

Negative Voters?

Electoral Competition with Loss-Aversion

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Abstract: This paper presents some evidence that voters respond in different ways to positive and negative changes in economic outcomes. We then model this asymmetric response as voter loss-aversion over platforms relative to the status quo, and we study how this impacts electoral competition; it leads to both platform rigidity and reduced platform polarisation. The results are robust to allowing the link between platforms and outcomes to be stochastic; they hold approximately for a small amount of noise. A distinct testable implication of loss-aversion is that incumbents adjust less than challengers to shifts in voter preferences, and as a result, favourable (unfavourable) preference shifts, from the point of view of the incumbent, intensify (reduce) electoral competition. We find some empirical support for these using data from US state legislatures.

KEYWORDS: electoral competition, loss-aversion, incumbency advantage, platform rigidity

JEL CLASSIFICATION: D72, D81

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1 Introduction

There is now considerable evidence that citizens place greater weight on negative news than on positive when evaluating candidates for office, or the track records of incumbents. In the psychology literature, this is known as negativity bias.¹ For example, several studies find that U.S. presidents are penalised electorally for negative economic performance but reap fewer electoral benefits from positive performance (Bloom and Price, 1975, Lau, 1985, Klein, 1991).

Similar asymmetries have also been identified in the UK and other countries. For example, for the UK, Soroka (2006) finds that citizen pessimism about the economy, as measured by a Gallup poll, is much more responsive to increases in unemployment than falls. Kappe (2013) uses similar data to explicitly estimate a threshold or reference point value below which news is “negative”, and finds similar results. Nannestad and Paldam (1997) find, using individual-level data for Denmark, that support for the government is about three times more sensitive to a deterioration in the economy than to an improvement.²

Here, to further motivate our study, in Online Appendix A, we present new US evidence that there is voter negativity bias, by showing that support for US State Governors varies asymmetrically with improvements and declines in economic conditions.³ An illustration of our findings is given in Figure 1.

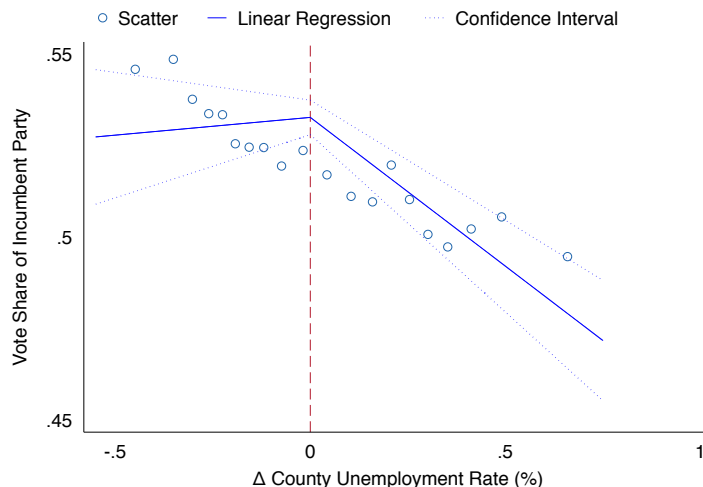
One can see that reductions in unemployment, the region to the left of the dashed red vertical line, have at best a weak impact on incumbents’ fortunes at the next election. Increases in unemployment, to the right of the red line, are however associated with a marked reduction in the expected vote share.

¹See for example, the survey on negativity bias by Baumeister et al. (2001).

²Soroka and McAdams (2015) argue that this negativity bias on the part of voters is an example of a more general bias whereby suggest that humans respond more to negative than to positive information, and they link this bias to loss-aversion.

³Full details of the regression estimated and numerical results along with further discussion, analysis of state-level opinion polls, and changes in incomes instead of unemployment as well as a full description of the data used may be found in Appendix A.

Figure 1: Incumbents' Vote Share and Unemployment



Note : The vote share is the county vote share of the incumbent in the gubernatorial election. The change in the county employment rate is the change over the two years preceding the year of election. The underlying distribution of both variables is displayed as a binned scatter plot, with each circle representing a vingtile of the joint distribution. The solid blue lines describe the estimated regression coefficients above and below the reference point, and the dotted lines the associated confidence intervals.

In this paper, we argue that negativity bias can be explained as arising from voter loss-aversion with a status quo reference point, and we explore the implications of voter loss-aversion for electoral competition. Specifically, we study a simple Downsian model with loss-averse voters. Voters care both about parties' policy choices and their competence in office (valence). Moreover, they are loss-averse in the policy dimension. There are two parties which choose policy platforms, and which care about both policy outcomes and holding office. One of the parties is the incumbent, and their winning platform from the previous period, taken as fixed, is the voter reference point. The competence of the incumbent is common knowledge, but the competence of the challenger is determined by random draw.

Without loss-aversion, this setting is similar to the well-known one of [Wittman \(1983\)](#), where in equilibrium, parties set platforms by trading off the probability of winning the election against the benefits of being closer to their ideal points. Our model differs from Wittman's in that in his model, this trade-off is generated by parties being uncertain about the position of the median voter, whereas in our model, it is generated by probabilistic voting, due to the challenger's ability being unknown. As explained below, the latter is required for loss-aversion to have any bite.

We assume that the reference point is the status quo policy. This assumption is widely made in the literature on loss-aversion applied to economic situations, and seems realistic, since benefits and costs of political reforms are normally assessed relative to existing

policies.⁴

In this setting, once the median voter's utility from a party's policy platform falls below utility from the status quo policy, the re-election probability starts to fall more rapidly than without loss-aversion. This asymmetric response is therefore consistent with the empirical evidence on voter negativity bias.

We show that this asymmetric response has a number of implications for electoral competition. First, there is *platform rigidity*; for a range of values of the status quo, one party will choose the status quo, and the other will choose a platform on the other side of the median voter's ideal point to the status quo, and equidistant from the ideal point of the median voter, regardless of other parameters. In this case, the election outcome is insensitive to small changes in other parameters, such as the weight that political parties place on office, the level of uncertainty about the challenger's competence, or shifts in the ideal points of the political parties. Note, however, that platform rigidity is *not* the same as status quo bias, as the election outcome may be a long way from the status quo. Second, there is a *moderation effect* of loss-aversion; generally, the gap between equilibrium party platforms is smaller than in the absence of loss-aversion.

We also explore the robustness of these results to noise in the mapping from party platform choices to voter payoffs. In the standard Downsian model, given a platform, there is no uncertainty about either the policy actually implemented, or the utility outcome for the voter. This is in fact a strong assumption. For example, a party may propose a tax, but due to changes in political support or the state of the macroeconomy, is only able to set that tax plus some noise. Or, the tax rate might actually be set as promised, but the payoff to a voter at the time of voting may be uncertain, because the voter may not know exactly what her wage will be.

In our setting, these shocks may matter, because it is possible that the uncertainty might smooth the kink in the election probability as a function of platforms. We show that as long as the support of the implementation or voter outcome shock is small, our main results will apply in an approximate sense.

We then consider in detail, both theoretically and empirically, the effect of shifts in the distribution of voter preferences. We suppose that once the status quo has been determined, i.e. between the previous election and the current one, there is a shift in the ideal points of all voters, including those voters that make up the membership of political parties. Without loss-aversion, this has the same effect on both incumbent and challenger parties - both move their equilibrium platforms in the direction of the preference shift by the full amount of the shift.

But, with loss-aversion, there is *asymmetric* adjustment - the incumbent's platform will adjust by less than the challenger's platform. In other words, loss-aversion generates a particular kind of asymmetry; incumbents adjust less than challengers to voter preference

⁴For example, [de Meza and Webb \(2007\)](#) for a principal-agent problem, [Freund and Ozden \(2008\)](#) in the context of lobbying on trade policy, and [Alesina and Passarelli \(2015\)](#) for direct democracy all assume a status quo reference point. We have investigated the case of a forward-looking reference point as in [Kőszegi and Rabin \(2006\)](#) and results are available upon request.

shifts.⁵ This prediction is potentially testable, given that we can identify preference shifts.

It also gives rise to a second testable prediction. Say that a preference shift is favourable (unfavourable) for the incumbent if it is in the same direction as the incumbent’s ideological bias i.e. a leftward (rightward) shift for the left (right) party. Then, following a “favourable” preference shift for the incumbent; the gap between platforms decreases, but following an “unfavourable” preference shift for the incumbent; the gap between platforms increases. That is, favourable (unfavourable) preference shifts intensify (reduce) polarisation.

We then take these predictions to data on elections to US state legislatures for 1990–2012. We employ a new data-set introduced by [Bonica \(2014b\)](#) which contains estimates of the platforms of all candidates, winners and losers, in elections to state legislatures, based on the campaign donations they received. These data have the important advantage of representing a large sample of institutionally and politically homogeneous elections.

We combine the Bonica data on candidate ideological positions with electoral data, to measure both voter preference shifts and changes in party positions. We use data for elections to the Lower House of each state legislature to construct measures of changes in party positions in these elections at the state level. Similarly, we calculate the position of the median voter in a state using elections to State Upper Houses and the US Congress. In this way, we measure voter preference shifts using voting in elections that are different to the election being used to construct the dependent variable, i.e. changes in party positions.

Using these data we find robust evidence that incumbent parties are significantly less responsive to shifts, as predicted by the theory. We also find suggestive evidence that following a “favourable” (resp. “unfavourable”) preference shift for the incumbent; the gap between platforms, decreases (increases).

The remainder of the paper is organised as follows. Section 2 reviews related literature, Section 3 lays out the model, and Section 4 has the main theoretical results. Section 5 explains how these are robust to introducing uncertainty into our model. Section 6 explains how loss-aversion gives a distinctive prediction about how incumbents and challengers respond to preference shifts. Section 7 discusses the US data we use to test our main hypotheses. Section 8 describes our empirical strategy and results, and finally Section 9 concludes.

⁵It is of course possible that other models could generate asymmetric adjustment. This is discussed further following Proposition 4 in Section 6, where we rule out several other explanations, such as a simple version of incumbency advantage, or loss-aversion in the competence dimension.

2 Related Literature

*Electoral competition with behavioural and cognitive biases.*⁶ The closest paper to ours is [Alesina and Passarelli \(2015\)](#), henceforth AP. This paper studies loss-aversion in a direct democracy setting, where citizens vote directly in a referendum on the size of a public project or policy.⁷ However, to our knowledge, ours is the first paper to study the effect of loss-aversion in a representative democracy setting.⁸

In AP, citizens vote directly on a one-dimensional policy describing the scale of a project, which generates both costs and benefits for the voter. In this setting, for loss-aversion to play a role, the benefits and costs of the project must be evaluated relative to separate reference points. This is because if loss-aversion applies to the net benefit from the project, the status quo cannot affect the ideal point of any voter. We do not need this construction, because in our setting, the voters compare the utility from policy positions to party valences. So, loss-aversion has “bite” in our model via an entirely different mechanism to theirs - that is, via the voters’ comparison of utility from policy and party valence, rather than via multiple reference points.⁹

In their setting, AP show the following. First, there is status quo bias of the usual kind: for a range of values of the median voter’s ideal point, the policy outcome is equal to the status quo. Second, there is policy moderation with loss-aversion; an increase in loss-aversion compresses the distribution of ideal points of the voters, and in particular, increases the number of voters who prefer the status quo. Finally, if there is a shift to the median voter’s preferences, this only has an effect on the outcome if the shift is sufficiently large.

Several of our results are similar in spirit to these, although the details differ substantially.¹⁰ Finally, our main empirical prediction, that incumbents adjust less than challengers to voter preference shifts, has no counterpart in their analysis.

A small number of other papers study electoral competition with voter behavioural biases. [Callander \(2006\)](#) and [Callander and Wilson \(2008\)](#) introduce a theory of context-dependent voting, where for example, for a left wing voter, the attractiveness of a left

⁶There are also a number of recent papers that consider the effects of voter biases in non-Downsian settings, either where party positions are fixed, or where policy can be set ex post e.g. political agency settings. However, these papers are clearly less closely related to what we do. For example, [Ashworth and Bueno De Mesquita \(2014\)](#) and [Lockwood \(2015\)](#) consider deviations from the full rationality of the voter in a political agency setting. [Ortoleva and Snowberg \(2013\)](#), show theoretically that the cognitive bias of correlation neglect can explain both voter overconfidence and ideological polarisation. [Levy and Razin \(2015\)](#), find that the cognitive bias of correlation neglect can improve outcomes for voters.

⁷Their paper is contemporaneous with the working paper version of our paper ([Lockwood and Rockey, 2015](#)).

⁸For an informal discussion of the role of loss-aversion in politics, see [Jervis \(1992\)](#).

⁹One way of seeing this is to note that if we introduce political parties and electoral competition into the AP model, then, absent any other changes, the classic Downsian result would emerge i.e. parties would converge to the median voter’s ideal point. In other words, a switch from direct to representative democracy would have no effect on the policy outcome in their setting. In contrast, we show that direct and representative democracy have quite different outcomes in our setting, with loss-aversion affecting the latter but not the former.

¹⁰The relationship between our notions of platform rigidity and platform moderation and theirs is discussed in more detail below.

wing candidate is greater the more right wing is the opposing candidate, and apply it to the puzzle of why candidates are so frequently ambiguous in their policy.

More recently, [Razin and Levy \(2015\)](#) study a model of electoral competition in which the source of the polarisation in voters' opinions is "correlation neglect", that is, voters neglect the correlation in their information sources. Their main finding is that polarisation in opinions does not necessarily translate into platform polarisation by political parties compared with rational electorates. This contrasts with our result that loss-aversion always reduces platform polarisation.

[Matějka and Tabellini \(2015\)](#) studies how voters optimally allocate costly attention in a model of probabilistic voting. Voters are more attentive when their stakes are higher, when their cost of information is lower and prior uncertainty is higher; in equilibrium, extremist voters are more influential and public goods are under-provided, and policy divergence is possible, even when parties have no policy preferences.

Finally, [Bisin et al. \(2015\)](#) consider Downsian competition between two candidates in a setting where voters have self-control problems and attempt to commit using illiquid assets. In equilibrium, government accumulates debt to respond to individuals' desire to undo their commitments, which leads individuals to rebalance their portfolio, in turn feeding into a demand for further debt accumulation.¹¹

Related empirical work. Our empirical work in Sections 7 and 8 is related to that of [Adams et al. \(2004\)](#) and [Fowler \(2005\)](#). In particular, both study party platform responses to changes in the position of the median voter. ([Adams et al., 2004](#)) is a purely empirical study, which pools national election results for political parties in eight West European countries over the period 1976-1998, to relate parties' manifesto positions to the preferences of the median voter. On the basis of this analysis they argue that parties only respond to disadvantageous moves in the median voter.

[Fowler \(2005\)](#) considers elections to the US Senate over the period 1936-2010. His theoretical model shows that parties learn about voter preferences from election results, and consequently predicts that Republican (Democratic) victories in past elections yield candidates who are more (less) conservative in subsequent elections, and the effect is proportional to the margin of victory. This is a rather different hypothesis to the one we test, which concerns the effects of shifts in voter preferences before elections.

Also related is the substantial empirical literature on incumbency advantage. This is related because in our empirical work, we control for incumbency either through an incumbency or state-year fixed effect. This is somewhat different to the conventional Regression Discontinuity (RD) design to identify incumbency advantage ([Lee, 2008](#)). This is because we are not concerned with explaining the probability that the incumbent wins,

¹¹[Passarelli and Tabellini \(2013\)](#) is also somewhat related; there, citizens belonging to a particular interest group protest if government policy provides them with utility that is below a reference point that is deemed fair for that interest group. In equilibrium, policy is distorted to favour interest groups who are more likely to protest or who do more harm when they riot. However, in their setting, there is no voting, so the main point shared feature between that paper and ours is that we both consider the role of reference points in social choice.

but how incumbents change their platforms relative to non-incumbents.

3 The Model

3.1 The Environment

There are two parties L and R ; and a finite set of voters N who interact over two periods $t = 0; 1$: The number of voters, n , is odd. We take the interaction in the first period as predetermined. Specifically, we suppose that at $t = 0$; one of the parties $l \in L; R$ won the election and set a platform x_0 in the policy space $X = [-1; 1]$, where $l; x_0$ are exogenously fixed. Thus, party l is the incumbent at $t = 1$: At $t = 1$; the two parties, L and R ; choose platforms $x_L; x_R$ in the policy space X : They are assumed to be able to commit to implement these platforms. Thus, the basic framework is Downsian competition.

However, parties are also described by a party valence characteristic v . Our primary interpretation of v will be as competence, although it could capture other things such as the charisma of the candidate, etc.

3.2 Order of Events and Information Structure

The valence of the incumbent is assumed to be common knowledge at the beginning of period 1 and is normalised to zero. The idea is that all agents have had a chance to observe the incumbent party's performance in office in the previous period.¹²

Within period 1, the order of events is as follows. First, parties $L; R$ simultaneously choose their platforms. Then, v_C ; the valence of the challenger, is drawn from a uniform mean zero distribution F with support $[-\frac{1}{2}; \frac{1}{2}]$. As we will see, the parameter measures the responsiveness of the median voter to policy changes by the parties. In Online Appendix B, we show how our analysis generalises to other symmetric mean-zero distributions of v_C .

Then, having observed $x_L; x_R; v_C$; all voters vote simultaneously for one party or the other. We will assume that voters do not play weakly dominated strategies; with only two alternatives, this implies that they vote sincerely.

There are two aspects of this timing that deserve comment. First, voters are assumed to observe the challenger valence before voting. The idea here is that once party manifestos are written (i.e. $x_L; x_R$ are fixed) an election campaign and scrutiny by the media give voters additional information about the competence or fitness for office of the challenger before the election. This assumption could be relaxed without changing the results by allowing the voter to observe some informative signal of v_C before voting.

Second, we are assuming that the valence of the challenger party C is not known to this party at the point when platforms are chosen. This is quite plausible; parties may not fully know their competence in office when they have been out of office for some time. Moreover, relaxing this assumption by allowing party C to know v_C before platforms

¹²This assumption is also made, for example, by [Bernhardt et al. \(2011\)](#).

are set creates a game of asymmetric information, where the challenger might use their platform x_C to signal their type. This introduces considerable additional complexity, and is not the main focus of our attention.

Finally, note that from a modelling point of view, the purpose of this timing assumption is standard one; it makes the outcome of the election uncertain for the two political parties, thus preventing complete convergence in equilibrium to the median voter’s ideal point.

