it will include a value that describes the gain in utility that a voter will gain solely from winning the election. This will happen with a probability depending on the distribution of voter preferences, such as those in Fig. 1 and Fig. 2.

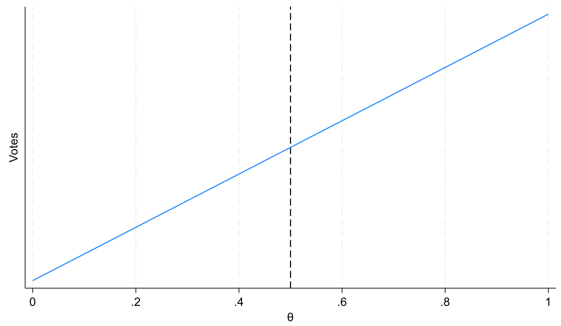

Fig. 1. A visual representation of an uneven distribution with the amount of voters per point on $\theta \in [0, 1]$. The dotted line shows the original indifference point when the parties are at $P_i = 0$ and $P_j = 1$.

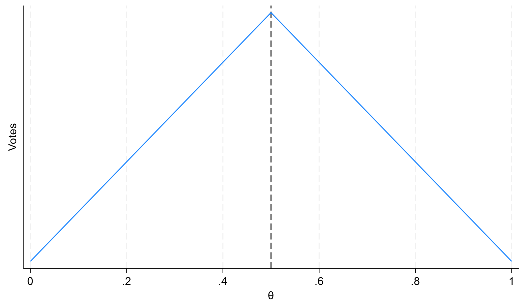

Fig. 2. A visual representation of an even distribution with the amount of voters per point on $\theta \in [0, 1]$. The dotted line shows the original indifference point when the parties are at $P_i = 0$ and $P_j = 1$.

In Fig. 1, a situation is shown where the party on the right (P_j) of the spectrum has more supporters than the party on the left (P_i), even though both parties are equally as far from the indifferent voter. In such a case, P_j is sure to win the election, and will thus gain the benefit of winning with probability $p = 1$. Therefore, P_i will gain the benefit with a probability of $p = 0$.

In Fig. 2, a scenario is given where both sides have an equal amount of votes. In this case, the election is decided by flipping a coin, meaning that both parties have a chance of winning, and thus enjoying the benefit of winning, with $p = \frac{1}{2}$. The new elector utility function will thus be:

$$U_e = \begin{cases} -(\theta - P_i)^2 + \beta p_i, & \text{when voting for } \mathrm{P_i} \\ -(\theta - P_j)^2 + \beta p_j, & \text{when voting for } \mathrm{P_j} \end{cases}$$

Here, in addition to the previous model, β represents the benefit of winning, which is gained with probability p_i or p_j taking values of $p = 0$, $p = \frac{1}{2}$ or $p = 1$ as described above, depending on the situation. Note that $p_i + p_j = 1$, since only one party can be the winner of the election.

Proposition 2

In a situation with an uneven distribution, electors with $\theta < \frac{1}{2}\left(P_i + P_j - \frac{\beta}{P_i - P_j}\right)$ *vote for* P_i *and those with* $\theta > \frac{1}{2}\left(P_i + P_j - \frac{\beta}{P_i - P_j}\right)$ *vote for* P_j*. The equilibrium lies with the indifferent voter on* $\theta_E = \frac{1}{2}\left(P_i + P_j - \frac{\beta}{P_i - P_j}\right)$*, where the electors vote is decided by a coinflip.*[2]

Proposition 3

In a situation with an even distribution, there are two equilibria.

a. *Each elector votes for the party closest to their preferred policy, with the indifferent voter casting a vote based on a coinflip. The equilibrium point is at* $\theta_E = \frac{1}{2}(P_i + P_j)$*.*[3]
b. *A voter can deviate from the previous strategy and vote for the party further away, resulting in the same equilibrium strategies as in proposition 2, which is possible when* $\frac{1}{2}\beta > \begin{cases} (\theta - P_j)^2 - (\theta - P_i)^2, & \mathit{if}\ P_i\ \mathit{is\ the\ closest\ party} \\ (\theta - P_i)^2 - (\theta - P_j)^2, & \mathit{if}\ P_j\ \mathit{is\ the\ closest\ party} \end{cases}$