3.3 Voter Policy Payoffs

Following [Osborne \(1995\)](#), we assume that “ordinary” or intrinsic utility over platforms $x \in \mathcal{X}$ for voter i is given by $u_i(x) = v(x - x_i)$ where v is twice continuously differentiable, with $v' > 0$; $v'' < 0$. So, x_i is the ideal point of voter i . We rank voters by their ideal points i.e. $-1 < x_1 < x_2 < \dots < x_n < 1$. We assume that voter $m = \frac{n+1}{2}$ has an ideal point $x_m = 0$. As we shall see shortly, this voter will be the median voter in the usual sense i.e. will be decisive in any election.

Following [Kőszegi and Rabin \(2006, 2007, 2009\)](#), we specify the gain-loss utility over policy for voter i as;

$$u_i(x; x_0) = \begin{cases} u_i(x) - u_i(x_0); & u_i(x) \geq u_i(x_0) \\ \lambda(u_i(x) - u_i(x_0)); & u_i(x) < u_i(x_0) \end{cases} \quad (1)$$

That is, the parameter $\lambda > 1$ measures the degree of loss-aversion, and the previous period’s platform x_0 is the reference point. The empirical evidence suggests a value for λ of around 2 ([Abdellaoui et al. \(2007\)](#)). The assumption that λ is the same for all voters is made just for convenience, and could be relaxed.

Note that we have assumed that voters are “backward looking” in that the reference point is the status quo, x_0 : The main reason for this is to ensure that voter behaviour is consistent with the evidence of Figure 1 and Appendix A i.e. that voters evaluate positive and negative changes from the status quo asymmetrically. However, there are also other reasons why this is a case of interest. For example, in a recent experiment, [Heffetz and List \(2014\)](#) finds there is little evidence for a forward-looking reference point of the Kőszegi-Rabin kind.

The overall payoff to voter i from a party with platform x and valence v is

$$u_i(x; x_0) + v \quad (2)$$

From (2) the two dimensions of utility are additively separable; so, preferences satisfy, in the language of Tversky and Kahneman, decomposability. This implies that the trade-off between the two dimensions changes discontinuously if the outcome in the policy dimension passes the reference point. This creates the change in the trade-off which is responsible for all of our results.

3.4 Party Payoffs

As is standard, parties have a payoff to holding office, denoted M : Parties are also assumed to have policy preferences, with the L party having an ideal point of -1 ; and party R an ideal point of 1 : Payoffs of the L and R party members are then $u_L(x) = \tilde{v}(jx + 1)$; $u_R(x) = \tilde{v}(jx - 1)$ respectively, where \tilde{v} is twice differentiable, strictly increasing, symmetric and convex in $jx = x/j$, and $\tilde{v}(0) = \tilde{v}'(0) = 0$:

Note that we allow the loss function of the parties, $\tilde{v}(\cdot)$ to be different from that of the voters, $v(\cdot)$. This specification allows for parties to be risk-neutral ($\tilde{v}'' = 0$) or strictly risk-averse ($\tilde{v}'' > 0$) over policy outcomes, separate to any assumptions about risk attitudes of voters. Note also that parties (or rather, their members) are assumed not to be loss-averse; party loss aversion raises a number of new issues which are not addressed in this paper.

So, expected payoffs for the parties are calculated in the usual way as the probability of winning, times the policy payoff plus M ; plus the probability of losing, times the resulting policy payoff. For parties R, L respectively, this gives

$$\begin{aligned} R &= p(u_R(x_R) + M) + (1 - p)u_R(x_L) \\ L &= (1 - p)(u_L(x_L) + M) + pu_L(x_R) \end{aligned} \quad (3)$$

where p is the probability that party R wins the election and is defined below. As we shall see, p depends not only on the platforms x_L, x_R , but also on the voter reference point x_0 .

3.5 Win Probabilities

From now on, without loss of generality, we assume that the incumbent party is party R : Here, we characterise the probability p that party R wins the election. Also, from now on, set $v_C = v$: We have assumed that all voters do not use weakly dominated strategies, implying that they vote sincerely. So, from (2), any voter i will vote for party R ; given platforms x_L, x_R ; if and only if

$$u_i(x_R; x_0) \geq v + u_i(x_L; x_0) \quad (4)$$

Now note from 1 that *even with loss-aversion, the policy payoffs $u_i(x; x_0)$ are single-peaked in x for a fixed x_0* : It follows immediately that the median voter is decisive.¹³ So, the probability that party R wins the election is the probability that the median voter votes for R :

From from (4), this is the probability that v is less than $u_m(x_R; x_0) - u_m(x_L; x_0)$; or

$$p = \frac{1}{2} + (u_m(x_R; x_0) - u_m(x_L; x_0)) \quad (5)$$

¹³To see this, let v_m be such that m is indifferent between voting for L and R i.e. $u_m(x_R; x_0) - u_m(x_L; x_0) = v_m$. So, assuming $x_R > x_L$, single-peakedness implies immediately that (i) $v < v_m$, all $i > m$ will vote for R ; (ii) if $v > v_m$, all $i < m$ will vote for L . So, when $v < v_m$, a majority vote for party R ; and when $v > v_m$, a majority vote for party L .

From now on, we can focus only on the median voter, and we can therefore drop the “m” subscripts, so $u_m(x; x_0) = u(x; x_0)$ in (5). Then, given (5), we can explicitly calculate the win probabilities as required.

3.6 Assumptions

So far, we have allowed for a wide class of voter and party loss functions. To proceed further, we need these elements to satisfy some technical assumptions.

The first assumption is that party R 's election probability p is strictly between 0 and 1 for all $x_R, x_L \in [0; 1]$; $x_0 \in [-1; 1]$: For this we require that for the median voter, the highest possible utility gain in the policy dimension from re-electing party R is smaller than the highest possible value of v : The latter is $\frac{1}{2}$: The former is the gain when $x_R = 0$; $x_L = -1$; giving a gain to re-election of zero minus $v(1)$; or simply $v(1)$: So, our first assumption is:

A1. $\frac{1}{2} > v(1)$:

Next, we will characterise equilibrium by first-order conditions for the choice of x_L, x_R by the parties: For this to be valid, we require that the expected party payoffs v_L, v_R defined above in (3) are strictly concave in x_L, x_R respectively. A sufficient condition for this is derived in Online Appendix B where v_C has a general mean zero symmetric distribution F and density f . This sufficient condition says that the rate of change of the density $f' = f$ not be too large. If F is uniform, as assumed here, this is automatically satisfied.

Next, we want our symmetric equilibrium to be unique. A sufficient condition for this is:

A2. $\frac{u''(x)}{u'(x)} < \frac{u''_R(x)}{u_R(x)+M} - \frac{u''_R(x)}{u_R(-x)}$; $x \in [0; 1]$

Here, $u(x) = v(x)$ is the median voter's intrinsic utility from x . This is satisfied for a wide range of utility functions $u(\cdot)$; $u_R(\cdot)$. For example, with quadratic loss functions for both the median voter and parties, i.e. $u = -x^2$; $u_R = -(1-x)^2$; it is easily checked that A3 holds for any $M > 0$.¹⁴

Finally, we want to rule out the uninteresting case where the incentives to converge to the median voter's ideal point, zero, are so large that parties do not choose different platforms in equilibrium. It turns out that to ensure this, it is sufficient to assume that $u(x)$ is differentiable at zero. Then, given the symmetry of $u(\cdot)$ around zero, it must be that $u'(0) = 0$; and this last condition ensures that parties are not penalised in terms of a lower election probability from a small move away from $x_R = x_L = 0$: So, we will assume:

A3. $u(x) = v(x)$ is differentiable at zero.

This assumption is satisfied by, for example, a symmetric loss function $u = -x^{2n}$; where n is a positive integer. Clearly, A3 rules out an absolute value loss function $-|x|$ or

¹⁴In this case, A3 reduces to $\frac{1}{x} < \frac{4x}{4x+M}$; which clearly holds for any $x \in [0; 1]$:

variants on this. In this case, M must also be “small enough” to ensure incomplete convergence. It is difficult to write down a general condition here, but we present an example below where we derive the required condition on M :

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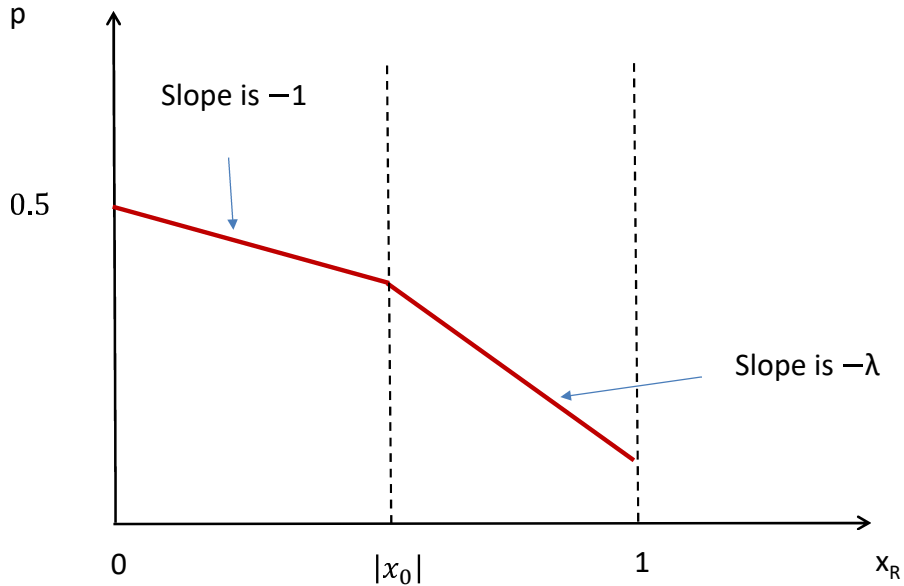
We know that the median voter prefers a platform to the reference platform if and only if it is smaller in absolute value than x_0 : From (5) and (1), we can compute

$$p = \frac{1}{2} + \Delta; \Delta = \begin{cases} u(x_R) - u(x_L) & x_L; x_R < |x_0| \\ u(x_R) - u(x_L) + (1 - \lambda)u(x_0) & x_R < |x_0| < x_L \\ u(x_R) + u(x_L) - (1 - \lambda)u(x_0) & x_R > |x_0| > x_L \\ (u(x_R) - u(x_L)) & x_L; x_R > |x_0| \end{cases} \quad (6)$$

So, p is continuous and differentiable in $x_L; x_R$ except at the points $x_R = |x_0|; x_L = |x_0|$: To illustrate, Figure 2 shows the win probability for party R as x_R rises from 0 to 1, for a fixed $x_L = 0$; and assuming also $\lambda = 1$, $u(x) = |x|$; so the median voter has absolute value preferences:

So, loss-aversion induces a kink in the *slope* of p in either x_R or x_L at $|x_0|$: For example, to the left of this point, a small increase Δ in x_R decreases p by Δ ; and to the right, a small increase in x_R decreases p by $\Delta \lambda$:

Figure 2: The Probability of Election for Party R



This kink in the win probability function drives our results on the effect of loss-aversion. It is also broadly consistent with the empirical findings about asymmetric voter responses

to macroeconomic shifts; in our model, where an economic policy platform yields the voter a lower utility than the status quo, he responds by “punishing” that party.

We begin with the following intermediate result, proved in the Appendix.

Lemma 1. *Given A2,A3, there exist unique solutions $x^+ > x^- > 0$ to the equations*

$$0.5u_R^l(x^+) - u^l(x^+) (u_R(x^+) + M - u_R(x^-)) = 0 \quad (7)$$

$$0.5u_R^l(x^-) - u^l(x^-) (u_R(x^-) + M - u_R(x^+)) = 0 \quad (8)$$

It is easily checked that (assuming A1 is also satisfied) these solutions x^+, x^- describe the symmetric Nash equilibria in the games where party R 's re-election probability is

$$p = \frac{1}{2} + \frac{u(x_R) - u(x_L)}{u(x_R) + u(x_L)}; \quad p = \frac{1}{2} + \frac{u(x_R) - u(x_L)}{u(x_R) + u(x_L)}$$

respectively. For example, (x^+, x^+) is the Nash equilibrium in the first case, which is the benchmark case without loss-aversion. To see this, note that in (7), $0.5u_R^l(x) > 0$ is the utility gain for party R from moving away from the median voter's ideal point, 0. In equilibrium, this is offset by the second term in (7), which measures the loss from a lower probability of winning. Specifically, party R loses the office benefit M and suffers a further loss because his opponent's platform, not his own, is implemented. (8) has a similar interpretation.¹⁵

We are now in a position to characterise the equilibrium with loss-aversion.

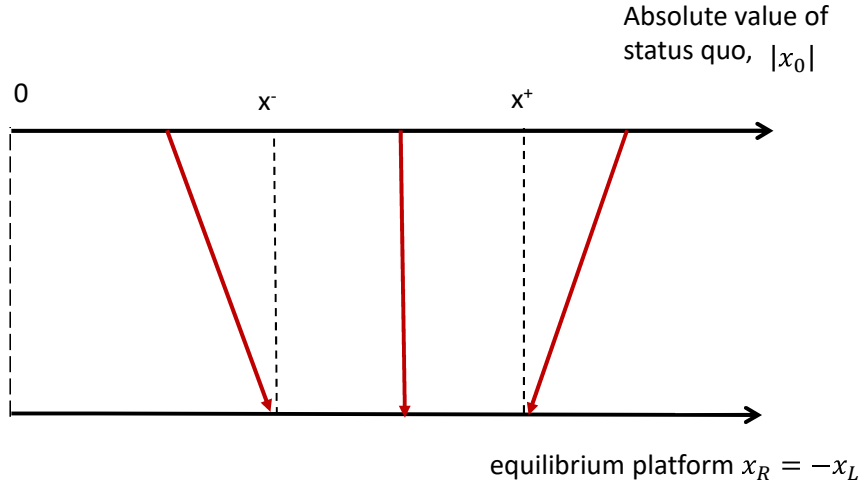
Proposition 1. *Assume A1-A3. If $x^+ < |x_0|$; then $x_R = x_L = x^+$ is the unique symmetric equilibrium. If $x^- > |x_0|$; then $x_R = x_L = x^-$ is the unique symmetric equilibrium. If $x^+ > |x_0| > x^-$; then $x_R = x_L = |x_0|$ is the unique symmetric equilibrium. The value $|x_0|$ is decreasing in λ ; so the interval $[x^-, x^+]$ is increasing in voter loss-aversion, λ .*

This baseline result is best understood graphically. Figure 3 below shows how the initial status quo maps into the equilibrium platforms. For convenience of exposition, the figure shows how the *absolute value* of the status quo, which is also minus the median voter's utility from the status quo, maps into the absolute value of the equilibrium policy platforms. The latter is of course, the actual equilibrium platform of the R party and minus the actual equilibrium platform of the L party.

Note from Proposition 1 and Lemma 1, that in the absence of loss-aversion and incumbency advantage, the equilibrium platforms are simply $x_R = x_L = x^+$: So, bearing this in mind, Proposition 1 shows that there are two important impacts of loss-aversion. First, there is *platform rigidity*; for a range of values of the status quo in the interval $[x^-, x^+]$, the outcome is insensitive to changes in other parameters, such as the weight

¹⁵it is possible to each of the two equilibria are stable under the usual sequential best-reply dynamics where starting at any two initial platforms, party R sets a best response to party L and vice versa. Specifically, Hefti (2016) shows that a sufficient condition for this is that x_R, x_L are strategic complements, and it is easily checked that this is the case.

Figure 3: Equilibrium Party Platforms



M that political parties place on office, or the responsiveness of the median voter to policy, β . However, note that platform rigidity is *not* the same as simple status quo bias; at a given x_0 in the interval $[x^-, x^+]$, the election outcome can either be x_0 or $-x_0$.

Second, there is a *reduced polarisation effect* of loss-aversion; the equilibrium platforms are both closer to the median voter's ideal point than in the absence of loss-aversion.

The intuition for this result is the following. First, if $|x_0|$ is large i.e. greater than x^+ , then electoral competition effectively takes place in the "gain" domain for the median voter i.e. where platforms are closer to zero in absolute value than the status quo platform. As a result, the equilibrium outcome is always x^+ , the outcome without loss-aversion. Conversely, if $|x_0|$ is small i.e. less than x^- , then electoral competition takes place in the "loss" domain for the median voter. Here, the median voter is more sensitive to platform changes, as she is evaluating them as losses, so now electoral competition will be more intense, and so the equilibrium involves greater convergence to the median voter's preferred point of zero, i.e. $x^- < x^+$.

Finally, if $|x_0|$ is intermediate i.e. between x^- and x^+ , then political competition must be at the margin between the gain and loss domains. This is easy to see. Suppose for example, that competition takes place in the gain domain. Then equilibrium will be x^+ . But this gives the median voter a payoff lower than the median voter's reference payoff, as $x^+ > x_0$, contradicting the assumption that competition is in the gain domain. So, competition between the two parties forces them to locate at the point where the election probability is kinked i.e. at $|x_0|$. The implication of being at the margin between the two domains is of course, that the equilibrium platform is exactly at the status quo, i.e. platform rigidity.

The following example shows these effects more explicitly. Assume both the median voter and political parties have absolute value preferences i.e. $u(x) = -|x|$; $u_R(x) =$

$\frac{1}{4} - x_j$; $u_L(x) = \frac{1}{4} + x_j$. Then it is easily checked that (7),(8) solve to give

$$x^+ = \frac{1}{4} - \frac{M}{2}; x^- = \frac{1}{4} + \frac{M}{2}$$

Note that polarisation of platforms (the size of x^+) is increasing in the variance of the valence shock, and decreasing in the payoff to office, M ; as expected. We assume that $M < \frac{1}{2}$; so $x^+; x^-$ are strictly positive. So, for

$$jx_0j \geq \left[\frac{1}{4} - \frac{M}{2}; \frac{1}{4} + \frac{M}{2} \right] \quad (9)$$

there is platform rigidity i.e. $x = jx_0j$: Note that as claimed in Proposition 1, the length of the interval in (9) is increasing in σ .

5 Uncertainty About Policies and Outcomes

The Downsian model that we work with makes the usual assumption that given a platform x ; there is no uncertainty about either the policy actually implemented, or the the utility outcome for the voter. This is in fact a strong assumption. For example, a party may propose a tax x ; but is due to changes in political support or the state of the macroeconomy, only is only able to set tax $x + \epsilon$ once in government, where ϵ is a random shock. Or, the tax rate x might actually be set as promised, but the payoff to a voter given x at the time of voting may be uncertain, because the voter may not know exactly what her wage will be. We will call these sources of uncertainty *implementation shocks* and *voter outcome shocks* respectively.

In our setting, these shocks may matter, because it is possible that the uncertainty might smooth the kink in the election probability as a function of platforms. In this section, we will show that as long as the support of the implementation or voter outcome shock is small, our main result, Proposition 1, will apply in an approximate sense, so our results are robust to this kind of uncertainty.

To keep the exposition simple, we will focus on implementation shocks. The case of voter outcome shocks is complex, as it requires some microfoundations, and is discussed at the end of this Section. Specifically, we will assume that policy platform x ; if promised, leads to a actual *implemented policy* $y = x + \epsilon$; where ϵ is mean zero and symmetric, with a continuous distribution G ; and support $[-\delta; \delta]$: Also, it is natural to suppose that the utility of a voter is defined on the actual implemented policy y . So, we define voter i 's utility as $u_i(y) = -\phi(jy - y_ij)$; where as before, ϕ is a loss function with the properties assumed above, and y_i is the ideal point of the voter.

We also assume that voters are loss-averse over implemented policy y , with the reference point being the policy implemented in the previous period by the incumbent, y_0 . So, if $u_i(y) > u_i(y_0)$; the voter's payoff is $u_i(y) - u_i(y_0)$; but if $u_i(y) < u_i(y_0)$; the voter's payoff is $-\lambda(u_i(y) - u_i(y_0))$; $\lambda > 1$:

Given this structure, the median voter i.e. the voter with the median ideal point $y_m = 0$ is still decisive, and so we need an expression for the median voter's expected utility over platform x , $u(x; y_0)$; taking the expectation over values of ϵ :

The actual formula is cumbersome but has a simple interpretation, and is given in equation (C.1) of Online Appendix C. Intuitively, if the policy x is close enough to zero that it ensures that the outcome is in the gain domain with probability 1 (i.e. that $x + \epsilon > |y_0|$); the payoff is just $E[u(x + \epsilon)] = u(x; y_0)$. Alternatively, if the policy x is close enough to one that it ensures that the outcome is in the loss domain with probability 1 (i.e. that $x - \epsilon < -|y_0|$); the payoff is just $E[u(x + \epsilon)] = u(x; y_0)$. In the intermediate case, the utility is a weighted average of the two elements.

Given $u(x; y_0)$; we can then compute the incumbent's win probability

$$p = \frac{1}{2} + \frac{u(x_R; y_0) - u(x_L; y_0)}{2}$$

much as before. Using this, we show in Online Appendix C that, given assumptions similar to A1-A3, with implementation shocks, the unique symmetric equilibrium *without* loss-aversion will be some $x_R = x_L = x^+$.

We can also define $x_R = x_L = x$ to be the symmetric equilibrium when the median voter has the expected policy payoff $E[u(x + \epsilon)]$ and thus puts more weight on policy relative to valence. Both $x^+; x$ are defined formally in Online Appendix C; as in the baseline case, $x^+ > x$. Then, we can show the following.

Proposition 2. *If $x^+ + \epsilon < |y_0|$; then $x_R = x_L = x^+$ is the unique symmetric equilibrium; (ii) if $x - \epsilon > |y_0|$; then $x_R = x_L = x$ is the unique symmetric equilibrium; (iii) If $x^+ + \epsilon > |y_0| > x - \epsilon$; then there is a unique symmetric equilibrium $x^* \in (x - |y_0|, x + |y_0|)$ i.e. the equilibrium lies between $x - |y_0|$ and $x + |y_0|$.*

We can make the following observations at this point. First, for a fixed ϵ ; we again have the moderation effect: the equilibrium is always less than or equal to x^+ , which is the equilibrium without loss-aversion. We also have platform rigidity. That is, if $|y_0|$ takes on an intermediate value, then equilibrium platforms are bounded in a narrow range of size $2|y_0|$ and so hardly responds to a parameter change, such as a change in M . Also, as the noise vanishes in the sense that ϵ goes to zero, we recover Proposition 1 as a special case. So, in this sense, our main results are robust to a "small" amount of noise, as measured by the support of the shock to platforms, ϵ .

Finally, in Online Appendix E.3, we sketch out how a similar argument can apply when the uncertainty concerns the mapping from policy x to a voter outcome. We consider a simple Meltzer-Richard model with n worker-voters. Worker-voter i has wage w_i ^{0.5}; where w is symmetrically distributed on $[1 - \epsilon; 1 + \epsilon]$; and is to be interpreted as a macroeconomic shock to wages. Workers are ranked in increasing wage order, i.e. $w_1 < w_2 < \dots < w_n$; and to minimise algebra, we also assume that the median wage squared and mean wage squared are both equal to unity. The government levies a linear income tax $\tau \in [0; 1]$ and uses

this to finance a lump-sum transfer b : A negative x and b is to be interpreted as a wage subsidy financed by a lump-sum tax. All worker-voters have preferences over consumption and labour supply given by $c = \frac{1}{2}L^2$:

In this setting, it is easy to establish that the indirect utility over the tax x for the median voter-worker is simply $\frac{1}{2}(1 - x^2)$. So, in this case, the mapping from the platform x to voter utility is rather different than in the case of implementation shocks - it is of the form $U(x)$; rather than $U(x + \cdot)$: But, it is easy to see that the basic logic of Proposition 2 will still apply. A result similar to Proposition 2 is stated and proved in Online Appendix E.3.

6 Preference Shifts and Platform Adjustment

In this Section, we study the effect of changes in public opinion on the outcomes with and without loss aversion. We will see that we can make a sharp empirical prediction that distinguishes loss-aversion from the base case with no loss-aversion.

The timing is now as follows. At period 0, the two parties compete as described in Proposition 1. They set platforms $x_{R,0} = x_0$; $x_{L,0} = -x_0$: One of these parties wins the election and is thus the incumbent at the beginning of period 1.

But now, we assume that at the beginning of period 1, there is a shift in the ideal point of both the median voter and the two parties. We allow the preference shift to affect both voters and parties equally. That is, the ideal points of both the median voters *and* the parties shift by Δ .¹⁶ This shift is common knowledge. Without loss of generality, we assume that the shift is positive i.e. $\Delta > 0$:

When it has occurred, the parties then set equilibrium platforms $x_{R,1}$; $x_{L,1}$. The question of interest is how the two platforms change with Δ : Let $x_{I,0}$ be the outcome at period 0, so $I \in \{R, L\}$ is the incumbent. We are interested in $\Delta_I = x_{I,1} - x_{I,0}$ relative to $\Delta_C = x_{C,1} - x_{C,0}$:

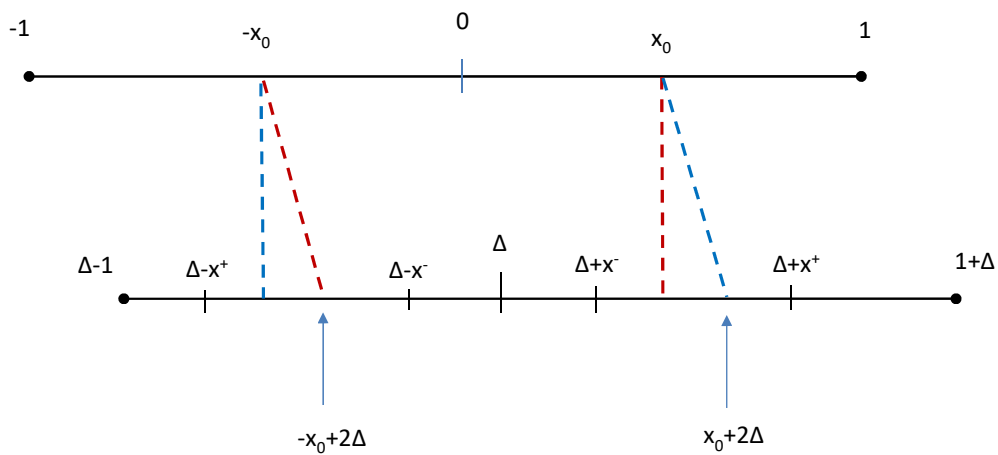
Before proceeding, we note that there are several reasons for allowing the ideal points of political parties to shift, not just voters. First, it is plausible that preference shifts will affect the views of party members as well as uncommitted voters. Second, this ties in with our empirical approach, where we construct the preferences of the median voter from the preferences of candidates for office (see Section 7.2 below). Finally, without this assumption we obtain the same intuition at the cost of considerable additional complexity.

Without loss aversion, i.e. $\lambda = 1$, it is clear that the period 0 equilibrium has no effect on the period 1 equilibrium. Specifically, at period 1, the parties play the same game before the shift, but the point of origin is moved from 0 to Δ . So, it is obvious that the new equilibrium will be the same, but with all variables translated by Δ . In other words, there is *symmetric adjustment* in platforms; that is, party platforms both move to the right by Δ :

¹⁶That is, the median voter's policy payoff shifts from $U(x)$ to $U(x - j)$; and the L and R party preferences shift from $U(x + 1/j)$; $U(x - 1/j)$ to $U(x + 1 - j)$; $U(x - 1 - j)$; respectively.

With loss-aversion, the effect of the preference shift will be very different than with no loss-aversion. To obtain clean results, we will assume that *either* (i) the preference shift is unanticipated at time zero, *or* (ii) parties have absolute value preferences i.e. $u_R = x - 1; u_L = -(x + 1)$. This assumption is required, because if the preference shift is anticipated, *and* parties care about the degree of polarisation of the two future equilibrium platforms (i.e. the gap between x_R and x_L) there may be dynamic incentives to choose the current platform in order to affect the future status quo. In an earlier version (Lockwood and Rockey, 2015), we show that dynamic incentives are absent when parties have absolute value preferences.¹⁷

Figure 4: Preference Shifts and Party Adjustment



The top part of Figure 4 shows the initial equilibrium, which will be at some $x_0 \in [x^-; x^+]$ if R won the last election (and thus is the incumbent) or at some $-x_0$ if L won the last election. The bottom line indicates that the ideal points of the median voter and the two parties all move rightward by Δ : We assume for purposes of illustration that this rightward shift is small enough so that $x_0 \in [x^- + \Delta; x^+ + \Delta]$: Then, the new equilibrium must be as shown in the bottom line of the figure.

Specifically, when $x_0 > 0$; so that R is the incumbent, the status quo platform has effectively moved inwards towards the new ideal point of the median voter. Moreover, as $x_0 \in [x^- + \Delta; x^+ + \Delta]$ from Proposition 1, there must be platform rigidity in equilibrium i.e. $x_{R,1} = x_0$. Also, the new platforms must be centred around Δ ; meaning that party L 's new equilibrium platform is $x_{L,1} = -x_0 + 2\Delta$: So, it is clear from the red dotted lines that the incumbent's platform does not move *at all*, whereas the challenger's platform moves by double the amount of the preference shift Δ i.e. 2Δ :

The argument is reversed when party L is the incumbent. Now, the the status quo

¹⁷This incentive works through the following mechanism. Because the model is symmetric, the equilibrium is always symmetric about the median voters ideal point. So, in equilibrium $x_R = -x_L = x$, a party faces a lottery $(x; -x)$ where each outcome occurs with probability 0.5. So, generally risk-averse parties dislike polarised platforms i.e. a higher x . If by manipulating the status quo, they can reduce future polarisation a bit, they will do so. But, clearly, this incentive is absent when parties are risk-neutral i.e. their payoffs are linear in the policy outcome.

platform effectively moves outwards away from the new ideal point of the median voter. Moreover, as $x_0 \geq (x^- + \Delta; x^+ + \Delta)$ from Proposition 1, there must be platform rigidity in equilibrium i.e. $x_{L,1} = x_0$. Again, the new platforms must be centred around Δ ; meaning that party R's new equilibrium platform is $x_{R,1} = x_0 + 2\Delta$. So, it is again clear from the blue dotted lines that the incumbent's platform does not move *at all*, whereas the challenger's platform moves by double the amount of the preference shift Δ i.e. 2Δ :

In the same way, we can compute what happens to equilibrium platforms for all shifts, not just small ones. Define the *platform shift* to be the change in the platform of a party in response to Δ . Given that initial platforms are $x_L = x_0; x_R = x_0$, formally, platform shifts are $\Delta x_R = x_{R,1} - x_0; \Delta x_L = x_{L,1} - (x_0) = x_L + x_0$ for parties R, L respectively: We can then prove;

Proposition 3. (Asymmetric Adjustment) *Assume that the status quo is x_0 if $R = I$; and x_0 if $I = L$, where $x_0 \geq [x^-; x^+]$: Following a preference shift $\Delta > 0$; the equilibrium party platform shift is smaller for the incumbent than the challenger i.e. $\Delta_I < \Delta_C$; with $\Delta_I < \Delta_C$ if $x_0 \notin [x^-; x^+]$:*

This result, combined with our observation that there is symmetric adjustment to the shift without loss-aversion, shows that loss-aversion generates a particular kind of asymmetry, which is testable; incumbents adjust less than challengers.

We now turn to consider how a shift affects the equilibrium gap between the platforms i.e. $\Delta_{RL} = x_R - x_L$; we can call this *party polarisation*. The initial level of polarisation is of course, $x_0 - (x_0) = 2x_0$: So, party polarisation increases (decreases) following the shift iff $\Delta_{RL} > 2x_0$ ($\Delta_{RL} < 2x_0$): Say that a preference shift is favourable (unfavourable) for the incumbent if it is in the same direction as the incumbent's ideological bias e.g. $\Delta > 0$ is favourable for R ; and unfavourable for L :

Then, from Proposition 3, we can infer the following. Suppose first that the incumbent is party L : Then, as we are considering a rightward shift, this is favourable for the incumbent. Then, both party positions shift to the right, but the incumbent party R 's position shifts less than the challenger, so party polarisation must decrease.

On the other hand, if the incumbent party is L ; the preference shift $\Delta > 0$ is unfavourable for the incumbent. Then, both party positions shift to the right, but the incumbent party L 's position shifts less than the challenger, so party polarisation must increase. So, we have proved:

Proposition 4. (Changes in Party Polarisation) *Following a "favourable" preference shift for the incumbent; party polarisation $\Delta_{RL} = x_R - x_L$ decreases. Following an "unfavourable" preference shift for the incumbent; party polarisation $\Delta_{RL} = x_R - x_L$ increases.*

Finally, we briefly consider other possible explanations for asymmetric adjustment. One obvious one might be some kind of incumbency advantage. However, if we model incumbency advantage in a standard way, by supposing that incumbency advantage is due to greater competence, then it is easy to see that following a preference shift,

both incumbent and challenger will adjust symmetrically.¹⁸ Specifically, we can capture incumbency advantage in the version of the model without loss-aversion i.e. $\alpha = 1$ by assuming that the valence of the incumbent is $v_I > 0$, and is thus higher than the expected valence of the challenger.

In this version of the model is studied in Online Appendix E.1. It is easily checked that the equilibrium platforms will generally be asymmetric, with the incumbent party R 's platform closer to its ideal point than party R 's platform is i.e. $x_R > x_L > 0$. But, it is also clear that due to the absence of loss-aversion, the preferences of the median voter are independent of the initial platform, and so following a preference shift Δ , both x_R ; x_L shift by Δ . So, in this case, there is *asymmetry in initial platforms, not in adjustment*, the reverse to the case of loss-aversion.

Another possibility might be loss-aversion in the competence dimension. In Online Appendix E.2, we characterise the equilibrium in this case. Depending on the position of the reference point, the incumbent may be advantaged or disadvantaged. However, in this case, as with incumbency, the policy preferences of the median voter are independent of the initial platform, and so again following a preference shift Δ , both x_R ; x_L shift by Δ . So, to conclude, our prediction of asymmetric adjustment seems quite distinctive to loss-aversion in the policy dimension.

7 Data and Measurement

The previous section makes two robust theoretical predictions; with voter loss-aversion, incumbents adjust less than challengers to changes in voter preferences, and parties become less (more) polarised following a “favourable” (“unfavourable”) preference shift for the incumbent. In the remainder of the paper, we take these predictions to US data on elections to the lower houses of state legislatures over the period 1990-2012. As noted by [Besley and Case \(2003\)](#), the US states are a natural laboratory for empirical exercises of this kind, for a number of reasons.

First, at the state level, consistent with the theory, there are effectively only two parties, Democratic and Republican; we do not study the ideological positions of independent candidates, who in any case, attract very few votes.¹⁹ Second, compared to the European elections studied by e.g. [Adams et al. \(2004\)](#), and the US Congress, studied by [Fowler \(2005\)](#), this is a large sample. Moreover, the states have common electoral rules; each state holds general elections every two years.²⁰

¹⁸For example, [\(Peskovitz, 2017\)](#) says, “The standard conception of incumbency advantage is that the effect is purely valence”.

¹⁹Where information is available, we do include the ideological positions of independent candidates when calculating the position of the median voter, but since they typically receive very few votes they have a very small effect on the calculation.

²⁰Most electoral districts are single-member, but some states have multi-member electoral districts, and while we exclude these states in our baseline specification this does not impact upon the results; see below.

We begin by arguing that the theoretical results obtained above apply to this setting, under a range of assumptions. Suppose that there are an odd number of districts $d = 1; \dots; D$ which each elect a candidate to the legislature. We suppose that each of the parties R, L field candidates in all districts. Let the median voter m in district d have ideal point x_m^d . Rank the districts so that $x_m^1 \leq x_m^2 \leq \dots \leq x_m^D$. Continue to assume that voter preferences are given by (2), and without of generality, assume that the ideal point of the median voter in the median district $q = \frac{n+1}{2}$ is $x_m^q = 0$.

Clearly, the actual policy implemented by the winning party $p = R; L$ will depend in some way on the positions of the candidates. There are two extreme possibilities. One is strong party discipline i.e. where all candidates in a given party must choose the same platform. In this case, it is easy to see that our results extend to the case of multiple districts.

The other is where each candidate in a given party can freely choose his own platform (weak party discipline). Then, as the result of internal voting or bargaining, a party p that wins the election implements some combination of the platforms of the candidates from the different districts. This version of the model is studied in Online Appendix E.4. There, we show that if the party chooses the median platform of all those set by the candidates in the party, the results extend as before.

We use new data collected by [Bonica \(2014b\)](#) which allow us to estimate separately the distribution of voter preferences in each electoral district in each state in each election. In particular, Bonica’s data are based on a new method which recovers the platforms of all candidates, not just the winner, for election to state legislatures, based on the campaign donations they received. This is important as it means that we are not forced to make assumptions about the preferences of candidates who lost. We then combine Bonica’s data with election results at the district level to construct estimates of the preferences of the median voter in each district at each election as described below.