Winning the election now gives a benefit to the elector, compensating (part) of the utility lost by not having the voters preferred policy. A person that previously had a slight preference for one of the parties might now enjoy a benefit of winning high enough to

[2] See appendix 2
[3] See appendix 3

compensate for the larger distance between the other parties policy and their own. As long as $F(\theta_m) \neq 1 - F(\theta_m)$, with θ_m being the preference point of the voter that is located perfectly in between P_i and P_j, there are more voters on one side of the indifferent voter in the previous model compared to the other side, meaning that the new indifference point will be located at $\theta_E = \frac{1}{2}\left(P_i + P_j - \frac{\beta}{P_i - P_j}\right)$. This new point inherits the same base value as before, finding the middle point between the two parties and adjusts it based on the benefit that a voter gains from winning. This adjustment becomes larger as β increases, since the benefit compensates for more of the loss, and when the parties are closer to each other, as this comes with a lower increase in the cost of voting for a further policy from the electors preferred point. The fact that more than half of the total electors vote for the winning party also means that there is no deviation strategy possible in this scenario.

There are two other equilibria however. In a situation where $F(\theta_m) = 1 - F(\theta_m)$, each party has a probability $p = \frac{1}{2}$ of gaining β, which cancels out when solving for the electorate indifference point. In this case, there is thus no shift of the equilibrium point, which remains at $\theta_E = \frac{1}{2}(P_i + P_j)$. In this situation, there is another equilibrium where a person deviates from voting for the closest party. Since each party gets an equal amount of votes, the elector could stray from this strategy and vote for the party that is further away, causing that party to win the election and granting the people voting for this winning party the extra utility from winning, including this deviating elector. This equilibrium is possible when the marginal benefit of winning for the deviating voter is larger than the extra distance between the parties policy and their own, meaning $\frac{1}{2}\beta > \begin{cases} \left(\theta - P_j\right)^2 - (\theta - P_i)^2, \; if\ P_i\ is\ the\ closest\ party \\ (\theta - P_i)^2 - \left(\theta - P_j\right)^2, \; if\ P_j\ is\ the\ closest\ party \end{cases}$.
Given this strategy, the other electors will have the same choice to make as in an uneven distribution, meaning that the same equilibrium of $\theta_E = \frac{1}{2}\left(P_i + P_j - \frac{\beta}{P_i - P_j}\right)$ is found.

For the third game, the elector utility function will remain the same as in the second model. The distribution can thus be uneven, meaning that a party is known to be a winner or a loser when the parties are placed in the same positions as in the second game. The difference between the second and this third game is that the parties can decide to move their policy point. Moving policy points is costly for a party, and winning the election grants utility, making the parties utility functions:

$$U_p = \begin{cases} -\alpha + \gamma p, & \textit{when moving} \\ \gamma p, & \textit{when not moving} \end{cases}$$

Here, α is the cost of moving, γ is the parties benefit of winning and p is the same probability of winning as described in the previous model.

To be able to analyse the parties strategies, the voters strategies have to be known first. These strategies are the same as in the second model, except they are now extended to situations where the parties are not locked at the extreme points of the policy spectrum. In cases with uneven distributions, the electors will cast significantly more votes for the party on the side with more people than for its opponent. This means that there are no deviation strategies possible. In the case of an even or uniform distribution, there are multiple options. The first option is where the voters all cast a vote for whichever party is closest to their preferred policy, which happens if the costs of moving further away from the closest party are higher than the marginal benefit of winning. The second option is a situation where a voter who gains more benefit from winning for sure than they lose by voting for the opposing party decides to vote for the party, resulting in more electors voting for this party, since they now enjoy that extra benefit. A new scenario, compared to the second model, is when both parties end up at the exact same policy point, in which case every voter is indifferent between the two parties and will decide their vote by flipping a coin.