In this way, we can measure changes to the distribution of voters’ preferences, and parties’ responses to these changes for all state legislatures over a 20 year period. The details of this procedure are in Section 7.1. Using these data we find, as predicted by the theory, that incumbent parties are less responsive to shifts.

7.1 Data Description

Our data are for elections to state legislatures and the US Congress for the period 1990–2012.²¹ Data describing the number of voters for each candidate in each district for every election are taken from [Klarner et al. \(2013\)](#). These are then matched by candidate, district, and election to the DIME database ([Bonica, 2014a](#)) that accompanies [Bonica \(2014b\)](#). These data are constructed using publicly available campaign finance information, collated by the National Institute on Money in State Politics and the Sunlight Foundation, and they are remarkable in that they provide estimates of the ideological

²¹This includes the single Nebraskan chamber, but excludes New England, Massachusetts, and Vermont.

position of almost every candidate in every election over the period we study.²² Crucially, as donors donate to losing candidates we observe the ideological position of *all* candidates.

7.2 Measuring Voter Preferences and Party Platforms

To test our two hypotheses, we need a measure of each party’s position, and that of the median voter, at a given election in a given state. We will build these position variables from Bonica’s candidate level position data in elections to various offices.

Bonica’s data give us a measure $Platform_{cst}$ of the platform of candidate c at a given election at date t in state s . We also know $Votes_{cst}$, the number of votes the candidate received. $Platform_{cst}$ is normalized such that -1 is the most left-wing position observed and 1 is the most right-wing observed in any election. The t variable is the set of even years $\{1990; \dots; 2012\}$; as elections are held in all states every even year.

We begin with the construction of party positions. The position of party p in elections to the state legislature in state s at time t is denoted as $Position_{pst}$. We define this as the median of the positions of all candidates of that party, including both incumbent and challengers i.e. the median of all the values of $Platform_{cst}$, for all candidates belonging to party p in state s .

Next, we construct a measure of the preference of the median voter in a given election. As already discussed, we use data from contemporaneous elections to *other* offices for this construction, since we are already using elections to the Lower Houses of state legislatures to calculate $Platform_{pst}$. Specifically, we have candidate positions and vote shares for elections to both State Upper Houses and the US Congress (House and Senate).²³

For each of these three offices o , we calculate for each electoral district d , the voter-weighted average position of the candidates in that district at that election;

$$o_{dt} = \sum_{c \in C_d} \frac{Platform_{cst}^o \cdot Votes_{cst}^o}{\sum_{c \in C_d} Votes_{cst}^o} \quad (10)$$

where C_d is the set of candidates in district d of both parties.²⁴

Our estimate of the ideology of the median voter at the state level, o_{st} , using election to office “ o ” is then simply $o_{st} = o_{Mt}$, where districts are ordered by means o_{dt} and $M = \frac{D_s + 1}{2}$, where D_s is the set of all districts in state s . In other words, our estimate of the ideology of the state median voter is the ideology of the mean voter in the median district at time t . Given that typically there are a large number of districts, this is likely to

²²Bonica (2014b) uses a correspondence analysis procedure that exploits the fact that many politicians receive funds from multiple sources and many sources donate to multiple politicians to recover estimates for the positions of both politicians and donors. As this procedure is applied simultaneously at the federal and state level, estimates for candidates in state-level elections are in a common space, and comparable over time and between states.

²³The logic for using the positions and vote shares of candidates in other State and in Federal Elections is that this avoids using the same data to measure party positions as voter ideology whilst still capturing variations in district ideology.

²⁴Different offices are associated with different partitions of State into electoral districts. Given this is not important for our analysis we abstract from it to avoid additional notation.

be close to the true median, even though within a district, without making distributional assumptions, we cannot identify the median voter and thus we work with the mean voter.

To get our baseline estimate of the median voter in state S at time t , μ_{st} , we use the first principal component of the office-specific measures μ_{st}^o . In Table B.1 in Appendix B we show that our results are robust to using data for elections to state upper houses only. Table D.1 in Online Appendix D shows they are also robust to using elections to the US Congress only.²⁵

Formula (10) highlights why an estimate of the platform of both candidates is so important – it allows us to consistently estimate μ_{st} without recourse to additional assumptions or additional information (see, Kernell, 2009). Note, that our calculations do not require any variation in $Platform_{ct}$ across candidates standing in different districts, where candidates’ platforms do vary we use this information to maximise the precision of our estimates.

Our variable measuring shifts to voter preferences is then simply:

$$\Delta Preference_{st} = \mu_{st} - \mu_{s:t-1} \quad (11)$$

Figure D.2 in Online Appendix D describes how the median voter of each state has varied over time. We can see that, as would be expected, voters in New York or Oregon are to the left of voters in Georgia or Oklahoma. We can also see that for some states, such as California or Texas, μ_{st} has varied less over time than others such as Arizona or Idaho.

This measure (11) has the advantage of corresponding directly to our theoretical definition of a preference shift. It does not necessarily use all of the available information, however. As a robustness test we will repeat our analysis using the state-wide *mean* voter position, μ_{st}^o . We calculate the mean voter in state S in year t for a given office o as

$$\mu_{st}^o = \frac{1}{D_s} \sum_{d \in D_s} \mu_{dt}^o \quad (12)$$

i.e. the average of the district mean ideologies. We then, as before, calculate μ_{st}^o as the first principal component of these office specific measures. Inspection of Figure D.3 in Online Appendix D suggests that the choice between μ_{st} and μ_{st}^o may not be that important as there is little empirical difference in the distributions across states in a given year of the mean and median voters.

The other main explanatory variable is a dummy Inc_{pst} recording whether the party p holds a majority of seats in the legislature in state S in the period prior to election t .

In Online Appendix D.1, as an example, we introduce the data for California for 2004 and 2006, that illustrates the construction of these variables and how they

²⁵In those years where there are no elections for the US Senate μ_{st} is defined solely by elections to the US House and the State Upper House. Similarly, in States with no upper chamber, μ_{st} is defined only by federal elections.

relate to one another. Table 1 contains summary statistics for the key variables $Position_{pst}$: $\Delta Preference_{st}$ for all US states, by party. We also show $\Delta Position_{pst}$: the change in $Position_{pst}$ for party p in state S between elections at t and the previous election $t - 1$. The Table shows, as expected, that $Position_{pst}$ for the Republicans is to the right of that for Democrats. Note however, that the difference between the Democrat and Republican mean values on the $[-1; 1]$ scale are small – only 0.142 – as the endpoints of this scale are determined by the most ideologically extreme candidates in the sample.

Looking now at the values for $\Delta Position_{pst}$ over the sample period, we see, not surprisingly, that there has been polarisation; the Republicans have moved to the right, and the Democrats to the left. Reflecting this, there are also relatively few large party moves with the 90th percentile of $\Delta Position_{pst}$ also being 0.04 for the Republican party. Comparison of the 1st and 99th percentiles suggests shifts are symmetrically distributed.

We can also see that, consistent with the literature (see, Erikson et al., 1993), that voter preferences are relatively stable – for example, both the mean and the median of the $\Delta Preference_{st}$ distribution are less than 0.002 and the 90th percentile is 0.47 compared to a theoretical maximum move of 3.4.²⁶

8 Empirical Strategy and Results

8.1 Asymmetric Adjustment

8.1.1 Empirical Strategy

To test Proposition 3, we can compare the change in party positions for a given change in voter positions by regressing $\Delta Position$ on Inc , $\Delta Preference$, and the interaction of the two explanatory variables. In other words we estimate an equation of the form:

$$\Delta Position_{pst} = \beta_1 \Delta Preference_{st} + \beta_2 Inc_{pst} + \beta_3 Inc_{pst} \Delta Preference_{st} + \beta_4 Inc_{pst}^2 + \epsilon_{pst} \quad (13)$$

Our key prediction from Proposition 3 is that the incumbent party shifts less i.e. $\beta_1 < 0$, while $\beta_2 > 0$. Note that the term in β_4 allows for a non-linear impact on the effect of incumbency on the response to the shift.

Given the data at hand, a key challenge in estimating (13) is to adequately control for any common factor, captured by ϵ_{pst} : that may be jointly driving changes in parties' platforms and changes in voters' preferences. These are likely myriad and will include both local political and economic factors in the districts of individual representatives (see, Healy and Lenz, 2014), the spillover effects of other elections (see, Campbell, 1986), the characteristics of the representatives themselves (see, Buttice and Stone, 2012, Kam and Kinder, 2012), or media-bias (see, Chiang and Knight, 2011). As well as endogeneity due

²⁶The theoretical maximum is given by the maximum possible change for each variable used in the PCA, which is 2, multiplied by its weighting. That is: $0.54 \times 2 + 0.44 \times 2 + 0.72 \times 2$.

to external events, there is also the possibility of simultaneity due to the campaigning efforts or persuasive powers of state-parties or individual politicians.

Our identification strategy is simple. Given our data are indexed by state, party, and year we include fixed effects for each of the pair wise combinations of the three. Our preferred model includes *state party* (henceforth, SP), *state year* (SY), and *party year* (PY) fixed effects. In other words, we assume

$$p_{st} = sp + st + pt + \epsilon_{pst} \quad (14)$$

where sp , st , pt are SP, SY, and PY fixed effects, and the error term ϵ_{pst} is assumed to be $N(0; \Sigma)$ where we allow for Σ to be clustered by both SP and SY. This is because one can imagine that as well as errors being correlated within an individual state party, that state parties' behaviour may be correlated across states within an election. For example, because Republican voters may be nationally affected by the Republican nominee for US President.

So, we have partialled out all variation associated with particular, states, parties, and years. Importantly, as well as addressing short-term variation this strategy also controls for secular trends in U.S. politics over the period we study, such as changes in the degree of voter polarisation.²⁷ We assume that, conditional on the fixed effects, the covariates in (13) are orthogonal to the error ϵ_{pst} . This implies three substantive claims, that conditional on the fixed effects; the change in the median voter is random; which party is incumbent does not alter voters' votes given their preferences; and conditioning on this incumbency that the change in the median voter is still random. It is hard to think of processes which, given these fixed effects, would give rise to some unaccounted for systematic bias in our results.²⁸

To relax these assumptions, and for the avoidance of doubt, we also present instrumental variable estimates. Here, our identification strategy relies on the premise that nearby states are likely to be subject to similar social forces and economic shifts, but that these shifts in other states should not depend on the incumbency or position of the parties in the state in question. Thus, we instrument $\Delta Preference_{st}$ and $Inc_{pst} \Delta Preference_{st}$ with the average shift in that state's census division, excluding state s , $\Delta Preference_{s,t}$, and its interaction with incumbency $\Delta Preference_{s,t} Inc_{pst}$.²⁹ As is standard, identification now requires $E[\Delta Preference_{s,t} \Delta Preference_{st}] \neq 0$ and $E[\Delta Preference_{s,t} \epsilon_{pst}] = 0$. Of course, if as we argue, concerns about endogeneity are satisfactorily addressed by our fixed-effects strategy then our OLS estimates are to be

²⁷[Ansolabehere et al. \(2006\)](#) provide evidence that, contrary to popular perception, the key trend has been increased centrism in the U.S. electorate and that the differences between states are smaller than commonly supposed.

²⁸To be precise, here, our identification assumptions are:

$$E[\Delta Preference_{st} \epsilon_{pst}] = E[(Inc_{pst} \epsilon_{pst})] = E[(Inc_{pst} \Delta Preference_{st}) \epsilon_{pst}] = 0$$

²⁹See Online Appendix D.2 for details of the Census Divisions.

preferred. In fact, it turns out that the results in both cases are similar.

A final concern is that there may be alternative explanations for asymmetric platform adjustment. In particular, one may be concerned that our results reflect incumbency advantage. The recent literature has focused on three key sources of incumbency advantage – that incumbents receive more campaign contributions which improve their chances of re-election; that high quality challengers avoid contesting elections against incumbents meaning incumbents run against relatively poor challengers on average; or that incumbents are themselves higher quality politicians.³⁰ It is possible that any of these three advantages could cause, in equilibrium, the incumbent to adjust less in response to a voter preference shift; however, there are to our knowledge, no theoretical predictions to this effect in the literature.

Our response to this is as follows. The first point here is that almost all states have term limits during our sample period. As a result, almost 27% of seats are open i.e. not contested by the incumbent. A second point is that the vast majority of the empirical literature has identified incumbency advantage at the *individual* level, whereas our analysis is at the *party* level, and so we are concerned with the average advantage across individuals in a given party. Our fixed effects will control for this.³¹

A final concern is the so-called Partisan Incumbency Advantage discussed by [Fowler and Hall \(2014\)](#), which describes the beneficial effect to individual candidates of belonging to the party currently in office, over and above any individual incumbency advantage. If such an advantage exists, it will be a component of Inc_{pst} . This, however, is of limited concern for two reasons. First, [Fowler and Hall \(2014\)](#) shows that this effect is in practice close to zero. Second, even it is present, it should not bias the estimation of the parameter of interest β_1 .

8.1.2 Results

We now report estimates of (13). To facilitate inference, all variables are standardised such that coefficients may be interpreted in terms of standard deviation changes in $\Delta Position_{pst}$ and $\Delta Preference_{st}$, etc. As a first step, column 1 of Table 3 reports results from a simplified version of (13) where $\beta_2 = 0$, and in which there are only SP and PY fixed effects. We see that, as expected, parties react to movements in the median voter, with the coefficient on

³⁰ [Uppal \(2010\)](#) applies the approach of [Lee \(2008\)](#) to provide evidence for state legislatures. He finds that incumbency is associated with an average electoral advantage of around 5.3%, similarly [Fowler and Hall \(2014\)](#) find it to be 7.8%. The results of [Fouirnaies and Hall \(2014\)](#) suggests a substantial portion of this advantage is due to the additional campaign funding received by incumbents. [Ban et al. \(2016\)](#) using term-limits as an instruments suggests that the choice of high quality opponents to avoid competing against incumbents accounts for around 40% of incumbents' advantage. While, [Hall and Snyder \(2015\)](#) using an RDD approach finds much smaller effect of around 5%.

³¹ For example, suppose it is the case that in a state, one party's representatives are on average is wealthier than the other's. Then, it is quite plausible, that following a shock to preferences, that party may seek to persuade the voters by increased advertising, rather than changing its platform, and so may respond less to the shock. Assuming that this differential does not change much over time, it will be picked up by the state-year fixed effect. Alternatively, to the extent that wealth differences between parties are at the national level, but vary over time, they will be picked up by the party-year fixed effect, and so on.

$\Delta Preference_{st}$ positive and significant. We also find, as the theory suggests, that parties with a majority react less. This coefficient is negative and significant and around 70% as large as for $\Delta Preference_{st}$. Thus, a one standard deviation move rightwards would move the incumbent party only 0.05 standard deviations rightwards, but a party not in power 0.17 standard deviations to the right, or three times as much. This is clearly as predicted by the theory as it shows that the party that lost (won) the previous election tend to make large (small) policy changes in the pursuit of future power. Given that we include $Inc_{pst} \Delta Preference_{st}$, gives the effect of Inc_{pst} given no shift. Perhaps unsurprisingly, given the shift will almost always be non-zero, the estimated effect is small, although positive and significant at the 5% level.

Column 2 maintains the restriction that $\beta_2 = 0$ but now includes the full battery of fixed-effects. Now β_1 is not identified but the addition of the SY fixed-effects simplifies the interpretation of the β_1 coefficient, given a shift, it is now the difference in the response of parties in power from those that are not. Importantly, β_1 remains of the same magnitude and significance.

This effect may not be linear however, parties may respond disproportionately to smaller or larger shifts. In columns 3 and 4 we therefore relax the constraint that $\beta_2 = 0$. Column 3 reports results omitting the SY fixed-effects while column 4 includes them. With and without the SY fixed-effects, we find that β_2 is imprecisely measured and not significant at any conventional level, suggesting we can reject a non-linear effect of larger shifts.

We now move on to show that we obtain similar, indeed stronger, results using our IV estimator. These results are reported in columns 5-9 of Table 3. Column 5 reports a simple IV specification without fixed-effects. We can see that again we find that both parties respond to a shift, but that the incumbent party moves less. Columns 6 and 7 additionally include the fixed-effects used in columns 1-5 to progressively weaken the identification assumptions of our estimator from $E[\Delta Preference_{s,t} | pst] = 0$ to $E[\Delta Preference_{s,t} | pst; SY; PY; SP] = 0$. Column 7 includes only SP fixed-effects, and we can see that the magnitudes of β_1 and β_2 are slightly lower but that the main difference from column 5 is that the coefficient on incumbency β_1 is now significant. Column 7 includes the full-set of fixed-effects and now, as before, β_2 is not identified but we again find that β_1 is negative and significant. Taken together these results provide strong evidence for the effects of loss-aversion predicted by the theory.

One might be concerned that shifts to the identity of the median voter maybe only weakly correlated with those in neighbouring states. If this were the case then the relevance assumption, $E[\Delta Preference_{s,t} | \Delta Preference_{st}] \neq 0$, maybe questionable. This is of particular concern given that our fixed-effects are designed to capture state and national trends. To allay such concerns we report the generalised LM test of under-identification test proposed [Kleibergen and Paap \(2006\)](#). Inspection of the associated p-values shows that we can reject under-identification and thus the violation of the relevance assumption in all cases. But, if $E[\Delta Preference_{s,t} | \Delta Preference_{st}] = 0$ then our estimates may still be

substantially biased. Thus, we also report the associated Wald test of weak-identification and we are able to reject this at all levels in all specifications.

As discussed in Section 7.1 our preferred measure of shifts is the change in the median voter. However, whilst this represents a natural choice, not least because it is in line with the theory, we may be concerned that this measure, focusing on the median district, disregards important information. To verify that this is not the case columns 8 and 9 report results using the same specification as in columns 6 and 7 except now using Δ_{st}^0 , the change in location of the mean voter. There is no substantively or statistically significant difference in the estimated coefficients. We provide further evidence of the robustness of our results in Appendix B which shows that these results are not altered by including states with multi-member districts, alternative measures of voters' preferences, or defining parties' positions as given by their mean representative. We also show the robustness of our results to excluding challengers when calculating the position variable. The reason for this is that individual politicians' positions may be relatively stable over time, implying that most of the change in the views of representatives would be due to electoral turnover. If this is the case, we would expect the effects of shifts in voter preferences to be different, and maybe smaller, when challengers (nearly all of whom are new candidates) are excluded from the calculation. In fact, we show that this makes little difference to the results. This finding is consistent with our modelling of platform choice by parties as being unconstrained.

8.2 Testing for Changes in polarisation

We now turn to our second empirical prediction, Proposition 4. This Proposition implies that at an election the gap between two parties $\Delta_{st} = Position_{Rst} - Position_{Dst}$ should be smaller if the shift was favourable for the incumbent. Recall that positive (negative) changes in Δ_{st} measure rightward (leftward) shifts in voter preferences. So, our measure of favourable shifts for Republicans and Democrats respectively are:

$$F_{Rst} = \max\{f(\Delta_{st}; 0), 0\}; F_{Dst} = \max\{f(-\Delta_{st}; 0), 0\}$$

We then estimate the following model:

$$\Delta_{st} = \beta_R(Inc_{Rst} - F_{Rst}) + \beta_D(Inc_{Dst} - F_{Dst}) + \beta_R(Inc_{Rst} - F_{Dst}) + \beta_D(Inc_{Dst} - F_{Rst}) + \mu_{pst} \quad (15)$$

where now, as Δ_{st} is defined at the state-year level, we are unable to control for state-year fixed effects and thus $\mu_{pst} = \alpha_s + \gamma_t + \rho_{pst}$.

To interpret this, consider first the variable $Inc_{Rst} - F_{Rst}$ which records the presence and size of the favourable shift when the Republican party is the incumbent. Given Proposition 4, we expect this to have a negative impact on the dependent variable i.e. $\beta_R < 0$. By the same argument, we expect $\beta_D < 0$. Next, the variable $Inc_{Rst} - F_{Rst}$

which records the presence and size of an unfavourable shift when the incumbent is the Republican. Following Proposition 4, we expect this to have a positive impact on the dependent variable i.e. $\beta_R > 0$. By the same argument, we expect $\beta_D > 0$.

The results of estimating (15) are reported in columns 1 and 2 of Table 4. As a first step in column 1, to maximise power, we impose the restriction that the Democratic and Republican parties respond equivalently, i.e. $\beta_R = \beta_D$ and likewise $\gamma_R = \gamma_D$. The results are as predicted: β is negative and γ is positive. β is however smaller than γ and insignificant. Column 2 estimates (15) without additional restrictions. We see that, as predicted, both $\beta_R < 0$ and $\beta_D < 0$ while $\gamma_R > 0$ and $\gamma_D > 0$. While all coefficients are of the expected sign only β_D is significant, but more importantly we are able to reject the joint hypothesis that $\beta_R + \beta_D = \gamma_R + \gamma_D$. Column 3 repeats the analysis in column 1 two analyses but now the model is estimated using IV with an analogous identification strategy to that in the previous section. We again instrument shifts to the identity of the median voter using shifts in nearby states. That is, we instrument F_{Rst} with $\max_{t'} \Delta_{Rst} \cdot 0g$ and so on. The results in column 3 again restrict $\beta_R = \beta_D$ and $\gamma_R = \gamma_D$, to preserve power. The coefficients are now less precise, but importantly we can again reject $\beta = \gamma$. Taken together the results of all three specifications provide some further evidence for the theory – all suggest that loss aversion means that unfavourable shifts lead to platform divergence.

9 Conclusions

This paper studied how voter loss-aversion affects electoral competition in a Downsian setting. We provided evidence that US voters may be loss-averse assuming, consistent with the body of previous evidence, a reference point of the status quo. We then showed theoretically that such loss-aversion has a number of effects on electoral competition. First, for some values of the status quo, there is policy rigidity both parties choose platforms equal to the status quo, regardless of other parameters. Second, there is a moderation effect when there is policy rigidity; the equilibrium policy outcome is closer to the median voter’s ideal point than in the absence of loss-aversion.

Finally, we made two empirical predictions. First, with loss-aversion, incumbents adjust less than challengers to changes in voter preferences. Second, we showed that following a “favourable” preference shift for the incumbent; the gap between platforms, decreases, whereas the reverse is true following an “unfavourable” preference shift.

We test both of these predictions using elections to US state legislatures. We find robust support for both. The results are as predicted: incumbent parties respond less to shifts in the preferences of the median voter. Also as predicted, “unfavourable” shifts lead to platform divergence.

Table 1: Summary Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max	P1	P10	P50	P90	P99
Republicans										
$Position_{pst}$	214	0.137	0.043	0.041	0.215	0.052	0.073	0.148	0.187	0.202
$\Delta Position_{pst}$	214	0.004	0.014	.053	0.064	.03	.01	0.003	0.022	0.04
$\Delta Preference_{st}$	214	0.002	0.036	.139	0.103	.086	.038	0.001	0.047	0.089
Democrats										
$Position_{pst}$	214	.05	0.064	.173	0.11	.167	.128	.066	0.051	0.096
$\Delta Position_{pst}$	214	.005	0.012	.063	0.036	.046	.019	.004	0.008	0.019
$\Delta Preference_{st}$	214	0.002	0.036	.139	0.103	.086	.038	0.001	0.047	0.089

Table 2: Cross-correlation table

Variables	$\Delta Position_{pst}$	$\Delta Preference_{st}$	Inc_{pst}	$\Delta Preference_{st}$
$\Delta Position_{pst}$	1			
$\Delta Preference_{st}$	0.15	1		
Inc_{pst} $\Delta Preference_{st}$	-0.03	0.7		1

Table 3: Asymmetric Adjustment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Preference _{st}	0.174 (0.0757)		0.173 (0.0705)		0.575 (0.168)	0.547 (0.171)		0.531 (0.142)	
Inc _{pst} Δ Preference _{st}	0.121 (0.0519)	0.157 (0.0550)	0.128 (0.0682)	0.171 (0.0485)	0.370 (0.110)	0.332 (0.120)	0.383 (0.125)	0.335 (0.0935)	0.342 (0.113)
Inc _{pst}	0.220 (0.112)	0.208 (0.110)	0.248 (0.146)	0.272 (0.127)	0.0578 (0.0732)	0.116 (0.111)	0.153 (0.147)	0.0119 (0.0734)	0.218 (0.135)
Inc _{pst} Δ Preference _{st} ²			0.0338 (0.0302)	0.0750 (0.0381)					
R ²	0.11	0.04	0.02	0.04	0.03	0.01	-0.02	0.04	0.01
Observations	554	554	554	554	554	554	554	554	554
Estimator					39.59	37.12	6.19	50.64	7.00
Trends					0.00	0.00	0.01	0.00	0.01
Kleibergen-Paap p-value					28.61	41.80	23.62	38.53	100.73
Hansen J p-value	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS
State Party Fixed-Effects	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Party Year Fixed-Effects	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
State Year Fixed-Effects	No	Yes	No	Yes	No	No	Yes	No	Yes
Shock Measure	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st

Note: The dependent variable is the change in a party's platform for elections to state legislatures as measured by that of the median candidate. Preference_{st} measures the change in the median voter's preferences as defined in Equation 11 calculated using data for state elections to the US Congress and any Upper House of the State Legislature, except columns 8 and 9 which employ the change in the position of the mean voter, Inc_{pst} is a binary variable that is equal to 1 if a party won more than 50% of the seats in the State legislature at the previous election. All columns except 5 and 8 include State Party and Party Year fixed-effects. Columns 2,4,7, and 9 additionally include State Year fixed-effects. Standard errors are in parentheses and are clustered by both State Party and Party Year except in columns 5 and 8 where they are not clustered, and column 6 where they are clustered by State Party. p < 0:10, p < 0:05, p < 0:01 UnderID LM refers to the generalised Under-identification test of Kleibergen and Paap (2006) and P(UnderID) the associated p-value. WeakID Wald refers to the Kleibergen and Paap (2006) generalised test of Weak-identification and we are able to reject this at all levels in all specifications.

Table 4: Platform Convergence

			(1)	(2)	(3)
Inc_{Rst}	$F_{Rst} + Inc_{Dst}$	F_{Dst}	-0.09 (0.05)		-0.03 (0.26)
Inc_{Rst}	$F_{Dst} + Inc_{Dst}$	F_{Rst}	-0.00 (0.05)		0.32 (0.23)
Inc_{Dst}	F_{Dst}			-0.12 (0.07)	
Inc_{Rst}	F_{Rst}			-0.05 (0.08)	
Inc_{Rst}	F_{Dst}			0.07 (0.06)	
Inc_{Dst}	F_{Rst}			-0.04 (0.06)	
$\chi^2(H_0)$			3.86	3.26	2.81
$Pr(H_0)$			0.05	0.07	0.09
N			636	636	636

The dependent variable is the absolute distance between the Republicans and the Democrats, $|jPosition_{Rst} - Position_{Dstj}|$. Columns 1 and 2 report OLS estimates. Column 3 reports 2SLS estimates. Inc_{Rst} (alternatively, Inc_{Dst}) is a binary variable that is equal to 1 if the Republican (Democratic) party won more than 50% of the seats at the previous election. F_{Rst} (alternatively, F_{Dst}) report the size of any favourable shock, taking a value of zero if the shock was unfavourable. Columns 1 and 2 include State and Year fixed effects. Standard errors are clustered by *State*. $\rho < 0.10$, $\rho < 0.05$, $\rho < 0.01$

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Appendix

A Proofs of Propositions and Other Results

Proof of Lemma 1. (a) First we define

$$g(x; \beta) = 0.5u_R^\beta(x) + u^\beta(x)(u_R(x) + M - u_R(x)); \quad \beta \in [0, 1] \quad (\text{A.1})$$

Then clearly (7), (8) are defined compactly as $g(x; 1) = 0$; $g(x; 0) = 0$. So, for both existence and uniqueness of a solution strictly between zero and one, it is sufficient to show $g(0) > 0$; $g(1) < 0$; $g_x < 0$; $x \in [0, 1]$:

(b) To prove that $g(0; \beta) > 0$; note that

$$\begin{aligned} g(0; \beta) &= 0.5u_R^\beta(0) + u^\beta(0)(u_R(0) + M - u_R(0)) \\ &= 0.5u_R^\beta(0) + u^\beta(0)M \\ &= 0.5u_R^\beta(0) > 0; \end{aligned}$$

where the last line follows as $u^\beta(0) = 0$ from Assumption A3.

(c) To prove $g(1; \beta) < 0$; note

$$\begin{aligned} g(1; \beta) &= 0.5u_R^\beta(1) + u^\beta(1)(u_R(1) + M - u_R(1)) \\ &= 0.5u_R^\beta(1) + u^\beta(1)(M - u_R(1)) \\ &< 0 \end{aligned}$$

where the second line follows as $u^\beta(1) = 0$; as 1 is party R 's ideal point, and the third follows because $u^\beta(1) < 0$; and of course $u_R(1) > u_R(1)$; $M > 0$:

(d) To prove $g_x(x; \beta) < 0$; $x \in [0, 1]$; first, differentiate (A.1):

$$g_x(x; \beta) = 0.5u_R^{\beta\prime}(x) + u^{\beta\prime}(x)(u_R(x) + M - u_R(x)) + u^\beta(x)(u_R^\beta(x) - u_R^\beta(x)) \quad (\text{A.2})$$

Now, the first and second terms are negative by the concavity of $u(x)$; $u_R(x)$ in x : Also, by the concavity of u_R ; $u_R^\beta(x) - u_R^\beta(x) > 0$; so the last term is positive. A sufficient condition for $g_x < 0$ is therefore that the terms in (A.2) are negative overall. i.e.

$$u^{\beta\prime}(x)(u_R(x) + M - u_R(x)) + u^\beta(x)(u_R^\beta(x) - u_R^\beta(x)) < 0 \quad (\text{A.3})$$

After some rearrangement of (A.3), we get

$$\frac{u^{\beta\prime}(x)}{u^\beta(x)} < \frac{u_R^\beta(x) - u_R^\beta(x)}{u_R(x) + M - u_R(x)}$$

But this last condition holds by A2.

(e) Finally, to prove $x^+ > x^-$; we just need to show that $\frac{dx}{d\beta} < 0$: Totally differentiating (A.1), we get

$$\frac{dx}{d\beta} = \frac{g_x(x; \beta)}{g_{x\beta}(x; \beta)} = \frac{u^{\beta\prime}(x)(u_R(x) + M - u_R(x)) + u^\beta(x)(u_R^\beta(x) - u_R^\beta(x))}{g_x(x; \beta)} \quad (\text{A.4})$$

The denominator of (A.4) is positive as $g_x < 0$: Moreover, the numerator is negative as $u^l(x_R); u^r(x_R) < 0$: So, from (A.4), $\frac{dx}{dt} < 0$ as required.

Proof of Proposition 1. (a) Generally, any symmetric equilibrium $x_R = x_L = x$ is characterised by the FOC for a maximum of ρ ; evaluated at equilibrium, at any point where ρ is differentiable in x_R (by symmetry, we do not need to consider the FOC for party L). From (3), this FOC is

$$\frac{\partial \rho(x; x)}{\partial x} = 0.5u_R^l(x) + \frac{\partial \rho(x; x)}{\partial x} (u_R(x) + M - u_R(x)) = 0 \quad (\text{A.5})$$

Moreover, from (6), we see that

$$\frac{\partial \rho(x; x)}{\partial x} = \begin{cases} u^l(x); & x < jx_0j \\ u^r(x); & x > jx_0j \end{cases} \quad (\text{A.6})$$

So, using (A.6), we can rewrite (A.5) as

$$0.5u_R^l(x) + u^l(x) (u_R(x) + M - u_R(x)) = 0; \quad x < jx_0j \quad (\text{A.7})$$

$$0.5u_R^r(x) + u^r(x) (u_R(x) + M - u_R(x)) = 0; \quad x > jx_0j \quad (\text{A.8})$$

Finally, from (6), at $x_R = x_L = x = jx_0j$; ρ has left- hand and right-hand derivatives in x_R , with the right-hand one being smaller than the left, as $\rho_x > 1$; $u^l(x) < 0$: So, if $x = jx_0j$, equilibrium must satisfy

$$0.5u_R^l(x) - u^l(x) (u_R(x) + M - u_R(x)) - 0.5u_R^r(x) - u^r(x) (u_R(x) + M - u_R(x)) = 0 \quad (\text{A.9})$$

(b) First, assume $x^+ < jx_0j$: We show that $x_R = x_L = x^+$ is the unique symmetric equilibrium. As $x_R = x_L = x^+ < jx_0j$; it solves (A.7) Also, from Lemma 1, (A.7) has a (unique) solution $x = x^+$. This shows that $x_R = x_L = x^+$ is an equilibrium.

Now suppose that there is another equilibrium $x^0 \neq x^+$: If $x^0 < jx_0j$; then x^0 must also solve (A.7), and so must be equal to x^+ ; a contradiction. If $x^0 > jx_0j$; then x^0 must solve (A.8). But then from Lemma 1, $x^0 = x < x^+ < jx_0j$; contradicting the assumption that $x^0 > jx_0j$:

Finally, if there is another equilibrium $x^0 = jx_0j$; (A.9) must be satisfied at $x = jx_0j$: But we know from the proof of Lemma 1 that given A2: $\frac{\partial \rho(x; x)}{\partial x} = g(x;)$ is strictly decreasing in x : So, as $x^+ < jx_0j$; we must have

$$0.5u_R^l(jx_0j) - u^l(jx_0j) (u_R(jx_0j) + M - u_R(jx_0j)) < 0.5u_R^r(x^+) - u^r(x^+) (u_R(x^+) + M - u_R(x^+)) = 0 \quad (\text{A.10})$$

But this is clearly inconsistent with (A.9) holding at $x = jx_0j$, as the first term in (A.10) is negative, not positive.

(c) Second, assume $x > jx_0j$: We show that $x_R = x_L = x$ is the unique symmetric equilibrium. As $x_R = x_L = x > jx_0j$; it solves (A.8) But then from Lemma 1, (A.8) has a (unique) solution $x = x$. This shows that $x_R = x_L = x$ is an equilibrium.

Now suppose that there is another equilibrium $x^0 \neq x$: If $x^0 > jx_0j$; then x^0 must also solve (A.8), and so must be equal to x ; a contradiction. If $x^0 < jx_0j$; then x^0 must solve (A.7). But then from Lemma 1, $x^0 = x^+ > x > jx_0j$; contradicting the assumption that $x^0 > jx_0j$:

Finally, if there is another equilibrium $x^0 = jx_0j$; (A.9) must be satisfied at $x = jx_0j$: As $\frac{\partial u_R(x, x)}{\partial x}$ is strictly decreasing in x ; and as $x > jx_0j$; we must have

$$0.5u_R^0(jx_0j) - u^0(jx_0j)(u_R(jx_0j) + M - u_R(jx_0j)) > 0.5u_R^0(x) - u^0(x)(u_R(x) + M - u_R(x)) = 0 \quad (\text{A.11})$$

But this is clearly inconsistent with (A.9) holding at $x = jx_0j$, as the first term in (A.11) is positive, not negative.

(d) Assume $x < jx_0j < x^+$: Then, it is easy to check that (A.9) holds at $x = jx_0j$; so this is certainly an equilibrium. Now, suppose that there is another equilibrium $x^0 < jx_0j$: Then, this equilibrium must satisfy (A.7) and thus $x^0 = x^+$ so $x^+ < jx_0j$: But this contradicts the assumption $jx_0j < x^+$: Finally, suppose that there is another equilibrium $x^0 > jx_0j$: Then, this equilibrium must satisfy (A.8) and thus $x^0 = x$ so $x < jx_0j$: But this contradicts the assumption $jx_0j < x$:

Proof of Proposition 3. Assume w.l.o.g. that the incumbent is party R : We establish the result for three different mutually exclusive and exhaustive cases:

(a) $\Delta + x < x_0 < \Delta + x^+$: This is the case considered in Figure 4, so no proof is needed.

(b) $x_0 > \Delta + x^+$: In this case, the equilibrium is as in Proposition 1, with (i) a status quo $x_0 < \Delta$; (ii) all equilibrium variables shifted right by Δ : So, as the effective status quo $x_0 < \Delta$ is greater than x^+ ; the (unshifted) equilibrium outcome is $x_R^0 = x^+$; $x_L^0 = x^+$: So, the actual equilibrium outcome is $x_{R,1} = \Delta + x^+$; $x_{L,1} = \Delta + x^+$: So, party platform shifts following the shock are

$$\Delta_R = \Delta + x^+ - x_0; \Delta_L = \Delta + x^+ + x_0$$

So, as $R = I$; $L = C$ we see

$$\Delta_C - \Delta_I = 2(x_0 - x^+) > 0$$

where the last inequality follows as $x_0 > \Delta + x^+$ by assumption, and $\Delta > 0$:

(c) $x_0 < \Delta + x$: Again, in this case, the equilibrium is as in Proposition 1, with (i) a status quo $x_0 < \Delta$; (ii) all equilibrium variables shifted right by Δ : So, as the effective status quo $x_0 < \Delta$ is less than x ; the (unshifted) equilibrium outcome is $x_R^0 = x$; $x_L^0 = x$: So, the actual equilibrium outcome is $x_{R,1} = \Delta + x$; $x_{L,1} = \Delta + x$: So, party platform shifts following the shock are following the shock are

$$\Delta_R = \Delta + x - x_0; \Delta_L = \Delta + x + x_0$$

So, as $R = I$; $L = C$ we see

$$\Delta_C - \Delta_I = 2(x_0 - x) < 0$$

where the last inequality follows as $x_0 < x$ by assumption.