Proposition 4

If a party decides to move its policy point, it will always move to the point on the preference spectrum where $F(\theta_m) = 1 - F(\theta_m)$.

A party wins when it gains more votes than its opponent. The amount of votes is directly coupled to the policy points of the parties. If a party is known to not move, the other party can guarantee more votes by moving away from their original point at the extremes. There are a few ways that parties can adjust based on the distribution of voters, and thus voting behavior. Firstly, Assuming the other party does not move, a party can move to any point where $F(\theta_m) > 1 - F(\theta_m)$ or $F(\theta_m) < 1 - F(\theta_m)$, with P_i and P_j being the moving parties respectively, which will grant the moving party the win. Assuming $\gamma > \alpha$, this is a strictly dominant strategy compared to not moving. If I remove the assumption that the first party does not move, there is a different equilibrium however. If a party shifts to any point where $F(\theta_m) \neq 1 - F(\theta_m)$, the opposing party can decide to move to a point closer to where $F(\theta_m) = 1 - F(\theta_m)$. This will guarantee the win for this party and is again the dominant strategy. The other party would than again be better off by moving closer to $F(\theta_m) = 1 - F(\theta_m)$, repeating the cycle until both parties end up at the median voter. In the case that $\alpha > \gamma$, it is never worth moving, since the costs outweigh the benefits even in the best case scenario. Therefore, a party will always move to where $F(\theta_m) = 1 - F(\theta_m)$ if it chooses to move. Note that if both parties move, the election results in a draw and the effect of the gain from winning for the voters is not a factor anymore.

Next, whether parties move or not will be analysed based on the payoff matrix of the strategies from both parties as seen in Fig. 3. Each party will have a choice between either moving or not moving and the payoffs are based on the parties utility functions.

P_1 \ P_2	Move	Not move
Move	$\left(\frac{1}{2}\gamma - \alpha, \quad \frac{1}{2}\gamma - \alpha\right)$	$(\gamma - \alpha, \quad 0)$
Not move	$(0, \quad \gamma - \alpha)$	$(\gamma p_1, \quad \gamma p_2)$

Fig. 3. Payoff matrix for the subgame of parties choosing policy platforms. Note that P_1 and P_2 are used as examples to not assume a winning party between P_i and P_j.[4]

Firstly, the distribution of voter preferences, and thus voting behavior changes the Nash equilibria of this subgame. Starting with a situation where the distribution is equal and the extra benefit of winning is not large enough to induce the deviation equilibrium, meaning both parties have a probability of winning $p = \frac{1}{2}$ when neither party moves. Filling this into the matrix in Fig. 3 shows that the Nash equilibria are:

[4] See appendix 4

Nash equilibria	Condition
(Not move, Not move)	$\alpha > \gamma$
(Not move, Not move)	$\alpha = \gamma$
(Not move, Not move)	$\frac{1}{2}\gamma < \alpha < \gamma$
(Move, Move) (Move, Not move) (Not move, Not move) (Not move, Move)	$\alpha = \frac{1}{2}\gamma$
(Move, Move)	$\alpha < \frac{1}{2}\gamma$

Table 1. Nash equilibria under conditions of α in relation to γ, when there is an even distribution and the marginal benefit of winning is too small to induce deviation.

In the case that there is an uneven distribution of voters or in the case of an even distribution where a voter will deviate and vote for the party that is further away, meaning one party has a probability $p = 0$ of winning the election and the opposing party has a probability of $p = 1$, assuming the parties do not move gives the following equilibria. Assuming that P_2 would be the winning party, the Nash equilibria are:

Nash equilibria	Condition
(Not move, Not move)	$\alpha > \gamma$
(Move, Not move) (Not move, Not move)	$\alpha = \gamma$
(Move, Not move)	$\frac{1}{2}\gamma < \alpha < \gamma$
(Move, Move) (Move, Not Move)	$\alpha = \frac{1}{2}\gamma$
(Move, Move)	$\alpha < \frac{1}{2}\gamma$

Table 2. Nash equilibria under conditions of α in relation to γ, when there is an uneven distribution or in the deviating equilibrium in an even distribution.