B Additional Empirical Results

As discussed above, one important advantage of studying state legislative elections is that there is a large sample of elections in an institutionally homogeneous setting. Thus, our preferred sample excludes all elections with multi-member districts.³² As well as making the states we study as similar as possible, a second advantage of restricting the sample is so that the setting we study empirically is as close as possible to that analysed theoretically. However, it is nevertheless important to check that our results are not an artefact of this choice. Columns 1-4 of Table B.1 report fixed-effects and IV estimates. Columns 1 and 3 include only SP fixed-effects, while columns 2 and 4 also include SY, and PY effects. The coefficients are largely unchanged, and remain statistically significant suggesting that our results are not being driven by the choice of states. Column 5, reports IV results calculating $\Delta Position_{pst}$ based only on the positions of incumbent legislators. We see that the results are quantitatively extremely similar. Columns 6-9 of Table B.1 now measuring the position of the median voter based only on elections to the upper houses of state legislatures. As in columns 1-4 the first two columns report OLS estimates and the latter two IV estimates. Also similarly, columns 6 and 8 report results only including SP effects, while 7 and 9 additionally include SY and PY effects. The coefficients are now a little smaller, but qualitatively unchanged. In sum, we argue that tables B.1 provides further evidence that the empirical support for the predictions of the theory is robust to a wide range of alternative modelling assumptions.

³²These are Arkansas, Arizona, Georgia, Idaho, Maryland, North Carolina, North Dakota, New Hampshire, South Dakota, Washington, and West Virginia.

Table B.1: Robustness Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Preference _{st}	0.26 (0.05)		0.47 (0.14)			0.07 (0.03)		0.37 (0.09)	
Inc _{pst} Δ Preference _{st}	0.10 (0.04)	0.13 (0.04)	0.24 (0.08)	0.33 (0.08)	0.34 (0.07)	0.04 (0.01)	0.04 (0.02)	0.19 (0.05)	0.19 (0.05)
Inc _{pst}	0.13 (0.10)	0.18 (0.08)	0.02 (0.06)	0.16 (0.11)		0.08 (0.04)	0.08 (0.03)	0.04 (0.03)	0.15 (0.04)
Observations	705	705	705	705	725	449	449	454	449
UnderID LM			30.00	5.68	6.01			29.08	3.14
P(UnderID)			0.00	0.02	0.01			0.00	0.08
WeakID Wald			19.72	21.08	25.84			23.35	6.38
Estimator	OLS	OLS	2SLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
State Party Fixed-Effects	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Party Year Fixed-Effects	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes
State Year Fixed-Effects	No	Yes	No	Yes	Yes	No	Yes	No	Yes
Shock Measure	Δ st	Δ st	Δ st	Δ st	Δ st	SU	SU	SU	SU
Representative	All	All	All	All	Inc	All	All	All	All
Multimember	Yes	Yes	Yes	Yes	No	No	No	No	No

Note: The dependent variable is the change in party position measured either by each party's median representative. OLS estimates are reported in columns 1,2,6, and 7. 2SLS estimates are reported in columns 3,4,5, 8, and 9. Columns 1-4 additionally include observations from states which have at least one multi-member district. Columns 5 reports results for party positions defined on those of incumbent candidates only. All columns other than 3 and 8 include SP fixed effects. Columns 2,4,5,7, and 9 additionally include SY, and PY fixed effects. Columns 3 and 8 report robust standard errors, columns 1 and 7 report standard errors cluster by SP, columns 2,4,6,8 and 10 report standard errors clustered by SP and PY. SU indicates that Δ st is calculated based on elections to the Upper Houses of state legislatures. UnderID LM refers to the generalised Under-identification test of Kleibergen and Paap (2006) and P(UnderID) the associated p-value. WeakID Wald refers to the Kleibergen and Paap (2006) generalised test of Weak-identification and we are able to reject this at all levels in all specifications. Other details as for Table 3.

For Online Publication

A US Evidence on Negativity Bias

Here, we study how voters' support for governors depends on state and county macroeconomic performance, using two different datasets.³³ The first is quarterly state-level data on State Governors' approval ratings and state macroeconomic performance, and the second is, county-level data on Governors' vote shares and county macroeconomic performance. Thus the first dataset captures changes in voter sentiment, while the second measures changes in voter behaviour. We measure macroeconomic performance using the change in the unemployment rate, as well as growth in personal income per capita for the county data. While other alternatives are available, the unemployment rate (income per capita) has the advantage of being visible to voters, uniformly disliked (liked), and comparable across time and place in a straightforward way.

For the quarterly state-level data, as our measure of public support we use governors' job-approval ratings (JARs) taken from the U.S. Officials' Job Approval Ratings (JARs) Database compiled by [Thad Beyle, Richard Niemi, and Lee Sigelman \(2010\)](#). Specifically, we focus on the percentage who 'approve', that is answer positively to questions of the form: *Do you approve or disapprove of the way [insert governor] is handling his job as governor?*. Polls are not always conducted on a regular basis and thus we average approval ratings by quarter.³⁴

We use quarterly data from the [U.S. Bureau of Labor Statistics \(2017\)](#) database. Voters may be inattentive and not update their impressions of macroeconomic performance instantly *a la* [Sims \(2010\)](#) and so we use a two quarter moving average to allow for this. Combining these data provides an unbalanced panel covering the period 1976-2009, with a total of 2;433 observations.

The county level data uses the level of support for the party of the incumbent governor at the subsequent gubernatorial election in each county. These data are taken from [Leip, Dave \(2018\)](#) and cover the period 1990-2016. Unemployment data are taken from [Bureau of Labor Statistics \(2018\)](#) and the personal income per capita data from [U.S. Bureau of Economic Analysis \(2018\)](#), for a total of 13;159 observations.

For both datasets we test for negativity bias with the following simple bivariate fixed-effects regression, where we allow for a piecewise linear functional form with a discontinuity at 0 in the relationship between the level of Support_{ta}, defined as either the governor's job approval rating JAR (vote share of the incumbent) in state (county) *a* in quarter (election) *t* and the change in the unemployment rate Δ_{ta} in state (county) *a* and quarter (election) *t*. We consider the log of the unemployment rate, meaning that the coefficients describe the effect of a percentage rather than a percentage point change. We include state (county) fixed-effects to allow for the fact that average support levels may vary by state, other things equal.

$$\text{Support}_{ta} = \alpha_a \max[\Delta_{ta}; 0] - \beta_a \min[\Delta_{ta}; 0] + \epsilon_{ta} \quad (\text{A.1})$$

If voters reduce support for the incumbent as unemployment increases, then $\beta_a > 0$. If there is no negativity bias then $\beta_a = 0$, whereas if there is, voters are more sensitive to positive changes in

³³So, we are following the literature on economic voting, which dates back to [Downs \(1957\)](#) and subsequently extended by [Fiorina \(1978\)](#). Important recent work includes [Lewis-Beck and Paldam \(2000\)](#), [Wolfers \(2007\)](#), [Lewis-Beck and Nadeau \(2011\)](#).

³⁴In particular, the frequency with which such polls are conducted varies by state, and also tends to be higher in the run up to elections.

the unemployment rate than negative ones i.e. $\beta_1 > 0$.³⁵

The results for the JAR data are depicted in Figure A.1a which overlays the estimated regression line and associated confidence intervals on a binned scatter plot which summarises the data. Figure A.1b depicts the equivalent results using the county-level data for the unemployment rate. Each point in the binned-scatter plots represents the mean of $Support_{ta}$ and Δ_{ta} conditional on Δ_{ta} for each ‘vingtile’ of Δ_{ta} and provides a simple non-parametric representation of the conditional expectation function as in Friedman et al. (2014). The binned-scatter plot makes clear that, in both cases, there is not any particularly strong relationship to the left of the vertical dashed red line. To the right there is a relatively clear downwards relationship consistent with voter negativity bias. Looking now at the (solid blue) regression line we see that, for both datasets, while both portions of the line slope downwards as expected, the slope to the right of 0 is steeper, that is $\beta_1 > 0$. The (blue dotted) confidence intervals show that while we cannot reject the hypothesis that $\beta_1 = 0$ we can reject the same hypothesis for β_2 .

Figure A.1c shows that we obtain similar results repeating the county-level analysis using incomes per capita.³⁶ In this voter negativity bias predicts that expect that while support will be increasing with positive changes in income per capita, but support will be more strongly decreasing in negative changes. Looking at Figure A.1c we see that this is indeed the case. While the regression line is increasing in positive income changes, it is indeed steeper to the left of zero. Again we can reject the null hypothesis that $\beta_1 = 0$.

It is important to verify that we are not simply identifying the effect of a non-linear relationship between Δ_{ta} and $Support_{ta}$. To exclude this possibility we re-estimate (A.1) additionally including separate quadratic terms for both sides of the reference point to allow for different That is we replace (A.1) with

$$Support_{ta} = \alpha + \beta_1 \max[\Delta_{ta}; 0] + \beta_2 \max[\Delta_{ta}^2; 0] + \gamma_1 \min[\Delta_{ta}; 0] + \gamma_2 \min[\Delta_{ta}^2; 0] + \epsilon_{ta} \quad (A.2)$$

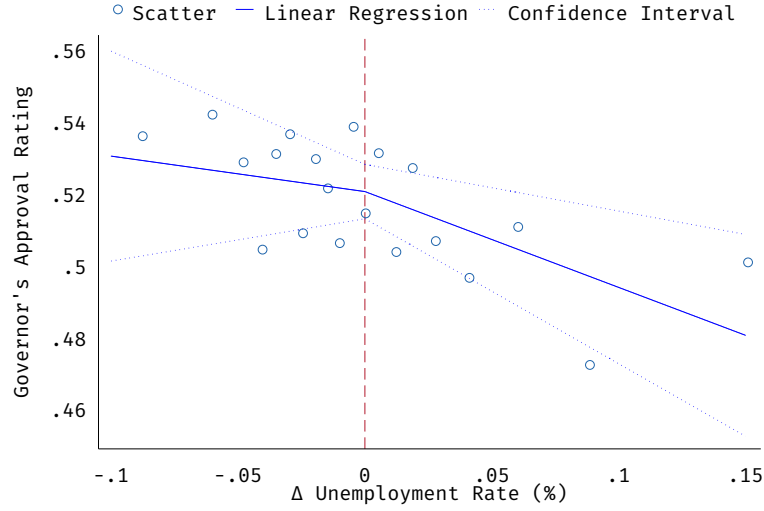
As can be seen in Table A.1, while there is indeed evidence of a quadratic relationship either side of 0, the key result does not change. In particular in every case we can rule out that $\beta_1 = 0$ and that $\beta_1 + \beta_2 = 0$ at the 1% level.

³⁵We are imposing the assumption that that there is no separate effect of an increase in unemployment per se, no matter the size, but only a larger response to a change of a given size. We can relax this assumption, by additionally including a binary variable taking positive values for $\Delta_{ta} > 0$ that allows for a different intercept term for increases in the unemployment rate. This variable is significant and negative, as expected, but the magnitude is relatively small, suggesting that while we cannot rule out other effects loss-aversion seems to be quantitatively most important.

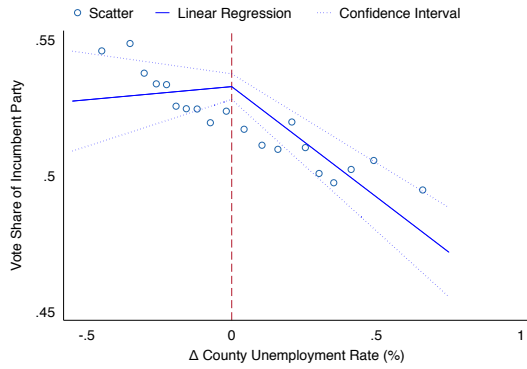
³⁶ There are relatively few state-level absolute declines in income per capita in our data, and this precludes an analogous analysis using the JAR data.

Figure A.1: Political Support Responds Asymmetrically to Deterioration in Macroeconomic Performance

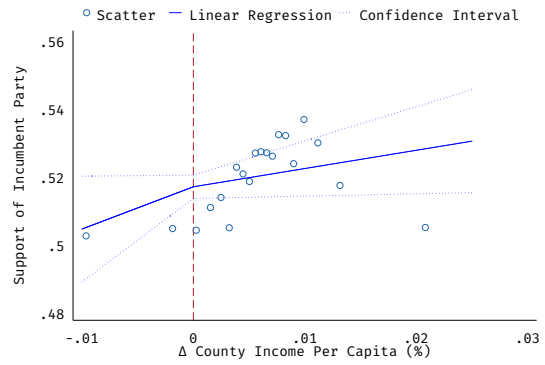
(a) Governors' Popularity and Unemployment



(b) Incumbents' Vote Share and Unemployment



(c) Incumbents' Vote Share and Incomes



(d) Numerical Results

	(1)	(2)	(3)
	Support for Governor	Incumbent Vote Share	Incumbent Vote Share
Δta	Unemployment	Unemployment	Income
	0.52	0.53	0.52
	(0.00)	(0.00)	(0.00)
	0.26	0.08	1.37
	(0.07)	(0.01)	(0.62)
	-0.09	0.01	-0.37
	(0.11)	(0.01)	(0.24)
Fixed Effects	State	County	County
N	2,416	13,159	13,166
$P(=)$	0.00	0.00	0.00

The specification is as in Equation A.1. The dependent variable is the state governor's approval rating, in Column 1 and the level of support of the incumbent party in Columns 2 and 3. β is the effect on political support associated with worsening macroeconomic performance, $\max[\beta; 0]$, while α is the effect associated with improvements $\min[\beta; 0]$. Standard errors in parentheses. $p < 0.10$, $p < 0.05$, $p < 0.01$

Table A.1: Political Support Responds Asymmetrically to Deterioration in Macroeconomic Performance: Quadratic Specification.

	(1)	(2)	(3)
	Support for Governor	Incumbent Vote Share	Incumbent Vote Share
Δta	Unemployment	Unemployment	Income
	0.52	0.52	0.52
	(0.00)	(0.00)	(0.00)
	0.58	0.04	3.06
	(0.18)	(0.02)	(1.06)
2	-2.19	0.02	-79.15
	(1.03)	(0.03)	(34.61)
	-0.17	-0.16	-1.09
	(0.17)	(0.03)	(0.42)
2	1.48	0.42	26.08
	(1.19)	(0.08)	(9.38)
N	2,417	13,367	13,166
$F(=)$	16.52	67.22	17.77
$P(=)$	0.00	0.00	0.00
$F(+ 2 = + 2)$	5.11	16.85	9.07
$P(+ 2 = + 2)$	0.02	0.00	0.00

Specifications are as in Figure A.1d

$p < 0.10$, $p < 0.05$, $p < 0.01$

B Sufficient Conditions for Concavity of π_L, π_R in x_L, x_R .

Here, we consider the more general case where v has a symmetric mean-zero distribution F with density f . So, in this general case, the probability that party wins the election is

$$p = F(u(x_R; x_0) - u(x_L; x_0)) \quad (\text{B.1})$$

Consider first π_R . First, from (3), at all points of differentiability

$$\frac{\partial p}{\partial x_R} = \frac{\partial p}{\partial x_R} (u_R(x_R) + M - u_R(x_L)) + p(x_L; x_R) u_R'(x_R) \quad (\text{B.2})$$

So, differentiating (B.2), we get;

$$\frac{\partial^2 p}{\partial x_R^2} = 2 \frac{\partial p}{\partial x_R} u_R''(x_R) + p(x_L; x_R) u_R''(x_R) + \frac{\partial^2 p}{\partial x_R^2} (u_R(x_R) + M - u_R(x_L)) \quad (\text{B.3})$$

Now, from (B.1) we see that

$$\frac{\partial p}{\partial x_R} = f(\Delta) \frac{\partial U(x_R; x_0)}{\partial x_R} = f(\Delta) u^j(x_R) < 0 \quad (\text{B.4})$$

where $\Delta = u(x_R; x_0) - u(x_L; x_0)$. So, from (B.3), as $u^j(x_R) > 0$, and also $u^j(x_R) > 0$ from Assumption A2, a sufficient condition for strict concavity of p is $\frac{\partial^2 p}{\partial x_R^2} < 0$. But from (B.4), we need

$$\frac{\partial^2 p}{\partial x_R^2} = f(\Delta) u^{jj}(x_R) + f'(\Delta) (u^j(x_R))^2 < 0 \quad (\text{B.5})$$

Also, $u(x) = u^j(x)$; and $f''(0) < 0$ has been assumed, so $u^{jj}(x_R) < 0$. So, rearranging (B.5), we require

$$\frac{f'(u(x_R; x_0) - u(x_L; x_0))}{f(u(x_R; x_0) - u(x_L; x_0))} < \frac{u^{jj}(x_R)}{(u^j(x_R))^2}$$

This condition is tighter when $\Delta = 0$; giving the first part of assumption A2.

Now consider x_L : Using the definition of x_L in (3), and following the same argument as above, we can calculate that a sufficient condition for strict concavity of p is that $\frac{\partial^2 p}{\partial x_L^2} < 0$. Again from (B.1) we see that

$$\frac{\partial p}{\partial x_L} = f(\Delta) \frac{\partial U(x_L; x_0)}{\partial x_L} = f(\Delta) u^j(x_L) < 0 \quad (\text{B.6})$$

as $u^j(x_L) > 0$: So, from (B.6), we have

$$\frac{\partial^2 p}{\partial x_L^2} = f(\Delta) u^{jj}(x_L) + f'(\Delta) (u^j(x_L))^2 < 0$$

Rearranging this, we get

$$\frac{f'(u(x_R; x_0) - u(x_L; x_0))}{f(u(x_R; x_0) - u(x_L; x_0))} < \frac{u^{jj}(x_L)}{(u^j(x_L))^2} \quad (\text{B.7})$$

But as f is symmetric around zero, $f(z) = f(-z)$; $f'(z) = -f'(-z)$: using these facts in (B.7), we get

$$\frac{f'(u(x_L; x_0) - u(x_R; x_0))}{f(u(x_L; x_0) - u(x_R; x_0))} < \frac{u^{jj}(x_L)}{(u^j(x_L))^2}$$

This condition is tighter when $\Delta = 0$; giving the second part of Assumption A2.

C Implementation Shocks.

For simplicity, assume that $x < 0$; the expression for expected utility in the other case $x > 0$ is symmetric. To proceed, note first from (1) that the outcome will be the gain domain for the median voter i.e. $x > y_0$ if $x + y > y_0$: In turn, this is always true, whatever y , if $x > y_0/2$: Similarly, the outcome is always in the loss domain if $x < -y_0/2$: Otherwise, the outcome is in both domains with positive probability. Using this observation, and (1), the expected

utility for the median voter is

$$u(x; y_0) = \begin{cases} \int_{x+}^{jy_0j} (f(x+y) - f(y_0))g(y)d''; & x+ < jy_0j \\ \int_{jy_0j}^x (f(x+y) - f(y_0))g(y)d'' + \int_{jy_0j}^x (f(x+y) - f(y_0))g(y)d''; & x+ > jy_0j > x \\ \int_{x+}^{jy_0j} (f(x+y) - f(y_0))g(y)d''; & x < jy_0j \end{cases} \quad (\text{C.1})$$

Note that unlike the case without noise, $u(x; y_0)$ is differentiable. Taking the derivative, we get;

$$u^\theta(x; y_0) = \begin{cases} u_+^\theta(x) = \int_{x+}^{jy_0j} f^\theta(x+y)g(y)d''; & x+ < jy_0j \\ \tilde{u}^\theta(x) = \int_{jy_0j}^x f^\theta(x+y)g(y)d'' + \int_{jy_0j}^x f^\theta(x+y)g(y)d'' & x+ > jy_0j > x \\ u^-(x) = \int_{x+}^{jy_0j} f^\theta(x+y)g(y)d'' & x < jy_0j \end{cases} \quad (\text{C.2})$$

Also, recall that the win probability for the incumbent is

$$p(x_R; x_L; y_0) = \frac{1}{2} + (u(x_R; y_0) - u(x_L; y_0)) \quad (\text{C.3})$$

To ensure that $p < 1$ for all values of $x_R; x_L$; we need the following analog of assumption A1:

$$\mathbf{A1}^\theta. \frac{1}{2} > u(1; y_0) - u(0; y_0):$$

So, given $\mathbf{A1}^\theta$; as $u^\theta(x; y_0)$ always exists, p is everywhere differentiable in $x_R; x_L$: So, following Lemma 1 and Proposition 1, the condition defining the symmetric equilibrium is given by the FOC for a maximum of p with respect to x_R ; evaluated at $x_R = x_L = x$: This is

$$\begin{aligned} \frac{\partial p}{\partial x_R}(x; x) &= 0.5u_R^\theta(x) + \frac{\partial p}{\partial x_R}(x; x; y_0)(u_R(x) + M - u_R(x)) \\ &= 0.5u_R^\theta(x) + u^\theta(x; y_0)(u_R(x) + M - u_R(x)) = 0 \end{aligned} \quad (\text{C.4})$$

where in the second line, we use (C.3).

Moreover, following Lemma 1, we can show that as long as A3 and the analogue of assumption A2 is satisfied, any solution x to (C.4) is unique. This analogue replaces $u^\theta(x); u^{\theta 0}(x)$ by $u^\theta(x; y_0); u^{\theta 0}(x; y_0)$ respectively i.e

$$\mathbf{A2}^\theta. \frac{u^{\theta 0}(x; y_0)}{u^\theta(x; y_0)} - \frac{u_R^\theta(x)}{u_R(x) + M} - \frac{u_R^\theta(x)}{u_R(x)}; \text{ all } x \in [0; 1]$$

Now, let $x^+; x^-$ solve (C.4) with $u^\theta = u_+^\theta; u^-$ respectively. From $\mathbf{A2}^\theta$, A3, we can assume that these solutions are unique. Note also from (C.1) that $x^+; x^-$ are independent of y_0 :

Proof of Proposition 2. (a) We first prove the following intermediate results. (i) If $x < jy_0j$; then $x = x^+$: To see this, note that if $x < jy_0j$; then from (C.1), $u^\theta = u_+^\theta$; and the result

follows.(ii) If $x < j y_0 j +$; then $x = x^+$: To see this, note that if $x < j y_0 j +$; then from (C.1), $u^l = u^l$; and the result follows.

(b) We can now prove the Proposition. We only need to show existence as we have already established uniqueness. The first case is where $x^+ < j y_0 j$: Note that if $x = x^+ < j y_0 j$; then $u^l = u^l_+$; then $x = x^+$ solves the equilibrium condition (C.4) and so it is an equilibrium. The second case is where $x < j y_0 j +$: To prove existence, note that if $x = x < j y_0 j +$; then $x = x$ solves the equilibrium condition (C.1) and so it is an equilibrium..

The last case is where $x^+ > j y_0 j > x$: First, suppose to the contrary that $x > j y_0 j +$: Then, all realisations of x are in the loss domain, so $u^l = u^l$: But then from part (a)(i), $x = x < j y_0 j +$; a contradiction. Next, suppose to the contrary that $x < j y_0 j$: Then, all realisations of x are in the gain domain, so $u^l = u^l_+$: But then from part (a)(ii), $x = x^+ > j y_0 j +$; a contradiction.

D Additional Figures and Empirical Results

D.1 The example of California

We take California as our example as it has a large population, and a relatively large state-legislature, in which neither party is overly dominant. Figure D.1 describes the results of the Californian State Legislature elections in 2004 and 2006. Panel D.1a plots kernel density estimates of voters' preferences in 2004 and 2006 i.e. the kernel of the distribution of θ_{it} . We can see that the solid 2004 curve is to the right of the dashed 2006 curve. This represents a leftward move in the position of the average voter between the two elections. The prediction of the theory is that this move, given the Democrats had a majority in 2004 should have led the Republican party to move to the left.

The kernel density estimates of representatives positions for each party in Panel D.1b show that this is precisely what happens. The distribution of Democrats changes little – there is a slight move to the left, particularly in the left-wing of the party – but as predicted the Republican party moves markedly to the left. The nature of this move is revealed by looking at the histograms in panels D.1c and D.1d. We can see again that there are no pronounced changes in the Democratic representatives. The Republican representatives, however, tend to move closer to the centre – there is now more overlap with the Democrats and the main body of the party can be seen to be more centrist.³⁷

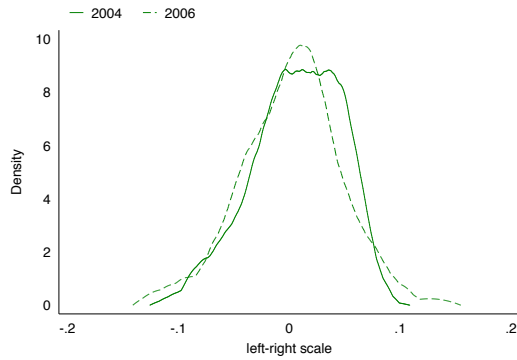
D.2 US Census Divisions

US Census Divisions are as follows: **New England Division:** Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. **Middle Atlantic Division:** New Jersey, New York and Pennsylvania. **East North Central Division:** Illinois, Indiana, Michigan, Ohio and Wisconsin. **West North Central Division:** Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota. **South Atlantic Division:** Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia and West Virginia. **East**

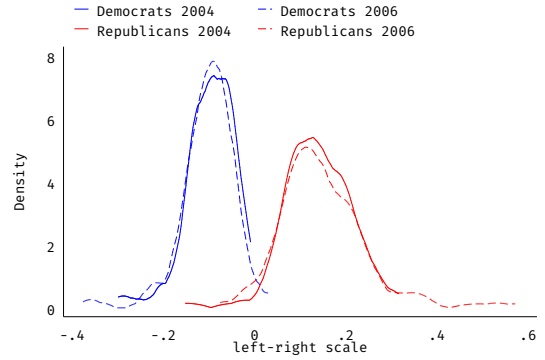
³⁷Notably, however there are a small number of comparatively extreme representatives. This highlights that districts and their representatives are extremely heterogeneous { the variation in the positions of Republicans is much larger than the distance between the two party means. This is why we pay close attention to our measures of the average voter, and party position.

South Central Division: Alabama, Kentucky, Mississippi and Tennessee. **West South Central Division:** Arkansas, Louisiana, Oklahoma and Texas. **Mountain Division:** Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming. **Pacific Division:** Alaska, California, Hawaii, Oregon and Washington.

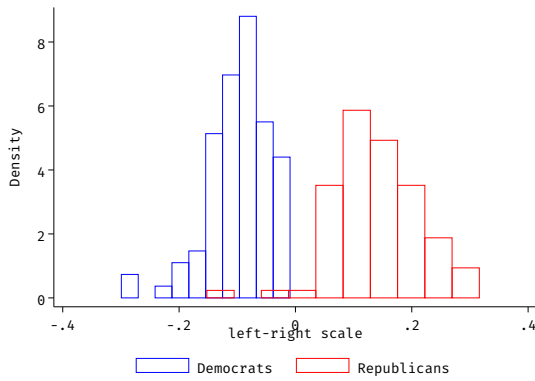
Figure D.1: Californian State Legislature Elections 2004 and 2006



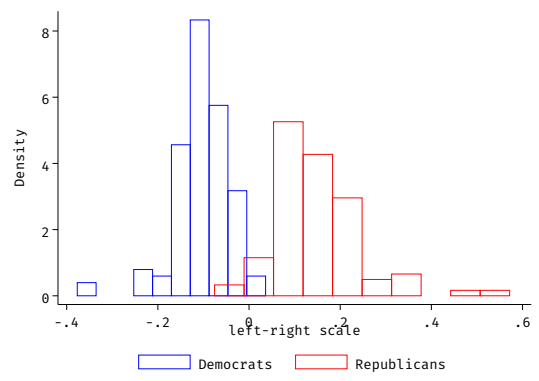
(a) Changes in Voter Positions



(b) Changes in Party Positions



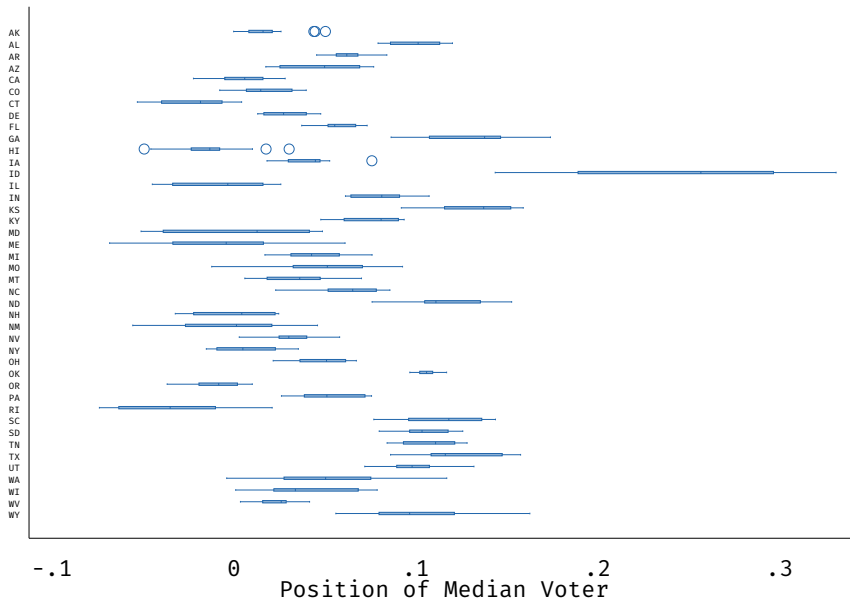
(c) Representatives 2004



(d) Representatives 2006

D.3 Additional Figures

Figure D.2: Distribution of State Median Voters



Each state is represented by a box-plot. The more heavily shaded area represents the inter-quartile range, and the whiskers represent the upper and lower adjacent values. These are the values x_i such that $x_i > 1.5 \cdot IQR + X_{75}$ and $x_i < 1.5 \cdot IQR + X_{25}$ respectively. Where, x_{75} and x_{25} denote the 75th and 25th percentiles respectively and IQR is the Inter-Quartile Range, $x_{75} - x_{25}$. (see, [Tukey \(1977\)](#)).

Figure D.3: Comparison of Mean and Median Voters

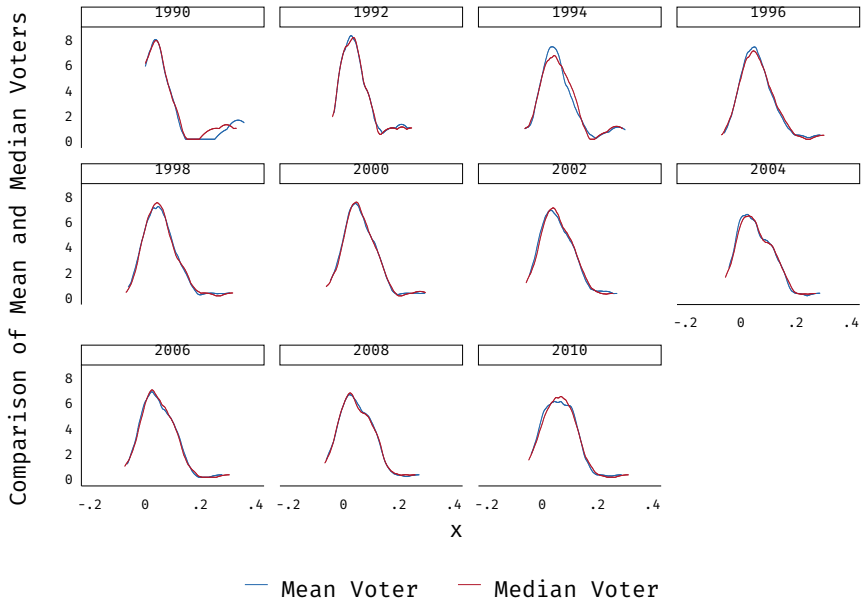


Table D.1: Asymmetric Adjustment: State Congressional Elections.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Preference _{st}	0.169 (0.0644)		0.168 (0.0652)		0.535 (0.162)	0.506 (0.166)		0.480 (0.152)	
Incpst	0.118 (0.0487)	0.148 (0.0557)	0.122 (0.0637)	0.154 (0.0511)	0.365 (0.113)	0.317 (0.123)	0.366 (0.141)	0.329 (0.107)	0.356 (0.127)
Incpst	0.225 (0.112)	0.218 (0.108)	0.252 (0.144)	0.276 (0.129)	0.0550 (0.0734)	0.124 (0.109)	0.177 (0.142)	0.0582 (0.0737)	0.190 (0.135)
Incpst			0.0284 (0.0267)	0.0592 (0.0383)					
Observations	554	554	554	554	554	554	554	554	554
UnderID LM					39.36	36.85	6.80	32.89	7.71
P(UnderID)					0.00	0.00	0.01	0.00	0.01
WeakID Wald					27.01	37.02	28.09	24.66	138.57
Estimator	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS
State Party Fixed-Effects	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Party Year Fixed-Effects	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
State Year Fixed-Effects	No	Yes	No	Yes	No	No	Yes	No	Yes
Shock Measure	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st	Δ st

Note: The dependent variable is the change in a party's platform for elections to state legislatures as measured by that of the median candidate. Preference_{st} measures the change in the median voter's preferences as defined in Equation 11 calculated using data for state elections to the US Congress, except columns 8 and 9 which employ the change in the position of the mean voter, Incpst_{st} . Incpst is a binary variable that is equal to 1 if a party won more than 50% of the seats in the State legislature at the previous election. All columns except 5 and 8 include State Party and Party Year fixed effects. Columns 2, 4, 7, and 9 additionally include State Year fixed effects. Standard errors are in parentheses and are clustered by both State Party and Party Year except in columns 5 and 8 where they are not clustered, and column 6 where they are clustered by State Party. $p < 0.10$, $p < 0.05$, $p < 0.01$ UnderID LM refers to the generalised Under-identification test of Kleibergen and Paap (2006) and P(UnderID) the associated p-value. WeakID Wald refers to the Kleibergen and Paap (2006) generalised test of Weak-identification and we are able to reject this at all levels in all specifications.

E Alternative Versions of the Theoretical Model

E.1 Incumbency Advantage

In this section, we briefly study a version of the model without loss aversion (i.e. $\lambda = 1$), but with incumbency advantage. Following (Peskovitz, 2017), we model incumbency advantage by supposing that the incumbent's competence or valence is on average greater than the challenger i.e. $v_I > 0$: We assume without loss of generality that R is the incumbent, and we continue to assume that the challenger's valence is uniformly distributed. then it is easy to compute, following the derivation of (6), that;

$$p(x_L; x_R; x_0) = 0.5 + v_I + (u(x_R) - u(x_L)) \quad (\text{E.1})$$

As expected, incumbency advantage raises the *intercept* of p i.e. raises p at any given $(x_L; x_R)$: Unlike loss-aversion, it does not induce a kink in p .

Then given (3),(E.1), the first-order conditions for choice of $x_R; x_L$ respectively are

$$\frac{\partial R}{\partial x_R} = p u'_R(x_R) - u'(x_R)(u_R(x_R) + M - u_R(x_L)) = 0 \quad (\text{E.2})$$

$$\frac{\partial L}{\partial x_L} = (1 - p) u'_L(x_L) + u'(x_R)(u_L(x_L) + M - u_L(x_R)) = 0 \quad (\text{E.3})$$

As (E.2), (E.3) are continuously differentiable in $x_R; x_L$ and the model parameters $M; v_I; \lambda$, it follows that there is no platform rigidity in equilibrium; that is, $x_R; x_L$ vary continuously with parameters. It is also possible to show that there is no generalised policy moderation in equilibrium, relative to the baseline case of no incumbency advantage. Specifically, as incumbency advantage v_I increases, the challenger becomes more moderate, but the incumbent becomes more extremist ³⁸.

Finally, it is clear from (E.2), (E.3) that if there is a shift in the ideal points of voters and parties by Δ , (E.2), (E.3) continue to hold when the equilibrium values are also shifted Δ . So, overall, there is *asymmetry in initial platforms, not in adjustment*, the reverse to the case of loss-aversion.