Comparing the two shows that, if $\alpha > \gamma$, a party will never decide to move. This makes sense as any value gained from moving would be outweighed by the cost of moving. The winner in this case is thus dependent on the distribution of voter preferences. Similarly, when $\alpha < \frac{1}{2}\gamma$, both parties will always decide to move regardless of the voter preference distribution. The winner here is decided by a coinflip, as both parties would get an equal amount of votes. In the other situations dissimilarities start to show. In situations with an uneven distribution, the disadvantaged party will always move, except when $\alpha = \gamma$, in which case there is also a Nash equilibrium where neither party moves. This means that the traditionally disadvantaged party will win the election, except when $\alpha = \gamma$, where either party can win depending on the Nash equilibrium that is being followed. The losing party always moving makes sense, as it is the only way to gain utility. Similarly, in the same situations, the winning party will always decide not to move, apart from when $\alpha = \frac{1}{2}\gamma$, where there is a Nash equilibrium where both parties move and the winner is thus decided by flipping a coin. Interestingly, when $\alpha = \frac{1}{2}\gamma$ and the distribution is even, both parties are indifferent between any option, meaning that every option is a Nash equilibrium. Finally, in an even distribution where $\alpha > \frac{1}{2}\gamma$, neither party chooses to change policy and the winner is again decided by a coinflip.

Discussion

Summarizing the theoretical analysis, I found that in the base model with a uniform distribution and parties at the extreme ends of the political spectrum results in the indifference point for the voters being in the exact centre of this spectrum. Considering that the only factor in deciding the votes is the distance between the elector and the party, it makes sense that the point where a voter does not have a preference for either party ends up perfectly in between the two party positions.

The second model, where there is a possibility for an uneven distribution giving one party more supporters and voters gain a benefit from voting for the winning party has three equilibrium outcomes, depending on whether there is an even or uneven distribution of voter preferences and how high the benefit of winning is in relation to the distance between the voter and both parties. In the case of an even distribution, there are two equilibria. The starting equilibrium is the same equilibrium as in the first model. This is the equilibrium when the costs of voting for the opposing party outweigh the benefits of winning for sure by voting for this opposing party. The second equilibrium in an even distribution is when these benefits outweigh the costs of voting for the non-preferred party, which results in the party that the deviating elector now votes for having more total votes and winning the election for sure. This is now a similar situation as in cases with an uneven distribution, which is the third equilibrium, where one party is also known to have more supporters, meaning one party is guaranteed to win. In these situations, the indifference point shifts in favour of the winning candidate, granting it even more votes than in the non-adjusted situation. These equilibria display how people are influenced by the feeling of winning (Herbst, 2016; Adam et al., 2013), since voters originally voting for the party closest to their preferred policy are now voting for a party that is further away, but guarantees a win. In a political economy context, there are very few papers concluding this effect. This finding could be explained by the bandwagon effect (Irwin and Holsteyn, 2000; Grillo, 2017). This bandwagon effect is empirically proven and explains a marginal group of people voting for a candidate that is seemingly already winning. In Grillo's (2017) model, the higher probability of winning is gained through the disadvantaged candidate having supporters with a lower probability of actually casting a vote. My result, where voters around the original indifference point can switch their preferred party because of the feeling of winning is a finding that has not been developed in existing studies.

The third model, where parties can choose their own policy has a few parts to the analysis. To start, the voters behave the same way as in the situation above. This impacts the movement from parties. If a party decides to move, they will always move to the point where both parties gain an equal amount of votes, assuming both parties move. This point is where the distribution is split exactly in half, meaning it is at the median voters policy point. This strategy guarantees a draw if both parties move, and guarantees a win if the opposing party chooses not to change its platform. This lines up with existing theories such as the median voter theorem (Black, 1958) or Downs (1957) pivotal voter model. Then, looking at the subgame that the parties play when deciding whether or not to actually move shows some interesting outcomes. Whether parties move or not is dependent on both which party would win if neither party moves, as well as the costs of moving in relation to the benefits of winning. First, when the benefit of winning is larger than twice the moving costs, both parties will decide to move, regardless of the distribution of voter preferences. This again confirms the theories in the models from Black (1958) and Downs (1957). Obviously, when the cost of moving is larger than the benefit of winning, a party will never choose to alter their platform, even if they lose in the original situation due to the voter distribution. There are other equilibria where neither party moves however. In the case where there is an even distribution and the costs of moving are larger than half of the benefit from winning, neither party moves from their original point at the extremes. This is in line with current literature explaining parties often do not converge (Adams et al., 2020; Dalton & McAllister, 2015). The final single Nash equilibrium is where the costs of moving are larger than half, but smaller than the whole benefit of winning and there is an uneven distribution. In this case, the losing party will move, whereas the previously winning party will not move. This could be explained by a mixture of the papers mentioned before, as it could be a combination of convergence and divergence of parties depending on their situation (Black, 1958; Downs, 1957, Adams et al., 2020; Dalton & McAllister, 2015). The final case to inspect is the situation in which the distribution is even and the costs of moving are equal to half of the benefit of winning. In this situation there are four Nash equilibria, meaning that any party pure strategy is an equilibrium strategy. This is not explained in the existing literature and deserves to be studied more extensively in the future.

There are some other options for future analyses. Starting with the second model, while my model did show the relationship, I still consider a more conclusive model required before a sound conclusion on the effect can be made, since my model does have significant shortcomings. Firstly, the models are rather limited, since they only take a two party system into account. Researching a situation where there are three or more candidates would be insightful in the direction the shift of indifference point occurs. This future model could better explain the relationship between the voters preference in policy and the candidates probability of winning with the idea of analysing how far a voter is willing to move over the political spectrum for a higher chance of winning. Secondly, to make the model more realistic, it could be insightful to extend the model into a three dimensional model, since most elections have two axes that decide party positions. A person would thus have to make a decision about the importance of each axis and its relationship with straying from the voters optimal point for a better chance at having their vote be for the winning party. Thirdly, my model did not include any other variables and is thus not a complete model. Adding variables such as voter turn-out could significantly alter the outcome and deserves to be studied more extensively. Obviously, when analysing these different scenarios, the analysis for the third model would have to be adapted to fit this new model, which itself could lead to new outcomes. Another interesting point for the third model would be to look at costs of moving as a function of how far the party moves, instead of a set cost as soon as the party deviates from its original point, since a party would likely have to spend more money on, for example, campaigning when it shifts further away from the original platform. This could lead to a different optimal point for parties to place their new policy, which in turn also changes the Nash equilibrium outcomes. Lastly, the model has to be tested empirically to prove the effect is present in more realistic scenarios.

If this future research does prove the existence of the effect, it will have lasting consequences in the fields of research and politics, as well as for policy makers. Obviously finding an effect means that the currently available models have to be updated to fit this new information. Political systems might, in the long run, be updated to better control for undesirable behaviour. The group that will probably benefit the most is policy makers. Especially those working for central banks or governments will profit from being able to better predict elections. As stated before, being able to predict election outcomes helps prepare programs influencing matters along the lines of monetary and fiscal policy, tax policy or even social norms. Preparing these policies as optimally as possible is important for maintaining stability in an area and would thus find substantial benefit from these results.

Conclusion

To summarize, in a situation where a party has a clearly better probability of winning the elections due to the distribution of voter preferences, and where people enjoy the feeling of winning, the indifference point for electors noticeably shifts towards the side of the disadvantaged party. This effect shows that it is possible for voters to change their preferred candidate based on the chance of winning that each party enjoys. This could help explain the phenomenon where people indicate that they would rather vote for a party that is relatively likely to either win or at least be part of the ruling coalition. Currently, few papers inherit this relationship in their models. This paper alone is probably not enough proof for this effect to sway public opinion and the currently accepted political economy models. Future research would have to explain this effect in models with three or more parties to see the exact workings of the effect and how far a person is willing to stray from their first choice if it means a higher winning probability. Similarly, to put this model in a more realistic scenario, a three dimensional model would help in describing how the personal importance of each axis influences the distance that a voter wanders away from the candidate with the most similar policy point. I also found that parties decide whether to alter their platform or not is dependent on how the voter preferences are distributed, often choosing to move when losing and to stay at the original point when winning or in the case of a draw. Furthermore, exploring alternative options to analyse the reasons for parties to move platform will be insightful in explaining when parties converge compared to when they do not move or even diverge. I believe it will be insightful to analyse mixed strategies, as this could bring new equilibrium strategies that might align more with realistic scenario's. Other than that, by analysing the new party strategies in the models described above, insights will be found in the inner workings of these party movements. Putting all these theories together should help in making a more complete model in the future. This will help produce more realistic voting behaviour models, as well as help predict election outcomes. This in turn supports policy makers anticipate which policy will be the most effective, which helps create stability in a country. In conclusion, this paper opens new ways to understanding voting behaviour and predicting election outcomes. By analysing gaps in political economy knowledge with respect to a voter wanting to win, this assessment can help make a more complete model of voting behaviour and party movement in the future.

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Appendices

Appendix 1

$$-(\theta - P_i)^2 = -\left(\theta - P_j\right)^2$$

$$-\theta^2 + 2P_i\theta - {P_i}^2 = -\theta^2 + 2P_j\theta - {P_j}^2$$

$$2P_i\theta - 2P_j\theta = {P_i}^2 - {P_j}^2$$

$$2\theta = \frac{{P_i}^2 - {P_j}^2}{P_i - P_j} = P_i + P_j$$

$$\theta = \frac{1}{2}\left(P_i + P_j\right)$$

Appendix 2

$$-(\theta - P_i)^2 + \beta = -\left(\theta - P_j\right)^2$$

$$-\theta^2 + 2P_i\theta - {P_i}^2 + \beta = -\theta^2 + 2P_j\theta - {P_j}^2$$

$$2P_i\theta - 2P_j\theta = {P_i}^2 - {P_j}^2 - \beta$$

$$2\theta = \frac{{P_i}^2 - {P_j}^2 - \beta}{P_i - P_j} = P_i + P_j - \frac{\beta}{P_i - P_j}$$

$$\theta = \frac{1}{2}\left(P_i + P_j - \frac{\beta}{P_i - P_j}\right)$$

Appendix 3

$$-(\theta - P_i)^2 + \frac{1}{2}\beta = -\left(\theta - P_j\right)^2 + \frac{1}{2}\beta$$

$$-\theta^2 + 2P_i\theta - {P_i}^2 + \frac{1}{2}\beta = -\theta^2 + 2P_j\theta - {P_j}^2 + \frac{1}{2}\beta$$

$$2P_i\theta - 2P_j\theta = {P_i}^2 - {P_j}^2$$

$$2\theta = \frac{{P_i}^2 - {P_j}^2}{P_i - P_j} = P_i + P_j$$

$$\theta = \frac{1}{2}\left(P_i + P_j\right)$$

Appendix 4

These are the matrices used in the analysis of model 3, depending on distribution.

In the case of an even distribution, $p = \frac{1}{2}$ for both parties, resulting in:

P_1 \ P_2	Move	Not move
Move	$\left(\frac{1}{2}\gamma - \alpha, \quad \frac{1}{2}\gamma - \alpha\right)$	$(\gamma - \alpha, \quad 0)$
Not move	$(0, \quad \gamma - \alpha)$	$\left(\frac{1}{2}\gamma, \quad \frac{1}{2}\gamma\right)$

In the case of an uneven distribution or an even distribution with the deviation equilibrium, $p = 1$ for the advantaged party and $p = 0$ for the disadvantaged party, resulting in:

P_1 \ P_2	Move	Not move
Move	$\left(\frac{1}{2}\gamma - \alpha, \quad \frac{1}{2}\gamma - \alpha\right)$	$(\gamma - \alpha, \quad 0)$
Not move	$(0, \quad \gamma - \alpha)$	$(0, \quad \gamma)$

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