E.2 Loss-Aversion Over Valence

Here, we explore the consequences of allowing for loss-aversion in the valence dimension. Throughout, we rule out loss-aversion in the policy dimension by assuming that $\lambda = 1$: Given that the valence of the incumbent is known to be zero, this boils down to a voter having a payoff from the realised valence of the challenger, v ; of

$$v = \begin{cases} v - v_0; & v > v_0 \\ (v - v_0); & v < v_0 \end{cases} \quad (\text{E.4})$$

where $v_0 \in \left(\frac{1}{2}; \frac{1}{2}\right)$ is the reference level of valence, against which the challenger is judged, and λ ; with a strict inequality if there is loss-aversion.

In this case, the median voter is clearly still decisive. Moreover, as $\lambda = 1$; it is clear from (E.4)

³⁸A general proof of this is straightforward but tedious and is available on request.

that the incumbent will be re-elected if and only if

$$\begin{aligned} \rho_I &= \Pr(v \geq \Delta) \\ &= \Pr(v \geq \Delta + v_0 | v \geq v_0) \Pr(v \geq v_0) + \Pr(v \geq \Delta = v_0 | v < v_0) \Pr(v < v_0) \end{aligned} \quad (\text{E.5})$$

where $\Delta = u(x_I) - u(x_C)$: Now it is easy to calculate that

$$\begin{aligned} \Pr(v \geq \Delta + v_0 | v \geq v_0) \Pr(v \geq v_0) &= \begin{cases} F(\Delta + v_0) - F(v_0); & \Delta \geq 0 \\ 0; & \Delta < 0 \end{cases} \\ \Pr(v \geq \Delta = v_0 | v < v_0) \Pr(v < v_0) &= \begin{cases} F(v_0); & \Delta \geq 0 \\ F(\Delta = v_0); & \Delta < 0 \end{cases} \end{aligned} \quad (\text{E.6})$$

Combining (E.5), (E.6), and using the definition of Δ ; and the fact that F is uniform, we get

$$\rho_I = \frac{1}{2} + \begin{cases} u(x_I) - u(x_C) + v_0; & u(x_I) \geq u(x_C) \\ \frac{1}{2}(u(x_I) - u(x_C)) + v_0; & u(x_I) < u(x_C) \end{cases} \quad (\text{E.7})$$

So, we see that we might expect, the higher the performance standard v_0 for the challenger, the greater the probability of re-election for the incumbent. As long as $v_0 \neq 0$; the game between the incumbent and challenger is now asymmetric, and so we expect asymmetric equilibria.

Without loss of generality, let the incumbent be party R : To keep the analysis tractable, we now assume absolute value preferences for both the median voter and political parties, so the median voter has utility $u = -|x|$; and parties have preferences i.e. $u_R(x) = -|x - 1|$; $u_L(x) = -|x + 1|$: In this case, for any fixed v_0 ; using it is easy to compute from (E.7) that

$$\rho_I = \frac{1}{2} + \begin{cases} x_R + x_L + v_0; & x_R \leq x_L \\ \frac{1}{2}(x_R + x_L) + v_0; & x_R > x_L \end{cases} \quad (\text{E.8})$$

Now for any fixed $v_0 \geq 0$; we can easily calculate, using (3) that in equilibrium, the FOC for party R and party L are

$$\frac{\partial \rho_I}{\partial x_R} = \frac{1}{2} \left(\frac{x_L + x_R}{2} + v_0 - (x_R + 1 - x_L) \right) = 0 \quad (\text{E.9})$$

$$\frac{\partial \rho_I}{\partial x_L} = \frac{1}{2} \left(\frac{x_L + x_R}{2} + v_0 - (-x_L + 1 + x_R) \right) = 0 \quad (\text{E.10})$$

These solve to give

$$x_R = \frac{1}{4} \left(\frac{M}{2} + v_0 \right); \quad x_L = \left(\frac{1}{4} - \frac{M}{2} - \frac{v_0}{2} \right) \quad (\text{E.11})$$

There are then two cases. The first is where the competency hurdle for the challenger is high i.e. $v_0 > 0$: In this case, from (E.11), no matter what M ; $x_R > x_L$ so in this case we are in the loss domain for the median voter. So, in equilibrium, the equilibrium platforms are given by (E.11) with $x = 1$ i.e.

$$x_R = \frac{1}{4} \left(\frac{M}{2} + \frac{v_0}{2} \right); \quad x_L = \left(\frac{1}{4} - \frac{M}{2} - \frac{v_0}{2} \right)$$

So, the incumbent's platform is more extreme than the challenger's. Also, for v_0 small enough, *both platforms are more polarised than in the game without loss-aversion* i.e. with $\alpha = 1$; $v_0 = 0$:

The second is where the competency hurdle for the challenger is low i.e. $v_0 < 0$: In this case,

from (E.11), no matter what x ; $x_R = x_L$ so in this case we are in the gain domain for the median voter. So, in equilibrium, the equilibrium platforms are given by (E.11) with $\alpha = 1$ i.e.

$$x_R = \frac{1}{4} - \frac{M}{2} + \frac{v_0}{2}; \quad x_L = \left(\frac{1}{4} - \frac{M}{2} - \frac{v_0}{2} \right)$$

So, now the incumbent's platform is less extreme than the challenger's. Also, as $v_0 \neq 0$; both platforms converge to those in the game without loss-aversion i.e. $\alpha = 1; v_0 = 0$:

Overall, this is clearly in contrast to the case with loss-aversion in the policy dimension, where equilibrium platforms are less polarised than in the baseline case. Also, there is no counterpart to the platform rigidity that we found in the case of loss-aversion in the policy dimension.

The intuition for this is the following. If $v_0 > 0$; the incumbent knows that he has the advantage and so calculates that in equilibrium, he will choose a platform further from the median voter's ideal point, which will force electoral competition into the loss domain where policy payoffs are "discounted" by α : The challenger of course makes the same calculation. On the other hand, If $v_0 < 0$; the incumbent knows that he is at a disadvantage and so calculates that in equilibrium, he will choose a platform closer to the median voter's ideal point, which will force electoral competition into the gain domain where policy payoffs are not discounted by α : The challenger of course makes the same calculation.

Finally, to complete the analysis, we can show that at $v_0 = 0$; there is no symmetric pure strategy equilibrium. Clearly from (E.8); when $v_0 = 0$; p_i is not differentiable in $x_R; x_L$ at $x_R = x_L$. So, a necessary condition for equilibrium is that (say) party R cannot raise x_R by either raising x_R or lowering it. From (E.9) evaluated at $\alpha = 1$; $x_R = x_L = x$; the condition ruling out the first possibility is $\frac{1}{2} + v_0 < -(2x + M)$: The condition ruling out the second is $\frac{1}{2} + v_0 > (2x + M)$: But these two conditions are clearly inconsistent as $x > 0$; $v_0 > 1$:

E.3 A Model With Outcome Shocks

Worker-voter i has utility $c = \frac{L_i^2}{2}$; and faces budget constraint $c = (1 - x)w_i L + b$: So, her labour supply and indirect utility are

$$L_i = (1 - x)w_i^{0.5}; \quad v_i(x; b) = \frac{(1 - x)^2 w_i^2}{2} + b \quad (\text{E.12})$$

Also, the government budget constraint is

$$b = x \frac{1}{n} \sum_j w_j L_j = x(1 - x) \frac{1}{n} \sum_j w_j^2; \quad \bar{w}^2 = \frac{1}{n} \sum_j w_j^2 \quad (\text{E.13})$$

Substitute out for b in (E.12) using (E.13), we see that the indirect utility of the median voter is

$$\begin{aligned} u(x) &= \left[\frac{(1 - x)^2 w_m^2}{2} + x(1 - x) \bar{w}^2 \right] \\ &= \left[\frac{(1 - x)^2}{2} + x(1 - x) \right] \bar{w}^2 \quad (\text{as } w_m^2 = \bar{w}^2 = 1) \\ &= \frac{1}{2} [1 - x^2] \end{aligned}$$

as required.

We now compute expected utility for the median voter, given the underlying utility $\frac{1}{2} [1 - x^2]$.

This is

$$u(x; y_0) = \begin{cases} \frac{1}{2}(y_0^2 - x^2); & x \leq \left(\frac{y_0^2}{1}\right)^{0.5} \\ \frac{1}{2} \int_{jy_0j}^x ((1 - x^2)^{1/2} - (1 + y_0^2)g(x))d'' + \frac{1}{2} \int_{jy_0j}^x ((1 - x^2)^{1/2} - (1 + y_0^2)g(x))d''; & \left(\frac{y_0^2}{1}\right)^{0.5} > x > \left(\frac{y_0^2}{1}\right)^{0.5} \\ \frac{1}{2}(y_0^2 - x^2); & x \geq \left(\frac{y_0^2}{1}\right)^{0.5} \end{cases} \quad (\text{E.14})$$

Note also that $\frac{y_0^2}{1} < \frac{y_0^2}{1+}$ as long as $y_0 < 1$; so that these cases are all possible. To both derive and interpret this formula, we reason as follows. First, $x \leq \frac{1}{2}$: So, if $1 - x^2 \leq \frac{1}{2} \frac{y_0^2}{1}$; or $x \leq \left(\frac{y_0^2}{1}\right)^{0.5}$; the outcome will always be in the gain domain for the median voter, and so his expected utility is $E\left[\frac{1}{2}(1 - x^2)^{1/2}\right] = \frac{1}{2}(1 - x^2)^{1/2} = \frac{1}{2}(1 - y_0^2) = \frac{1}{2}(y_0^2 - x^2)$: On the other hand, as $x \geq \frac{1}{2}$; if $1 - x^2 \leq \frac{1}{2} \frac{y_0^2}{1+}$; or $x \leq \left(\frac{y_0^2}{1+}\right)^{0.5}$, the outcome will be in the loss domain for the median voter, and so his utility will be $\frac{1}{2}(y_0^2 - x^2)$: Finally, in the intermediate case, the outcome is in both domains with positive probability.

Also, recall that

$$p(x_R; x_L; y_0) = \frac{1}{2} + (u(x_R; y_0) - u(x_L; y_0)) \quad (\text{E.15})$$

To ensure that $p < 1$ for all values of $x_R; x_L$; we make an assumption similar to A1 in Section 3.6 i.e. $\frac{1}{2} > u(1; y_0) - u(0; y_0)$:

So, following Lemma 1 and Proposition 1, the condition defining the symmetric equilibrium is given by the FOC for a maximum of p with respect to x_R ; evaluated at $x_R = x_L = x$: This is

$$\begin{aligned} \frac{\partial p}{\partial x_R}(x; x) &= 0.5u'_R(x) + \frac{\partial p}{\partial x_R}(x; x; y_0)(u_R(x) + M - u_R(x)) \\ &= 0.5u'_R(x) + u'(x; y_0)(u_R(x) + M - u_R(x)) = 0 \end{aligned} \quad (\text{E.16})$$

where in the second line, we use (E.15).

Following Lemma 1, we can show that as long as A2⁰; A3 are satisfied, any solution x to (C.4) is unique, where obviously, now, in A2⁰; the derivatives $u^\theta(x; y_0); u^{\theta\theta}(x; y_0)$ are computed from (E.14).

Now, let $x^+; x^-$ solve (C.4) with $u^\theta = u^\theta_+; u^\theta$ respectively. From A2⁰, A3, we can assume that these solutions are unique. Note also from (C.1) that $x^+; x^-$ are independent of y_0 : Finally, we note from () that $u^\theta_+ = x^+; u^\theta = x^-$: So, following the argument for the case of implementation errors, we can define

$$0.5u^\theta_R(x^+) - x^+(u_R(x^+) + M - u_R(x^+)) = 0 \quad (\text{E.17})$$

$$0.5u^\theta_R(x^-) - x^-(u_R(x^-) + M - u_R(x^-)) = 0 \quad (\text{E.18})$$

Then, following the proof of Proposition 2, we can show:

Proposition E.3. Assume A1, A2⁰, A3. (i) If $x^+ < \left(\frac{y_0^2}{1}\right)^{0.5}$; then $x_R = x_L = x^+$ is the unique symmetric equilibrium; (ii) if $x^- > \left(\frac{y_0^2}{1+}\right)^{0.5}$; then $x_R = x_L = x^-$ is the unique symmetric equilibrium; (iii) If $\left(\frac{y_0^2}{1}\right)^{0.5} < x < \left(\frac{y_0^2}{1+}\right)^{0.5}$; then there is a unique symmetric equilibrium, x , which lies between $\left(\frac{y_0^2}{1}\right)^{0.5}$ and $\left(\frac{y_0^2}{1+}\right)^{0.5}$:

Proof of Proposition E.3. (a) We first prove the following intermediate results. (i) If $x < \left(\frac{y_0^2}{1}\right)^{0.5}$; then $x = x^+$: To see this, note that if $(1 - \alpha)(x)^2 + \alpha < y_0^2$; then from (E.14), $u^l = u^+$; and the result follows. (ii) If $(1 + \alpha)(x)^2 > y_0^2$; then $x = x^-$: To see this, note that if $(1 + \alpha)(x)^2 > y_0^2$; then from (E.14), $u^l = u^-$; and the result follows.

(b) We can now prove the Proposition. We only need to show existence as we have already established uniqueness. The first case is where $(1 - \alpha)(x^+)^2 + \alpha < y_0^2$: Note that if this condition holds, then $x = x^+$ solves the equilibrium condition (E.17) and so it is an equilibrium. The second case is where $(1 + \alpha)x^- > y_0^2$: Then, $x = x^-$ solves the equilibrium condition (E.18) and so it is an equilibrium..

The last case is where $(1 + \alpha)(x^-)^2 + \alpha > y_0^2$: First, suppose to the contrary that $x > \left(\frac{y_0^2}{1}\right)^{0.5}$: Then, all realisations of x are in the loss domain, so $u^l = u^-$: But then from part (a)(i), $x = x^+$ a contradiction. Next, suppose to the contrary that $x < \left(\frac{y_0^2}{1}\right)^{0.5}$: Then, all realisations of x are in the gain domain, so $u^l = u^+$: But then from part (a)(ii), $x = x^- > \left(\frac{y_0^2}{1}\right)^{0.5}$; a contradiction.

E.4 Legislatures

Here, we show how our main results are robust to decision-making in a legislature where legislators are elected from different districts. There are three districts $d = 1; 2; 3$: We assume that the median voters in districts 1; 2; 3 have ideal points $-z; 0; z$; i.e. districts are ranked from left to right in terms of their median voters. Each district elects one legislator. Both parties $R; L$ contest all districts. Party preferences are as in Section 3 of the paper i.e. all candidates of party R (resp. L) have ideal points 1 (resp. -1). A candidate from party p in district d sets a platform x_p^d : There is also a status quo policy x_0 which is the reference point for voters in all districts. We assume for simplicity that voters are naive in the sense that they do not "see through" legislative bargaining i.e. they believe that if their candidate from party p offers x_p^d and wins, x_p^d will be implemented. If party p wins, it gets to implement its preferred policy x_p and all candidates of the winning party get a payoff M :

Assume w.l.o.g. that incumbents in all districts are from party R ; all these candidates have a known competence of zero. Competence shocks of party L candidates are v_C^d and are i.i.d. across districts with a uniform distribution as in Section 3 above. Let p_d be the probability that the R party wins in district d . So, the overall win probability for the R party is the probability that it wins in at least two districts i.e.

$$p = p_1 p_2 p_3 + p_1 p_2 (1 - p_3) + p_1 (1 - p_2) p_3 + (1 - p_1) p_2 p_3 \quad (\text{E.19})$$

Here, p_2 is defined exactly as in (6), p_1 by (6) where $u(x); jx_0$ are replaced by $u(x + z); jx_0 + z$; and p_3 by (6) where $u(x); jx_0$ are replaced by $u(x - z); jx_0 - z$:

It is clear that if all candidates in a party are constrained to offer the same platform in all districts i.e. full party discipline, i.e. $x_p^d = x_p$; our results extend. So, we consider the opposite extreme, weak party discipline. Here, a candidate can set a platform x_p^d without any constraints at the electoral stage. We will also assume that the preferred policy of the winning party p ; x_p ; is the median platform x_R^m of the platforms $f; x_p^1; x_p^2; x_p^3; g$; where m is the district with the median platform: One explicit story that generates this outcome is if (i) ex post, after the election, each candidate most prefers his own platform, (maybe to avoid loss of reputation with his constituents),

and (ii) the preferred policy of the winning party p ; x_p ; is decided by majority voting over the platforms:

We look for a symmetric equilibrium. Note that only the median district can affect the outcome x_R ; so that at the electoral stage, the payoff to an R candidate in district d is

$$x_R^d = p(u_R(x_R^m) + M) + (1 - p)u_R(x_L^m); \quad d = 1; 2; 3 \quad (\text{E.20})$$

So, any candidate in a district that does *not* expect to be the median will just set x_R^d to maximise the probability of winning p i.e. set x_R^d equal to the median voter's ideal point in that district. So, conjecture that candidates in districts 1 and 3 expect not to be median. Then, they will set

$$x_R^1 = x_L^1 = z; \quad x_R^3 = x_L^3 = z$$

If the candidates in district 2 expect to have the median platform, then the R candidate in this district chooses $x_R = x_R^2$; and so wherever p_d is differentiable with respect to x_R^d ; we have from (E.20) that

$$\frac{\partial p}{\partial x_R^2} = p \frac{\partial u_R^d(x_R)}{\partial x_R} + \frac{\partial p}{\partial x_R^2} \frac{\partial p}{\partial p_2} (u_R(x_R) - u_R(x_L) + M) \quad (\text{E.21})$$

So, there is a non-convergent equilibrium in district 2, with $x_R^2 = x_L^2 = x$; where at points of differentiability, x solves (E.21) set equal to zero i.e.

$$p \frac{\partial u_R^2(x)}{\partial x_R} + \frac{\partial p}{\partial x_R^2} \frac{1}{2} (u_R^2(x) - u_R^2(x) + M) = 0 \quad (\text{E.22})$$

Here, $\frac{\partial p}{\partial x_R^2} = u^j(x); \quad j = 1; 2$ is computed from (6), where j records whether equilibrium is in the gain or loss-domain for the median voter in district 2. Also, in moving from (E.21) to (E.22), we use the fact that at symmetric equilibrium, $\frac{\partial p}{\partial p_2} = \frac{1}{2}$ from (E.19): So, $x_R^2; x_L^2$ are defined as in Proposition 1, with the slight difference that in Lemma 1, j is replaced with $j=2$. Finally, we need to verify that $x_R^1 < x_R^2 < x_R^3$ i.e. district 2 indeed has the median platform. This clearly requires $z > x^+$: