Warwick Economics Research Paper Series

Negative Voters: Electoral Competition with Loss-Aversion

Ben Lockwood and James Rockey

July 2015
Series Number: 1063
ISSN 2059-4283 (online)
ISSN 0083-7350 (print)

Negative Voters: Electoral Competition with Loss-Aversion

Ben Lockwood James Rockey
University of Warwick University of Leicester

First version: 4 December 2013
This version: 11 July 2015

Abstract

This paper studies how voter loss-aversion affects electoral competition in a Downsian setting. Assuming that the voters' reference point is the status quo, we show that loss-aversion has a number of effects. 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 moderate voters' ideal point than in the absence of loss-aversion. In a dynamic extension of the model, we consider how parties strategically manipulate the status quo to their advantage, and we find that this increases policy rigidity. Finally, we show that with loss-aversion, incumbents adjust less than challengers to changes in voter preferences. The underlying force is that the status quo works to the advantage of the incumbent. This prediction of asymmetric adjustment is new, and we test it using elections to US state legislatures. The results are as predicted: incumbent parties respond less to shocks in the preferences of the median voter.

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

JEL CLASSIFICATION: D72, D81

Address for correspondence; Department of Economics, Warwick University, Coventry, CV4 7 AL, United Kingdom. E-mail B.Lockwood@warwick.ac.uk.

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 penalized electorally for negative economic performance but reap few 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 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 micro-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.

Soroka 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. In this paper, we study the impact of voter negativity bias on electoral competition in an otherwise quite standard Downsian setting. Following Soroka and McAdams (2015), we explain negativity bias in terms of loss-aversion; our model is formally set up as one where voters suffer loss-aversion if a party platform offers lower utility than the reference point; the additional ingredient of probabilistic voting means that when the platform is “negative” i.e. generates a utility between the reference point, it lowers the probability that the citizen votes for that party by more than a “positive” platform of the same distance from the reference point increases that probability.

This is one of the very few papers to incorporate loss-aversion into models of political choice. A recent important contribution by Alesina and Passarelli (2015), discussed in detail in Section 2 below, studies loss-aversion in a direct democracy setting, where voters vote directly in a referendum on the size of a public project or policy. However, to our knowledge ours is the first paper to study the effect of loss-aversion in a representative democracy setting.[2]

In more detail, we study a simple Downsian model with moderate and extremist voters where the moderates are loss-averse. There are two parties comprised of left and right extremists who also value political office, who choose policy positions on the real line. Moderates have an ideal point normalized to zero, but vote probabilistically. In this setting,

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

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

without loss-aversion, the model is a variant of 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.

We assume initially, as in Alesina and Passarelli (2015), that the reference point is the status quo policy. This assumption is widely made in the literature on loss-aversion applied to economic situations (e.g. de Meza and Webb (2007) for a principal-agent problem, Freund and Özden (2008) in the context of lobbying on trade policy), and seems realistic, since benefits and costs of political reforms are normally assessed relative to the current situation for given existing policies.[3]

We first establish that loss-aversion affects the election probability of each party. Once moderate voters' utility from a party's policy platform falls below utility from the reference point, the re-election probability starts to fall more rapidly than without loss-aversion. Thus, there is a kink in the election probability for each party at this point. This kink has a number of implications for electoral competition.

First, there is *policy rigidity* ; for a range of values of the status quo (where the absolute value of the status quo lies in an interval $[x^-, x^+]$, $0 < x^- < x^+$) both parties choose platforms equal to the status quo, regardless of other parameters. In this case, the outcome is insensitive to small changes in other parameters, such as the weight that political parties place on office, the variance of probabilistic voting shocks, or shifts in the ideal points of the moderates. Second, that there is a *moderation effect* of loss-aversion; when there is policy rigidity, the equilibrium policy outcome is closer to the moderate voters' ideal point than in the absence of loss-aversion.

We then consider the dynamic effects of loss-aversion of electoral competition. Our baseline model does not really allow us to investigate how equilibrium platforms evolve over time and thus . It also abstracts from a potentially very important fact that forward-looking parties may have an incentive to *strategically manipulate* the status quo to their advantage. To investigate these issues, we embed our model of political competition in an OLG model. We find that if the political parties are risk-averse, the range of status quo values for which there is policy rigidity, as described above, increases, as does the policy moderation effect. The reason is that with risk-aversion, there is an incentive for *strategic manipulation of the status quo*; starting at any policy platform that is short-run optimal for a party, a small move in the platform towards zero (the ideal point of the moderates) will reduce next period's status quo in absolute value the event that the party wins, and thus reduce the variance of the policy outcome. If the party is strictly risk-averse, this makes

[3] Extensions to the case of a forward-looking reference point as in Kőszegi and Rabin (2006) are discussed in the Appendix. Due to probabilistic voting, the reference point is stochastic. There, it is shown that the political equilibrium exhibits policy moderation, as in the backward-looking case, but perhaps not surprisingly, due to the forward-looking reference point, there is no longer policy rigidity.

the party better off.

Third, we consider in detail, both theoretically and empirically, shifts in the distribution of preferences of both moderate and extremist voters. Theoretically, we consider a scenario where one party has won the previous election and this party's platform is the voter reference point. Starting from this position, without loss aversion, shift in either direction (left or right) in the ideal points has the same effect on both incumbent and challenger - both move their equilibrium platforms in the direction of the preference shift by the same amount. But, with loss-aversion, there is asymmetric adjustment : regardless of the direction of the preference shock - i.e. left or right - the incumbent platform will adjust by less than the challenger's platform. In other words, loss-aversion generates a particular kind of asymmetry, which is testable; incumbents adjust less than challengers. The underlying force is that the status quo works to the advantage of the incumbent.

This prediction of asymmetric adjustment is new, and we take it to the data on elections to US state legislatures. We employ a new dataset introduced by Bonica (2014b) which crucially contains estimates of the platforms of all candidates, winners and losers, in state legislature elections based on the campaign donations they received. We combine these with detailed election results to identify shocks to the distribution of voters and parties' responses for all state legislatures over a 20 year period. These data have the important advantage of representing a large sample of, institutionally and politically homogeneous elections, with which to take the theory to the data. Using these data we find, as predicted by the theory, that parties with majorities are significantly less responsive to shocks.

The remainder of the paper is organized as follows. Section 2 reviews related literature, Section 3 lays out the model, and Section 4 has the main theoretical results. Section 5 discusses the US data we use to test out main hypothesis, the empirical specification, and the empirical results, and finally Section 6 concludes.

2 Related Literature

1. *Alesina and Passarelli (2015)*. This paper, henceforth AP, is the most closely related to what we do. In their paper, citizens vote directly on a one-dimensional policy, which generates both costs and benefits for the voter. In this setting, for loss-aversion to play a role, the benefits and costs of a project of variable scale must be evaluated relative to separate reference points. This is because if loss-aversion applies to the net benefit from the project, it does not affect the ideal point of any voter. We do not need this construction, because we assume probabilistic voting, an assumption widely made in the literature on electoral competition (Persson and Tabellini, 2000).

In their setting, they show the following (Propositions 1-4). First, a range of voter

types prefer the status quo to any other level of the policy. Second, the policy outcome (the most preferred point of the median voter) varies with the status quo. Third, 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 shock to the median voter, the this only has an effect on the outcome if the shock is sufficiently large.

Several of our results are similar in spirit to these, although the details differ substantially. Our finding of policy rigidity i.e. for a range of values of the status quo, platforms are equal to the status quo, is similar to their first finding. But, our moderation effect of loss-aversion i.e. that the equilibrium policy outcome is closer to the moderate voters' ideal point than in the absence of loss-aversion, is somewhat different to theirs. Furthermore, the dynamic behavior of our model is quite different to theirs; for example, we have a strategic choice of the reference point by political parties in equilibrium. Finally, our main empirical prediction i.e. that incumbents adjust less than challengers to voter preference shocks, has no counterpart in their analysis.

2. *Related Empirical Work.* Our empirical work is related to that of Adams et al. (2004) and Fowler (2005). Both are concerned, like us, with understanding the dynamics of political competition. In particular, both study responses to changes in the identity of the median voter. (Adams et al., 2004) use a panel of national election results for European political parties, to relate parties' manifesto positions to the preferences of the median voter. Unfortunately, their model is only identified for a subset of the cases they consider and appropriately restricting the sample limits the robustness of their results.[4]

These difficulties, as well as greater institutional homogeneity, mean we prefer to focus on the United States. Fowler (2005) considers elections to the US Senate over the period 1930-2010, and finds that senators tend to moderate their positions following a close election. In passing, he considers a hypothesis similar to ours – whether the loss of the other senator changes response of the winning senator to the margin of victory – but finds no significant effect. This may reflect that his data are only available for those candidates elected, that is we do not know what senators who lost would have done. It may also reflect the important roles of incumbency and candidates' personal characteristics in senatorial elections.[5]

3. *Voting with behavioral and cognitive biases.* A small number of papers that study electoral competition with behavioral biases. First, Callander (2006), Callander and Wilson (2008), introduce a theory of context-dependent voting, where for example, for a left wing voter, the attractiveness of a left wing candidate is greater the more right wing is

[4]Details are available upon request.

[5]An early contribution was Stone (1980) who argued that district electorates exercised very little control on the positions of their representatives.

the opposing candidate, and apply it to the puzzle of why candidates are so frequently ambiguous in their policy. Another early contribution is Aragones (1997), who also models negativity bias. However, the formal details, as well as the results, are very different to this paper. Specifically, in her setting, parties have no ideological preferences and cannot commit to policies before elections. Voters vote for the party that has generated the highest weighted utility for them in the past. The main finding is that parties act *as if* they have ideological preferences.

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

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 him 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.

There are also a number of recent papers that consider other aspects of voter biases on political outcomes in non-Downsian settings, either where party positions are fixed, or where policy can be set ex post e.g. political agency settings. For example, Ghirardato and Katz (2006) show that if voters are ambiguity-averse, they might strictly prefer abstaining to voting, even if voting is costless.[6] Ellis (2011) extends the arguments of Ghirardato and Katz (2006) to investigate information aggregation in large elections.

Levy and Razin (2015), find that the cognitive bias of correlation neglect can improve outcomes for voters, due to a second-best argument; in their setting, information aggregation via voting is initially inefficient, because voters underweight their information when deciding how to vote. If a voter ignores the fact that two of her signals are correlated, she will "overweight" the signals, and thus put more weight on her information, offsetting

[6]The paper is motivated by the empirical observation that voters who arguably face no cost of voting might still abstain, as in the case of case of multiple elections on one ballot.

the original distortion.[7]

Ashworth and Bueno De Mesquita (2014) and Lockwood (2015) consider deviations from the full rationality of the voter in a political agency setting. Ashworth and Bueno De Mesquita (2014) consider voters who in their words,"fail to filter".[8] This refers to the stylized fact that voters vote for or against the incumbent partly in response to events (like natural disasters, or losses by a favorite football team) that the voters should know are outside of the politicians' control. They capture this by the assumption that the voter's payoff to the incumbent is affected by a random shock. Failing to filter can make the voter better off.[9] Lockwood (2015) shows that voters who suffer from confirmation bias, a very well-established cognitive bias, can actually be better off, because confirmation bias decreases pandering by incumbents.

4. *Multi-Period Electoral Competition*. This paper shows how loss-aversion may create dynamic linkages between successive election outcomes. There is now a substantial literature on repeated elections; the closest strand of this literature are those contributions in a Downsian setting where parties can make ex ante policy commitments. In an influential contribution, Duggan (2000) studied a model where individual citizens have policy preferences and also care about office, and can pre-commit to policy positions before elections. Every period the incumbent faces a challenger in an election, where the latter is randomly selected from the population. This model has since been extended in various directions. to allow for term limits (Bernhardt et al., 2004), multi-dimensional policy spaces (Banks and Duggan (2008)), for political parties who can choose candidates, ((Bernhardt et al., 2009)), and to the case where candidates also differ in valence (Bernhardt et al., 2011). The dynamic model of Section 4.2 below can be thought of as a special version of the Duggan model, but with voter loss-aversion and probabilistic voting.[10] However, the predictions concerning the dynamics of platforms are very different; see the discussion in Section 4.2.

[7] Ortoleva and Snowberg (2013), in a related paper, show theoretically that overconfidence and ideological extremeness are connected. They find empirically, using a large US election study, that overconfidence is the most reliable predictor of ideological extremeness and an important predictor of voter turnout.

[8] They also show that if the voter can choose a re-election rule that is more stringent than the sequentially rational one, voter welfare can be improved. However, there is no particular support for such a behavioural bias in the psychology literature.

[9] Spiegler (2013) studies a related phenomenon in a political economy setting, where salient, recent events are intuitively perceived to be causes of an observed outcome.

[10] The special ingredients are: two-period overlapping generations rather than infinitely lived agents, only three types of voter, and moderate voters do not stand for election.

3 The Model

3.1 The Environment

Apart from loss-aversion, the set-up is a version of the standard Downsian model. There are three sets of voters E_L, E_R, M. Each voter i has an ideal point x_i in the policy space $X = [-1,1]$. There equal numbers of voters in each of E_L, E_R, and these voters are extremists i.e. have extreme ideal points, $x_i = -1,\ i \in E_L,\ x_i = 1,\ i \in E_R$. The voters in M are moderates. We assume for the moment that all moderates have ideal points of zero. The extremists group themselves into two parties, L and R, which simultaneously choose platforms x_L, x_R and compete for the votes of the moderates. They are assumed to be able to commit to implement these platforms. Thus, the basic framework is that of Downsian competition.

3.2 Voter Payoffs

Following Osborne (1995), we assume that "ordinary" or intrinsic utility over alternatives $x \in X$ for voter i is given by $u_i(x) = -l(|x - x_i|)$ where l is twice differentiable, strictly increasing, symmetric and convex in $|x - x_i|$, and that $l(0) = l'(0) = 0$. So, for any $x \in [-1,1]$, the payoffs of the L and R party members are $u_L(x) \equiv -l(|x+1|)$, $u_R(x) \equiv -l(|x-1|)$. Also, the payoff of a moderate voter is $u(x) \equiv -l(|x|)$.

We suppose that the moderates are loss-averse, but parties, being made up of professional decision-makers, are not loss-averse. Following Kőszegi and Rabin (2006), Kőszegi, Botond and Rabin, Matthew (2007, 2009), we specify the gain-loss utility over policy for moderate voter i as;

$$v(x;r) = \begin{cases} (u(x) - u(r)), & u(x) \geq u(r) \\ \lambda(u(x) - u(r)), & u(x) < u(r) \end{cases} \tag{1}$$

The parameter λ measures the degree of loss-aversion, and r is the reference point. The empirical evidence gives a value for λ of around 2. Then, overall policy-related utility for the moderates is the sum of u and v;

$$u(x) + v(x;r) = \begin{cases} 2u(x) - u(r), & u(x) \geq u(r) \\ (1+\lambda)u(x) - \lambda u(r), & u(x) < u(r) \end{cases} \tag{2}$$

All moderate voters also are subject to a common preference shock ε drawn from a symmetric distribution F around zero, with support $[-\sigma, \sigma]$, which captures other features that may affect choice between candidates. Given ε, any moderate voter will vote for party

R, given platforms x_L, x_R, if and only if

$$u(x_R) + v(x_R; x_S) \geq \varepsilon + u(x_L) + v(x_L; x_S) \tag{3}$$

Without loss of generality, we restrict x_R to be non-negative, and x_L to be non-positive.

Finally, following Alesina and Passarelli (2015), we assume that voters are "backward looking" in that the reference point r is an initial policy outcome, the status quo, x_S. The case of a forward-looking reference point, as in Kőszegi and Rabin (2006), Kőszegi, Botond and Rabin, Matthew (2007, 2009), is considered in the Appendix. In the Koszegi-Rabin case, from the point of view of the individual voter, the reference point is a probability distribution over party platforms, (x_L, x_R) with probabilities $1-p$, p, where p is the probability of a win for the R party. We show in this case, loss-aversion induces policy moderation, but that there is no policy rigidity.

3.3 Win Probabilities

From (3), given platforms x_L, x_R, the probability that a moderate votes for R is

$$p(x_L, x_R; x_S) = F\left(u(x_R) + v(x_R; x_S) - u(x_L) - v(x_L; x_S)\right) \tag{4}$$

Then, given (2), we can explicitly calculate;

$$p(x_L, x_R; x_S) = \begin{cases} F\left(2(u(x_R) - u(x_L))\right) & u(x_L), u(x_R) \geq u(x_S) \\ F\left(2u(x_R) - (1+\lambda)u(x_L) + (\lambda - 1)u(x_S)\right) & u(x_R) \geq u(x_S) > u(x_L) \\ F\left((1+\lambda)u(x_R) - 2u(x_L) - (\lambda - 1)u(x_S)\right) & u(x_L) \geq u(x_S) > u(x_R) \\ F\left((1+\lambda)u(x_R) - (1+\lambda)u(x_L)\right) & u(x_L), u(x_R) < u(x_S) \end{cases} \tag{5}$$

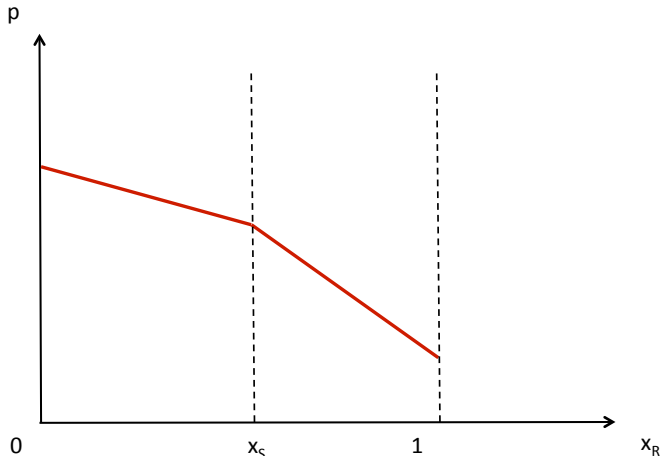
So, p is continuous and differentiable in x_L, x_R except at the points $|x_R| = |x_S|$, $|x_L| = |x_S|$. Figure 1 shows the win probability for party R as x_R rises from 0 to 1, for a fixed x_L; for clarity, we assume in the Figure that F is uniform on $[-\sigma, \sigma]$ and $u(x) = -|x|$. It is clear from (5) that there is a kink at the point where $x_R = |x_S|$; specifically, to the left of this point, a small increase in x_R decreases p by $\frac{1}{\sigma}$, and to the right, a small increase in x_R decreases p by $\frac{1+\lambda}{2\sigma} > \frac{1}{\sigma}$. This is shown if Figure 1.

This kink in the win probability function drives all of our results.

Finally, for convenience, we assume that the variance of ε is large enough that p is strictly between 0 and 1 for all $x_R, -x_L \in [0,1]$, $x_S \in [-1,1]$. This requires $p(0,1;0) > 0$, or $\sigma > (1+\lambda)(u(0) - u(1))$.

Note finally from (5) or Figure 1 that loss-aversion affects the election probability of each party, even though the policy space is one-dimensional and there is a single reference point x_0. This is in sharp contrast to AP, where for loss-aversion to play a

Figure 1: The Win Probability



role, the benefits and costs of a project of variable scale are evaluated separately relative to different reference points. We do not need this construction, because we assume probabilistic voting, an assumption widely made in the literature on electoral competition (Persson and Tabellini, 2000).

3.4 Assumptions

Before proceeding, we state and explain some simplifying assumptions[11]. First, no crucial role is played by concavity of the moderate voters' utility function, so we abstract from this by assuming that moderates have linear, or absolute value preferences:

A1. *Moderate voters are risk-neutral;* $u(x) = -|x|$.

Second, we will characterize equilibrium by first-order conditions for the choice of x_L, x_R. For this to be valid, we require that party payoffs π_L, π_R defined below in (6) are strictly concave in x_L, x_R respectively. In combination with A1, A2, below, implies concavity; this is shown in the Appendix.

A2. *Party members are risk-neutral or risk-averse i.e.* $l''(x) \geq 0$, *and the density of* f *is non-decreasing.*

Finally, we require, for non-trivial results, that the return to office, M, is not so large that parties compete to full convergence of platforms. The following assumption ensures this.

A3. $0.5u_R(0) = -0.5u_L(0) = 0.5l'(1) > (1+\lambda)f(0)M$.

[11] These are similar to those used in Proposition 4 of Bernhardt et al. (2009).

4 Results

4.1 Baseline Results

Party payoffs 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

$$\begin{aligned} \pi_L &= (1-p(x_L,x_R))(u_L(x_L)+M)+p(x_L,x_R)(u_L(x_R)) \\ \pi_R &= p(x_L,x_R)(u_R(x_R)+M)+(1-p(x_L,x_R))(u_R(x_L)) \end{aligned} \tag{6}$$

with $p(x_L,x_R)$ defined in (5). We are interested in characterizing the symmetric Nash equilibria of the game with these payoffs, and actions $x_L, x_R \in [-1,1]$. We begin with the following intermediate result.

Lemma 1 *Given A1-A3, there exist unique solutions x^+, x^- ,$x^+ > x^- > 0$ to the equations*

$$0.5u_R'(x^+) - 2f(0)\Big(u_R(x^+) - u_R(-x^+) + M\Big) = 0 \tag{7}$$

$$0.5u_R'(x^-) - (1+\lambda)f(0)\left(u_R(x^-) - u_R(-x^-) + M\right) = 0 \tag{8}$$

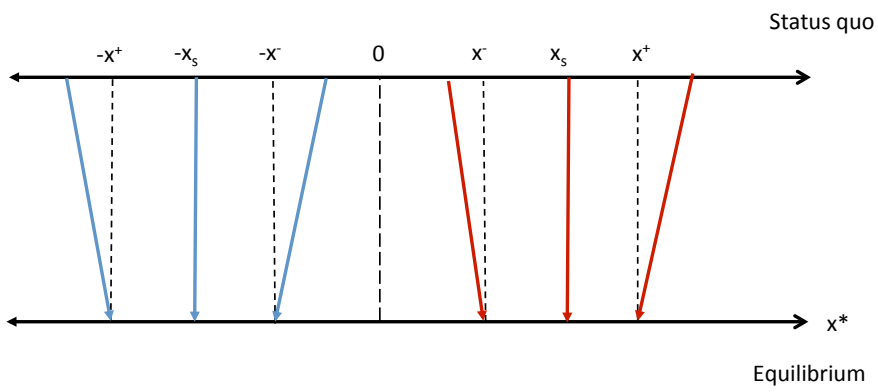
It is easily checked that these solutions x^+, x^- are the symmetric Nash equilibria in the games where party R's re-election probability is $p = F(2(u(x_R) - u(x_L)))$ and $p = F((1+\lambda)(u(x_R) - u(x_L)))$ respectively. In each case, $0.5u_R'(x) > 0$ is the utility gain for party members from moving away from the moderates' ideal point, 0; in equilibrium, this is offset by the lower win probability i.e. the term in $f(0)$. Note that $x^+ > x^- > 0$, as there is a stronger incentive to converge to 0 when $\lambda > 1$.

We are now in a position to characterize the equilibrium in the overall game.

Proposition 1 *If $x^+ < |x_S|$, then $x_R = -x_L = x^+$ is the unique symmetric equilibrium. If $x^- > |x_S|$, then $x_R = -x_L = x^-$ is the unique symmetric equilibrium. If $x^+ \geq |x_S| \geq x^-$, then $x_R = -x_L = |x_S|$ is the unique symmetric equilibrium. The interval $[x^-, x^+]$ is increasing in voter loss-aversion, λ.*

This baseline result is best understood graphically. Figure 2 below shows how the initial status quo maps into the equilibrium outcome. Clearly, for $x^+ \geq |x_S| \geq x^-$, there is *platform rigidity* induced by voter loss-aversion; the equilibrium platform is determined entirely by the status quo value. If the status quo is closer to the moderates' median, zero,

Figure 2: The Baseline Result



than x^-, there is adjustment away from zero to x^-. If the status quo is further from zero than x^+, there is adjustment towards zero to x^+.

Note that in the absence of loss-aversion, from Proposition 1 and Lemma 1, the equilibrium platforms are simply $x_R = -x_L = x^+$. So, bearing this in mind, Proposition 1 shows that there are several important impacts of loss-aversion. First, as just remarked, there is platform rigidity ; for a range of values of the status quo (i.e. for $x^+ \geq |x_S| \geq x^-$), the outcome is insensitive to changes in other parameters, such as the weight M that political parties place on office, or the variability of voter preference shocks, σ. This platform rigidity is similar in spirit to the entrenchment effect found the by AP[12].

Second, there is a *moderation effect* of loss-aversion; the equilibrium policy outcome is closer to the moderate voters' ideal point than in the absence of loss-aversion. In AP, there is also a moderation effect of loss-aversion (their Proposition 3), although there, the details are rather different; 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, we close this section with an example showing how the equilibrium can be computed.

Example. Assume that $l(z) = z$, i.e. political parties have absolute value preferences and that ε is uniformly distributed on $\left[-\frac{\sigma}{2}, \frac{\sigma}{2}\right]$. Then, $u_L = -|x+1| = -(1+x)$, $u_R = -|x-1| = -(1-x)$. Moreover, from the uniform distribution, we have;

$$p = F\left(v(x_L; x_S) - v(x_R; x_S)\right) = \frac{1}{2} + \frac{v(x_L; x_S) - v(x_R; x_S)}{\sigma}$$

[12]The rigidity of policy with respect to shifts in the mean preference of the moderates is studied separately below

Then, it is easily verified that (7),(8) become;

$$\begin{aligned} 0.5 - \frac{2}{\sigma}(-(1-x^+) + M + 1 + x^+) &= 0 \\ 0.5 - \frac{1+\lambda}{\sigma}(-(1-x^+) + M + 1 + x^+) &= 0 \end{aligned}$$

These solve to give $x^+ = \frac{\sigma}{8} - \frac{M}{2}$, $x^- = \frac{\sigma}{4(1+\lambda)} - \frac{M}{2}$. By assumption A3, $x^- = \frac{\sigma}{4(1+\lambda)} - \frac{M}{2} > 0$. So, for $|x_S| \in \left[\frac{\sigma}{4(1+\lambda)} - \frac{M}{2}, \frac{\sigma}{8} - \frac{M}{2}\right]$, there is platform rigidity i.e. $x^* = |x_S|$. Note that as claimed in Proposition 1, the length of the interval $\left[\frac{\sigma}{4(1+\lambda)} - \frac{M}{2}, \frac{\sigma}{8} - \frac{M}{2}\right]$ is increasing in λ. □

4.2 Dynamics

The baseline model does not really allow us to investigate how equilibrium platforms evolve over time. It also abstracts from a potentially very important fact that this period's platform chosen by the election winner will be next-period's status quo, and so forward-looking parties may have an incentive to *strategically manipulate* the status quo to their advantage.

To investigate this issue, we embed our model of political competition in an OLG model[13]. We assume that the above interaction between the parties unfolds over periods $t = 1, 2, ..$, with an initial status quo $x_{S,0} = x_S$. Each extremist voter lives for two periods, and so parties are comprised of old and young extremists. Let $(x_{L,t}, x_{R,t})$ be platforms at time t, which that map from the status quo at time t, $x_{S,t}$ to $[-1, 1]$. Independent voters are assumed to be myopic or only live for one period, so their behavior is captured by (5), i.e. $p(x_{L,t}, x_{R,t}; x_{S,t})$ is the win probability for party R, given status quo $x_{S,t}$ and platforms $x_{L,t}, x_{R,t}$. There is no population growth.

In any period t, the old extremists at t have payoffs

$$\begin{aligned} \pi_{R,t} &= p(x_{L,t}, x_{R,t}; x_{S,t})(u_R(x_{R,t}) + M) + (1 - p(x_{L,t}, x_{R,t}; x_{S,t}))u_{R,t}(x_{L,t}) \\ \pi_{L,t} &= (1 - p(x_{L,t}, x_{R,t}; x_{S,t}))(u_L(x_{L,t}) + M) + p(x_{L,t}, x_{R,t}; x_{S,t})u_L(x_{R,t}) \end{aligned} \tag{9}$$

Young extremists are forward-looking, so have payoffs

$$\pi_{L,t} + \delta\pi_{L,t+1},\ \pi_{R,t} + \delta\pi_{R,t+1}$$

where δ is the discount factor. A process of bargaining between old and young extremists

[13] An OLG model is chosen for its analytical tractability. Similar results can be obtained in a T−period version of the baseline model, but in the case of risk-averse parties, the analysis is much more messy.

gives the party objectives

$$\pi_{L,t} + \beta\delta\pi_{L,t+1},\ \pi_{R,t} + \beta\delta\pi_{R,t+1}$$

where $\beta > 0$ measures the relative bargaining power of the young.

As is common in the OLG setting, we focus on Markov equilibrium, where in any period t, equilibrium choices $x^*_{L,t}, x^*_{R,t}$ depend on the past history of play only via the state variable, which is this setting is the initial status quo, $x_{S,t}$. Formally, a Markov equilibrium is a pair $x^*_L(.), x^*_R(.)$ such that for any t and any $x_{S,t}$; (i) given $x^*_R(x_{S,t})$, $x^*_L(x_{S,t})$ maximizes $\pi_{L,t} + \beta\delta\pi_{L,t+1}$; (ii) given $x^*_L(x_{S,t})$, $x^*_R(x_{S,t})$ maximizes $\pi_{R,t} + \beta\delta\pi_{R,t+1}$. From now on, we can without loss of generality drop the "t" subscripts, so that $x_{S,t} \equiv x_S$, and so on.

As above, we will focus on symmetric equilibrium, where $x^*_R(x_S) = x^*(x_S)$, $x^*_L(x_S) = -x^*(x_S)$ for all $x_S \in [-1, 1]$. Within the class of symmetric equilibria, we focus on *symmetric cutoff* equilibria. This is where x_S maps to x^* as follows;

$$x^*(x_S) = \begin{cases} \tilde{x}^+ & \tilde{x}^+ < |x_S| \\ x_{S,} & \tilde{x}^- \leq |x_S| \leq \tilde{x}^+ \\ \tilde{x}^-, & |x_S| < \tilde{x}^- \end{cases} \tag{10}$$

Note that in (10), the cutpoints need not be the same as in the static case.

Also, note that given (10), and assuming that the status quo at $t+1$ is some x^*, the continuation payoffs of the young members of party R at t are;

$$V(x^*) = 0.5M + \begin{cases} 0.5(u_R(\tilde{x}^+) + u_R(-\tilde{x}^+)), & \tilde{x}^+ < x^* \\ 0.5(u_R(x^*) + u_R(-x^*)), & \tilde{x}^+ \geq x^* \geq \tilde{x}^- \\ 0.5(u_R(\tilde{x}^-) + u_R(-\tilde{x}^-)), & \tilde{x}^- > x^* \end{cases} \tag{11}$$

So, in equilibrium, party R chooses policies to maximize its current payoff (9) *plus* $\delta\beta$ times next period's continuation payoff, which is

$$p(x_{L,t}, x_{R,t}; x_{S,t})V(x_{R,t}) + (1 - p(x_{L,t}, x_{R,t}; x_{S,t}))V(x_{L,t}) \tag{12}$$

and similarly for party L. So, strategic manipulation of the status quo for party R amounts to taking into effect of $x_{R,t}$ on (12) and similarly for party L.

We start with the simplest case, absolute value preferences for the parties i.e. where *political parties are risk-neutral i.e.* $l'' \equiv 0$. Here, $u_R(-x^*) + u_R(x^*) \equiv 0$, so from (11), in *any* symmetric equilibrium x^*, the continuation payoff of the political party in the next period is just $V(x^*) = 0.5M$ and thus is independent of x^*. So, in every period, the only symmetric equilibrium must be the static one. Intuitively, with risk-neutrality, parties do not care about next period's status quo and so there is thus no incentive to strategic manipulation of next period's status quo via platform choice in the current period. Formally, we can

state:

Proposition 2 *If political parties are risk-neutral i.e. $l'' \equiv 0$, there is a unique symmetric cutoff equilibrium, which is also the unique symmetric equilibrium, where $\tilde{x}^+ = x^+$, $\tilde{x}^- = x^-$.*

In the general case with party risk-aversion, we need to make one more assumption. To motivate this, note that for party R's overall payoff to be concave in $x_{L,t}$, we require $V(x^*)$ to be concave in x^*. This requires

$$V''(x) = 0.5(u_R''(x) - u_R''(-x)) = \int_{-x}^{x} u_R'''(z)dz \leq 0$$

So, the required condition on the underlying loss function is :

A4. $l''' \leq 0$.

We can then prove;

Proposition 3 *Assume A1-A4. Then, there exists a symmetric cutoff equilibrium, such that if $|x_S| \in [\tilde{x}^-, x^+]$, $x^* = |x_S|$, where x^+ is the cutoff in the static case, and $\tilde{x}^- < x^-$. If $|x_S| > x^+$, $x^* = x^+$, and if $|x_S| < \tilde{x}^-$, $x^* = \tilde{x}^-$. Thus, platform rigidity is greater than in the static case.*

The reason why $\tilde{x}^-$ is lower than x^- is that with risk-aversion, there is an incentive for *strategic manipulation of the status quo*; starting at any x^* that is short-run optimal i.e. maximizes the current payoff of (say) party R, a small reduction in x_L by party R will reduce next period's status quo in the event that party R wins, and thus, from (10), if $\tilde{x}^- \leq x^* \leq \tilde{x}^+$, reduce the variance of the policy outcome. If the party is strictly risk-averse, this makes the party better off, as is clear from the definition of V.

What do Propositions 2, 3 imply about the dynamic evaluation of party platforms? Starting with $x_{S,0}$, there is *one-step convergence* to a steady state. In particular, if $\left|x_{S,0}\right| \in [\tilde{x}^-, x^+]$, then in absolute value, the status quo policy is replicated in every period i.e. $|x_t| = \left|x_{S,0}\right|$. If $\left|x_{S,0}\right| > x^+$, $|x_1|$ jumps to x^+ and stays there in all subsequent periods. If $\left|x_{S,0}\right| < \tilde{x}^-$, $|x_1|$ jumps to $\tilde{x}^-$ and stays there in all subsequent periods.

Next, we can ask how a change in forward-looking behavior affects platform rigidity.

Proposition 4 *An increase in forward-looking behavior i.e. an increase in the discount factor, δ, or in the influence of the young in the party, β, implies an decrease in $\tilde{x}^-$, and thus an increase in $[\tilde{x}^-, x^+]$ i.e. more platform rigidity.*

The intuition here is that an increase in $\delta\beta$ decreases $\tilde{x}^-$, because as $\delta\beta$ increases, the incentive for strategic manipulation of the status quo becomes stronger.

4.3 Preference Shocks

A key question which will help us draw out the observable implications of the theory is to ask how an initial equilibrium responds to changes in voter preferences, as such shifts can be identified empirically, as described in Section 5.

To do this, assume absolute value preferences for the political parties for convenience. Also, suppose that initially, in the first period, the platforms are at their steady-state values, so the status quo is either x_S or $-x_S$, $x_S \in [x^-, x^+]$, depending on whether the R party or the L party won the previous election. Now consider (w.l.o.g.) a rightward shift in the distribution of preferences between the first and second period, so all ideal points of both party members and the independents shift rightward by $\Delta\mu$ i.e. the independents shift from $-|x|$ to $-\left|x-\Delta\mu\right|$, and the L and R party preferences shift from $-|x+1|$, $-|x-1|$ to $-\left|x+1-\Delta\mu\right|$, $-\left|x-1-\Delta\mu\right|$.

Then, without loss-aversion, it is easy to check that adjustment to the shock is symmetric i.e. the equilibrium platform of the R party moves from x^+ to $x^+ + \Delta\mu$, and the platform of the L party moves from $-x^+$ to $-x^+ + \Delta\mu$. But what happens with loss-aversion?

The new equilibrium is then described in Proposition 1, except that all variables except the initial status quo are shifted rightward by $\Delta\mu$. There are three cases, illustrated by Figures 3(a)-(c) below. Each of the figures shows the initial equilibrium value of x, the status quo. If R won the last election, we denote this x_S, and if L won the last election, we denote this $-x_S$. The figures differ only in the size of the shift $\Delta\mu$. The red and blue lines show the movement of R and L parties respectively (colors here are for US readers; blue for Democrat, red for Republican). A solid (dotted) line shows how that party's position moves given that it won (lost) the last election.

For example, in Figure 1, by Proposition 1, if R won the last election, as $x_1^* \in [x^- + \Delta\mu, x^+ + \Delta\mu]$, the party's position does not move, and so equilibrium requires that party L's position moves by $2\Delta\mu$. The reverse is true if R won the last election.

Inspection of these figures gives the following conclusions.

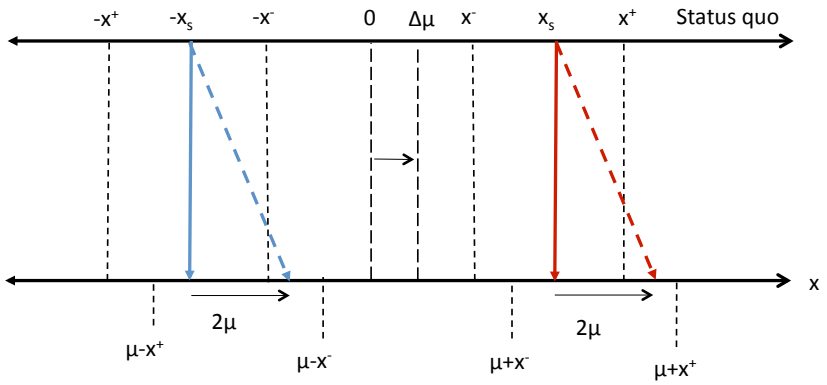
(a) *A small shock i.e.* $\Delta\mu \leq x_S - x^-$. Then, if R won the election, i.e. is the incumbent, so that the status quo is x_S, as $x_S \in [x^- + \Delta\mu, x^+ + \Delta\mu]$, the outcome is $x_R = x_S$, $x_L = -x_S + 2\Delta\mu$. If L won the election i.e. is the incumbent, so that the status quo is $-x_S$, then the outcome is $x_R = x_S + 2\Delta\mu$, $x_L = -x_S$.

(b) *A medium shock i.e.* $x_S - x^- < \Delta\mu \leq x^+ - x^-$. Then if R won the election, so that the status quo is x_S, the outcome is $x_R = \Delta\mu + x^-$, $x_L = \Delta\mu - x^-$.Then if L won the election, so that the status quo is $-x_S$, then the outcome is $x_R = 2\Delta\mu + x_S$, $x_L = -x_S$.

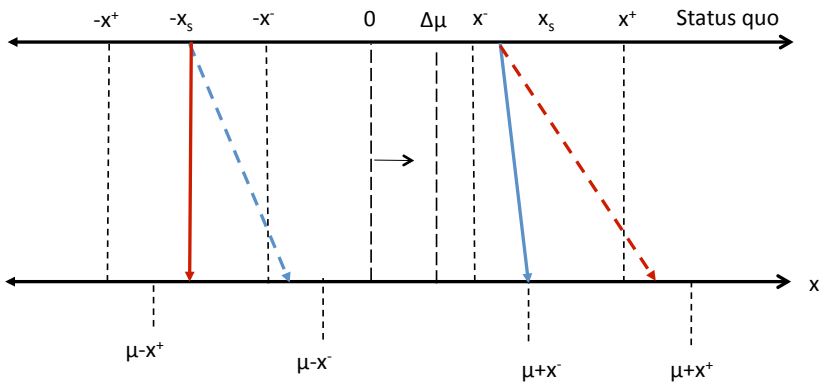
(c) *A large shock i.e.* $x^+ - x^- < \Delta\mu$. Then, if R won the election, so that the status quo is x_S, the outcome is $x_R = \Delta\mu + x^-$, $x_L = \Delta\mu - x^-$. If L won the election, i.e. is the incumbent,

Figure 3: Responses to Different Sized Shocks

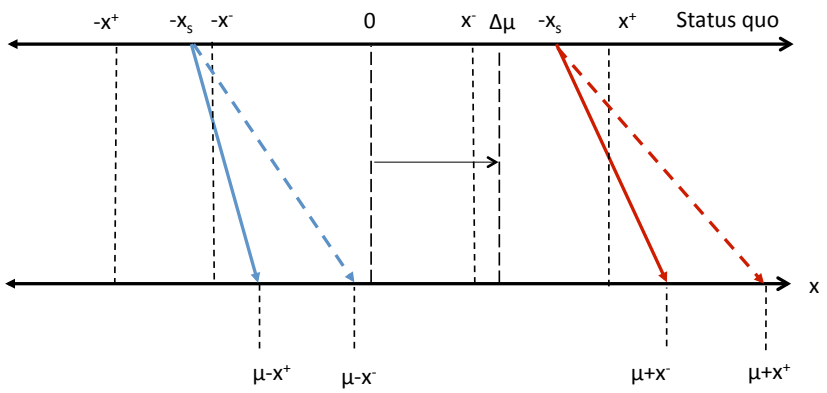
(a) Response to a Small Shock



(b) Response to a Medium Shock



(c) Response to a Large Shock



so that the status quo is $-x_S$, then the outcome is $x_R = \Delta\mu + x^+$, $x_L = \Delta\mu - x^+$.

Now consider the amount of adjustment made by either party as $\Delta\mu$ varies. First let $\Delta x_p = x_p - x_S$, $p = R, L$. Then, if R won the previous election, so that the status quo is x_S, it is easy to compute from the above results that

$$\Delta x_R^I = \begin{cases} 0, & \Delta\mu \leq x_S - x^- \\ \Delta\mu + x^- - x_S, & x_S - x^- < \Delta\mu \end{cases}$$

and if R lost the previous election,

$$\Delta x_R^C = \begin{cases} 2\Delta\mu, & \Delta\mu \leq x^+ - x^- \\ \Delta\mu + x^+ - x_S, & x^+ - x^- < \Delta\mu \end{cases}$$

where I and C denote incumbent and challenger respectively.

The reaction for the L party is somewhat different, as the preference shift is to the right. If the L-party is the incumbent, we have;

$$\Delta x_L^I = \begin{cases} 0, & \Delta\mu \leq x^+ - x^- \\ \Delta\mu - x^+ + x_S, & x^+ - x^- < \Delta\mu \end{cases}$$

And, if L lost the previous election,

$$\Delta x_L^C = \begin{cases} 2\Delta\mu, & \Delta\mu \leq x_S - x^- \\ \Delta\mu + x^- - x_S, & x_S - x^- < \Delta\mu \end{cases}$$

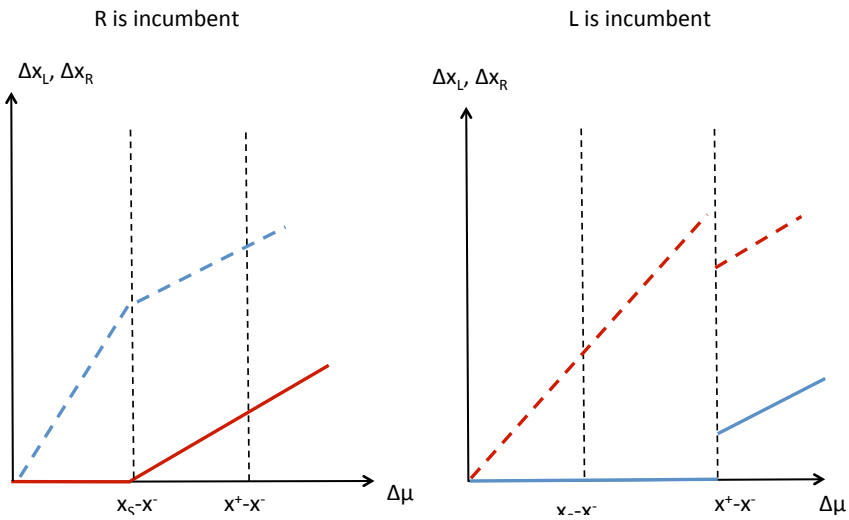
These reactions are shown on the two panels of Figure 4 below. The first (second) panel shows the case where R (L) is the incumbent, and the reactions of incumbent and challenger platforms to the shock are denoted by solid and dotted lines respectively. As $x_S \geq x^-$, the amount of adjustment actually jumps down at $\Delta\mu = x^+ - x^-$, because then the L party starts adjusting.

Note also that if the shock was a leftward shift in the mean of the moderates i.e. $\Delta\mu < 0$, Figure 4 would continue to apply with the L and R indices reversed. We can thus summarize as follows:

Proposition 5 *With loss-aversion, the incumbent party that won the previous election always has a smaller platform adjustment to the shock than the party that lost i.e. the challenger. Moreover, the adjustment to the shock is non-linear for both the winner and the loser, and generally increasing in the size of the shock.*

Proof of Proposition 5. It remains to show that in every case, the party than won the previous election has a smaller adjustment to the shock than the party that lost. In

Figure 4: Overview of Responses to a Preference Shock



case 1, this is obvious. In case 2, if R won, $\Delta x_R^I = \Delta\mu + x^- - x_1^*$, $\Delta x_L^C = \Delta\mu - x^- + x_1^*$, so $\Delta x_L^C - \Delta x_R^I = \Delta\mu - x^- + x_1^* - (\Delta\mu + x^- - x_1^*) = 2x_1^* - 2x^-$ which is always non-negative, and strictly positive unless $x_1^* = x^-$. If L won, $\Delta x_R^C = \Delta\mu + x^+ - x_S$, $\Delta x_L^I = \Delta\mu - x^+ + x_S$, so $\Delta x_L^I - \Delta x_R^C = \Delta\mu - x^+ + x_S - (\Delta\mu + x^+ - x_S) = 2x_S - 2x^+ \leq 0$. In case 3, if R won, $\Delta x_R^I = \Delta\mu + x^-$, $\Delta x_L^C = \Delta\mu - x^-$, so $\Delta x_L^I - \Delta x_R^C = -2x^- + 2x_S \geq 0$. If Lwon, $\Delta x_R^C = 2\Delta\mu$, $\Delta x_L^I = 0$, so $\Delta x_L^C - \Delta x_R^I < 0$. $\square$

This result, combined with our observation that there is symmetric adjustment to the shock without loss-aversion, shows that loss-aversion generates a particular kind of asymmetry, which is testable; incumbents adjust less than challengers. The underlying force is that the status quo works to the advantage of the incumbent.

Finally, we note that the result that the adjustment is non-linear is also found by AP, who show that if there is a shock to the median voter, this only has an effect on the outcome if the shock is sufficiently large. (AP, Proposition 4).

5 Evidence

The previous Section makes a robust theoretical prediction; incumbents adjust less than challengers to changes in voter preferences. This section takes this central prediction of the theory to data on elections to US state legislatures. As noted by Besley and Case (2003), the US states are a natural laboratory for empirical exercises of this kind.

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 5.1. Using these data we find, as predicted by the theory, that parties with majorities are less responsive to shocks.

5.1 Data Description

Our data are for elections to the lower-chamber of all state legislatures for the period 1990–2012.[14] These data have much to commend them for our purposes. First, consistently with the theory, there are effectively only two parties, Democrat and Republican; we do not study the ideological positions of independent candidates, who in any case, attract very few votes.[15] Second, compared to the European elections studied by e.g. Adams et al. (2004), this is a large sample, with common electoral rules; each state holds general elections every two years.[16] They also have important advantages compared to the using data on elections to the US Senate, as done by Fowler (2005), because almost all states have term limits for the lower-chamber, which precludes the accumulation of incumbency advantages of other types, which may confound the effect we are looking for (Caughey and Sekhon (2011)).

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 remarkable in that they provide estimates of the ideological position of almost every candidate in every election over the period we study. These are obtained using publicly available campaign finance information, collated by the National Institute on Money in State Politics and the Sunlight Foundation. Bonica (2014b) proposes 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. Crucially,

[14] This includes the single Nebraskan chamber, but excludes New England, Massachusetts, and Vermont.

[15] Where information is available, we do include the ideological positions of independent candidates in the calculation of the median voter's ideology, but their positions have a very small effect on the calculation, as these candidates attract very few votes.

[16] Most electoral districts are single-member, but some states have multi-member electoral districts, and we exclude these states in our baseline specification; see below.

as donors donate to losing candidates we observe the ideological position of *all* candidates.

5.2 Measuring Voter Preferences and Party Platforms

To test the theory, we need a measure of each party's position and that of the median voter, at a given election in a given state. Given a set of candidates $c = 1,\ldots,C_d$ in each district $d = 1,\ldots,D_s$ of state S , $Platform_{ct}$ is the platform of candidate c at election t, as measured by Bonica and $Votes_{ct}$ is the number of votes they received. The t variable is the set of even years {1990,..2012}, as elections are held in all states every even year. $Platform_{ct}$ is normalized such that −1 is the most left-wing position observed and 1 is the most right-wing observed in any election.

As a first step, we define the preference of the mean voter in each district d as the voter-weighted average position of the candidates;

$$\mu_{dt} = \sum_{c=1}^{C_d} \frac{Platform_{ct} \times Votes_{ct}}{\sum_{C_M} Votes_{ct}} \tag{13}$$

Our baseline estimate of the ideology of the median voter at the state level, μ_{st} is then simply $\mu_{st} = \mu_{Mt}$, where districts are ordered by μ_d and $M = \frac{D_s+1}{2}$. In other words, our estimate of the ideology of the median voter at the state level, μ is defined as ideology of the mean voter in the median district. Given that typically there are a large number of districts, this is likely to be close to the true median, even though within a district, without making distributional assumptions, we cannot identify the median voter and thus work with the mean voter.

Formula (13) 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)).One further refinement is that this procedure for constructing μ_{st} is done separately for the two parties, as typically neither party contests all districts in a state, so we end up with μ_{pst}.

Our variable measuring changes, or shocks, to voter preferences is then simply:

$$Shock_{pst} \equiv \Delta\mu_{pst} = \mu_{pst} - \mu_{ps,t-1}. \tag{14}$$

Figure A.1 illustrates μ_{st} 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 (14) has the advantage of corresponding directly to the theory. 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}. We calculate the mean

voter in state s in year t as

$$\mu'_{st} = \frac{1}{D_s} \sum_{d=1}^{D_s} \mu_{dt}. \tag{15}$$

i.e. the average of the district mean ideologies. Again, as a refinement, this is done for each party separately.Inspection of Figure A.2 suggests that the choice between μ_{st} and μ'_{st} may not be that important as there is little empirical difference in the distributions across states in an given year of the mean and median voters.

The other main explanatory variable is a dummy Inc_{st} recording whether the party s holds a majority of seats in the legislature in the period prior to election t. The dependent variable is a (state) party's position, $Position_{pst}$. We define this as the median of the positions of all candidates of that party in the election at t including both incumbent and challengers i.e. the median of all numbers $Platform_{ct}$, for all candidates belonging to party p in state s. The decision to treat incumbents and challengers equally is made for both statistical and substantive reasons.

Firstly, the substantive reason is that it well known (see, (Poole, 2007, Poole and Rosenthal, 2006)) that individual politicians' positions are relatively stable over time and that most of the change in the views of representatives is due to electoral turnover. Thus, the response of incumbents to an electoral shock is likely to be relatively small. The second, statistical, reason relates to this. If we were to focus only on those who were elected we would introduce a substantial composition effect – for a given shock those still in office are those more isolated from changes in the median voter. Thus, a leftward move in the median voter, might mean the average republican incumbent moves rightward. In the context of our model the dynamic implications would create a substantial econometric problem. By considering both incumbents and challengers we not only avoid the composition effect, but also observe better a party's response to changes in the distribution of voters.

Our measure $Position_{pst}$ is a party's median representative rather than the mean as this corresponds both better to standard theory, and is less likely to be distorted by the preferences of extreme representatives. It is possible however that in the presence of a large number of uncompetitive seats, perhaps due to gerrymandering, a party's median representative will not have changed position despite large changes in its platform in competitive districts. However, as we will see, all of our results are robust to using the mean representative instead.

We introduce the data with an example, that illustrates our empirical strategy. 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 5 describes the results of the Californian State Legislature elections in 2004 and 2006. Panel 5a plots kernel density

estimates of voters' preferences in 2004 and 2006 i.e. the kernel of distribution of the μ_{dt}. 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 5b 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 5c and 5d. 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[17].

Table 1 contains summary statistics for the key variables $Position_{pst}$, $Shock_{pst}$ 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.

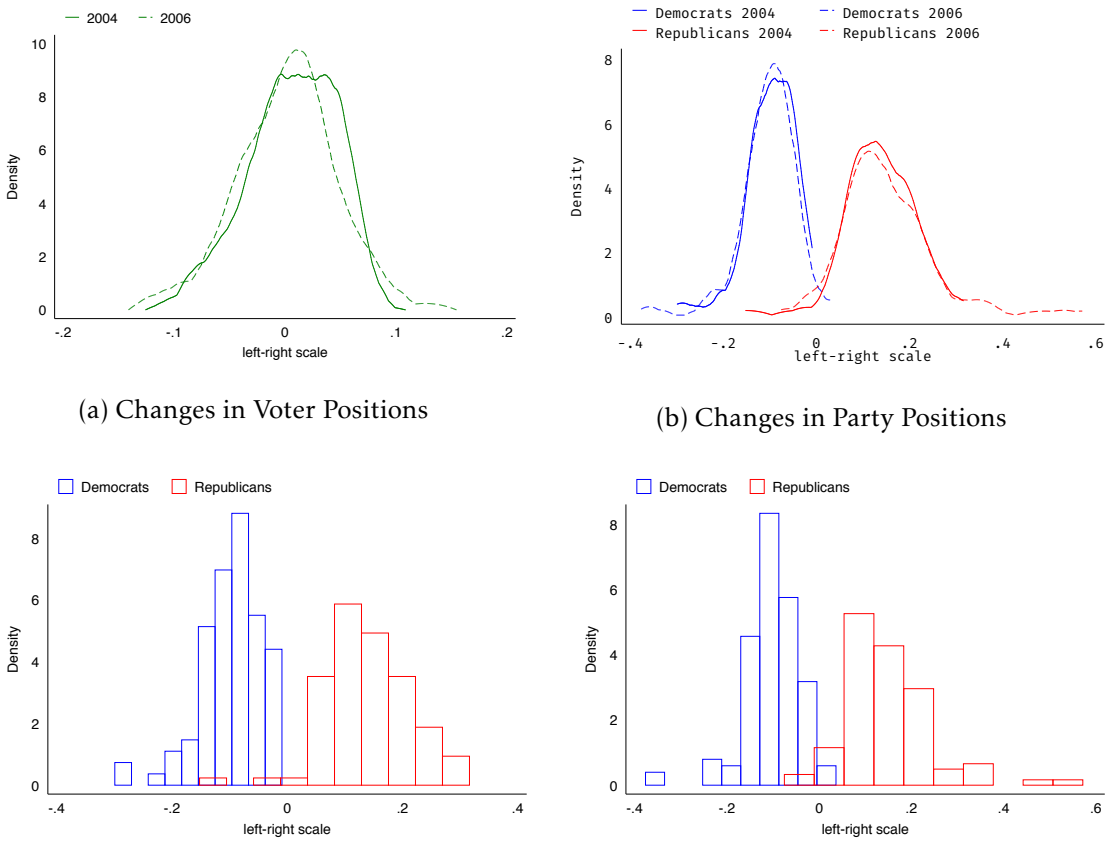
Looking now at the values for $\Delta Position_{pst}$ over the sample period, we see, not surprisingly, that there has been polarization; the Republicans have moved to the right, and the Democrats to the left. Reflecting this, there are also relatively few large party moves with the $90th$ percentile of $\Delta Position_{pst}$ also being 0.02 for the Republican party. Comparison of the 1st and 99th percentiles suggests shocks 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, for voter preferences in districts contested by the Republicans, the $90th$ percentile of the $Shock_{pst}$ distribution is 0.02 compared to a theoretical maximum move of 2, and the corresponding figure for Democrats is 0.18.

Using the same underlying ideology data to measure both party and voter positions is important because it ensures that both $Shock_{pst}$ and $\Delta Position_{pst}$ are defined on the same space and thus directly comparable. However, it is also worthwhile being clear about why, despite some common underlying information, there is no mechanical relationship between them. Consider an individual district; in (13) we estimate the mean ideology of

[17] Notably, 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.

Figure 5: Californian State Legislature Elections 2004 and 2006



(a) Changes in Voter Positions

(b) Changes in Party Positions

(c) Representatives 2004

(d) Representatives 2006

this district as the vote weighted average of the candidates' positions. Yet, if candidates change their positions, in the absence of a change in the preferences of voters, then the vote shares for the parties might plausibly change in an offsetting way so that such that μ_{st} may not change much. For example, suppose both parties were initially located either side of the median voter, and both parties move to the right. Given that the distribution of voter preferences is single-peaked, then support for the Republicans will fall, and that for the Democrats will rise. As shown in Table 2, something like this seems to be occuring; the correlation between $Shock_{pst}$ and $\Delta Position_{pst}$, while positive, is in fact quite small at 0.271.

5.3 Empirical Strategy

Proposition 5 suggests that parties that lost the previous election will respond more to any change in voters' preferences than the winner. The theory also suggests that this relationship maybe non-linear. We take this prediction to the data by relating the change in the position of party p in state s, and year t, to whether the party won the previous

election and what changes there have been in voters' preferences. In other words we estimate an equation of the form:

$$\Delta Position_{pst} = f(Inc_{pst}, Shock_{pst}) + \epsilon_{pst} \tag{16}$$

Specifically, we assume a functional form which is linear in $Inc_{pst}, Shock_{pst}$ and quadratic in the interaction $Inc_{pst} \times Shock_{pst}$ i.e.

$$\begin{aligned} \Delta Position_{pst} = \lambda Shock_{pst} + \gamma_1 Inc_{pst} + \beta_1 Inc_{pst} \times Shock_{pst} + \\ \beta_2 Inc_{pst} \times Shock^2_{pst} + \varepsilon_{pst} \end{aligned} \tag{17}$$

Proposition 5 implies that β_1 is negative.

Give the data at hand, a key challenge in estimating (17) 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), media-bias (see, (Chiang and Knight, 2011), or even the weather (see, (Gomez et al., 2008)). As well as endogeneity due to external events, there is also the possibility of simultaneity due to the persuasive or campaigning efforts 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 $state \times party$ (henceforth, SP), $state \times year$ (SY), and $party \times year$ (PY) fixed effects. In other words, we assume

$$\varepsilon_{pst} = \gamma_{sp} + \phi_{st} + \delta_{pt} + \zeta_{pst} \tag{18}$$

where $\gamma_{sp}, \phi_{st}, \delta_{pt}$ are SP, SY, and PY fixed effects, and the error term ζ_{pst} is assumed to be $\zeta_{pst} \sim N(0, \Sigma)$ 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' behavior may be correlated across states within an election. For example,that Republicans in say, Arizona, may pay attention to the fortunes of Republicans in New Mexico.

So, we have partialled out all variation associated with particular, states, parties, and years. Moreover, conditional on this we assume that the covariates in (17) are orthogonal to the error ζ_{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'

behavior; and conditioning on this incumbency that the change in the median voter is still random. We argue that, it is hard to think of processes which, given these fixed effects, would give rise to some unaccounted for systematic bias in our results[18]. So, our final specification is given by (17) and (18).

5.4 Results

We now report estimates of (17). As a first step, column 1 of Table 3 reports results from a simplified version of (17) where $\gamma = \beta_2 = 0$, and in which there are only SP and year fixed effects. We see that, as expected, parties react to movements in the median voter, with the coefficient on $Shock_{pst}$ positive and significant. We also find, as the theory suggests, that parties with a majority react less. This coefficient is negative, significant and in fact larger than that for $Shock_{pst}$. Calculating standardized coefficients, reported in column 2, reveals in fact it is around 80% as large. Here, a one standard deviation move rightwards would move the incumbent party only 0.07 standard deviations rightwards, but a party not in power 0.37 standard deviations to the right. 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.

Column 3 maintains the restriction that $\gamma = \beta_2 = 0$ but now includes the full battery of fixed-effects. The effect of movements in the median voter is no longer sufficiently precise to be significant, but remains positive. This is because $Shock_{pst}$ will be almost collinear with the state-year fixed effect. Thus, in this specification $Shock_{pst}$ is controlling for any differences in how the shock affects parties, say because they do not contest all districts. The negative coefficient on β_1 is now larger and still significant at the 1% level. The addition of the SY fixed-effects simplifies the interpretation of this coefficient, given a shock, it is now the difference in the response of parties in power from those that are not. This effect may not be linear however, parties may respond disproportionately to smaller or larger shocks.

In column 4 we therefore relax the constraint that $\beta_2 = 0$, but, we find that it is imprecisely measured and not significant at any conventional level. Column 5 reimposes the restriction that $\beta_2 = 0$ but now allows for a direct effect of Inc_{pst}. Given that we include $Inc_{pst} \times Shock_{pst}$ this is equivalent to the effect of Inc_{pst} given no shock. Perhaps unsurprisingly, given the shock will almost always be non-zero, the estimated effect is small although positive and significant at the 1% level. One reason for this is that the average shock is slightly positive. Column 6 reports the unrestricted model, where, β_1, the

[18] To be precise our identification assumptions are:

$$E[Shock_{pst}\zeta_{pst}] = E[(Inc_{pst}\zeta_{pst})] = E[(Inc_{pst} \times Shock_{pst})\zeta_{pst}] = 0$$

coefficient on $Inc_{pst} \times Shock_{pst}$ continues to be large, negative, and precisely estimated, but the coefficients on $Shock_{pst}$ and the quadratic term are still not sufficiently precise. Given the included fixed-effects all of these coefficients are consistent with the theory, although the additional variables make inference more complicated in this model. The positive coefficient on Inc_{pst}, $\gamma = 0.01$ and negative coefficient on its interaction with the shock $\beta_1 = -0.639$ suggest that a move from -0.5 to 0.5 leads to a $0.63 - 0.01 = 0.62$ smaller move by the incumbent party compared to the non-incumbent. The results in column 2 suggest that this will still be positive.

The theory is ambiguous about the sign of any non-linear effects but is clear that there should be a direct linear effect. As a further test, we compare the performance of a model excluding the linear effect, as the lack of a significant coefficient on the quadratic term in column 6 may reflect colinearity between $Inc_{pst} \times Shock_{pst}$ and its square due to the SY fixed effects. The comparatively low R^2 of this regression reveals that this model fits the data considerably less well and $Shock_{pst}$ is now negative and again β_2 is insignificant. Inc_{pst} is now significant again at the 5% level. We interpret these results as reflecting a restricted model that is unable to fit the data. Taken together these results provide strong evidence for the effects of loss-aversion predicted by the theory.

To address any remaining concerns we also estimate (17) in first-differences using the same set of fixed effects (now trends). We write the model in first differences as:

$$\begin{aligned} \Delta^2 Position_{pst} = \lambda \Delta Shock_{pst} + \gamma_1 \Delta Inc_{pst} + \beta_1 \Delta Inc_{pst} \times Shock_{pst} + \\ \beta_2 \Delta Inc_{pst} \times Shock^2_{pst} + \chi_{ps} + \psi_{st} + \phi_{pt} + \zeta_{pst} \end{aligned} \tag{19}$$

This specification is now a demanding one – the inclusion of time fixed effects in a first-differences model is equivalent to the inclusion of random trends in the levels equation (see, Wooldridge (2010)). Thus, as well as a state-party specific linear trend, we are now also allowing for state specific, and party specific, stochastic trends. The only assumption now necessary is that there is no non-linear state-party time-trend driving our results. It is very unlikely that this would occur. Specifically, interpreting β_1 differently would mean that the fact that a party lost led to voters moving away from that party at the next election, yet voters would not move towards parties that won. This would imply very different preferences than are normally imputed to voters, and be contrary to the canon of models of electoral competition since Downs. The empirical prediction is also contrary to what we observe – as the implied party dynamics are potentially unstable, losing one election would lead to an increased chance of a party losing the next election, and as such we would not expect stable electoral competition. For this reason, we discount this possibility.

The results of (19) are reported in Table (4). We again build up the model step by

step. The key result is the same and robust across all specifications – $\beta_1 < 0$. The overall inference is the same as before, parties exhibit loss-aversion. The precise inference is a little more involved – the results suggest that parties in power react less to an increase in the size of a shock than parties out of power. The coefficient is large, negative, and significant at all conventional levels. Given the comprehensive set of fixed-effects that this specification employs we interpret this result as providing clear evidence for the mechanism that we suggest. Otherwise, as before we do not find a significant effect of the shocks themselves, again due to the inclusion of SY fixed-effects. Column 2 reports standardized coefficients as in column 2 of Table 3, again omitting the SY fixed effects. The quantitative interpretation in the results is also consistent with that in Table 3, the effect of additional movement due to an increase in the shock by 1 standard-deviation compared to the previous period is only around 20% as large for the party not in power.

As discussed in Section 5.1 our preferred measure of shocks is the change in the median voter. However, whilst this represents a natural choice for substantive reasons, we may be concerned that this measure, focusing on the median district, disregards important information. We now re-estimate both (17) and (19) using the change in the mean voter as our measure of the shocks. Columns 1 and 2 of Table 5 report specifications equivalent to parsimonious specification in column 3 of Table 3 and the unrestricted specification of column 6. In both cases the change in the mean voter is negative and significant although the coefficient is now around 40% larger. This larger coefficient is in line with our expectations, since as discussed previously, representatives in seats that are uncompetitive may be expected to respond less to changes in the voter preferences, and in some states the median voter may be in a non-competitive district.

Columns 3 and 4 report the results of repeating this analysis for the first-differenced model. In the parsimonious model, the result is again larger, and still significant. Table 6 considers the parallel decision to focus on a party's median representative and re-estimates the model using mean representatives. We can see that in all cases, both in levels and first differences, and both using the change in the mean and the median voter as the shock, β_1 is significant and indeed is often now more precisely measured. Whilst the coefficient on β_2 is always insignificant and its sign varies across specifications. These results suggest that our previous assumptions were, if anything conservative, and provide strong support for the predictions of the theory.

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.[19] As well as making the states we study as similar as possible, a second advantage of restricting the

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

sample is so that the setting we study empirically is as close as possible to that analyzed theoretically. However, it is nevertheless important to check that our results are not an artefact of this choice. Columns 5 and 6 of Table 5 report the parsimonious and unrestricted versions of our fixed-effects model, and columns 7 and 8 do likewise for the first-differenced model. The fixed-effect coefficients are largely unchanged suggesting that our results are not being driven by the choice of state. The coefficients for the first-differenced model are slightly larger, and a little more precise. Results, not reported, show that these results are robust to using the median-voter as our shock measure. Taking the results reported in Tables 5 and 6 as a whole, it is clear that the results are not being driven by our modelling assumptions.

6 Conclusions

This paper studies how voter loss-aversion affects electoral competition in a Downsian setting. Assuming that voters' reference point is the status quo, we show that loss-aversion has a number of effects. 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 moderate voters' ideal point than in the absence of loss-aversion. In a dynamic extension of the model, we consider how parties strategically manipulate the status quo to their advantage, and we find that this increases policy rigidity. Finally, we show that with loss-aversion, incumbents adjust less than challengers to changes in voter preferences. The underlying force is that the status quo works to the advantage of the incumbent. This prediction of asymmetric adjustment is new, and we test it using elections to US state legislatures. The results are as predicted: incumbent parties respond less to shocks in the preferences of the median voter.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	P1	P10	P50	P90	P99
				Republicans						
$Position_{pst}$	214	.137	.043	.041	.215	.052	.073	.148	.187	.202
$\Delta Position_{pst}$	214	.004	.014	-.053	.064	-.03	-.01	.003	.022	.04
$Shock_{pst}$	214	.001	.015	-.048	.046	-.042	-.014	.001	.02	.042
				Democrats						
$Position_{pst}$	214	-.05	.064	-.173	.11	-.167	-.128	-.066	.051	.096
$\Delta Position_{pst}$	214	-.005	.012	-.063	.036	-.046	-.019	-.004	.008	.019
$Shock_{pst}$	214	0	.014	-.039	.051	-.028	-.016	-.001	.018	.035

Table 2: Cross-correlation table

Variables	$\Delta Position_{pst}$	$Shock_{pst}$	$Inc_{pst} \times Shock_{pst}$
$\Delta Position_{pst}$	1		
$Shock_{pst}$	0.271	1	
$Inc_{pst} \times Shock_{pst}$	0.063	0.518	1

Table 3: Fixed Effect Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Shock_{pst}$	0.44***		0.07	0.07	0.10	0.11	-0.29***
	(0.14)		(0.12)	(0.12)	(0.12)	(0.12)	(0.09)
$Inc_{pst} \times Shock_{pst}$	-0.47***		-0.62***	-0.62***	-0.63***	-0.63***	
	(0.15)		(0.08)	(0.08)	(0.08)	(0.08)	
$Inc_{pst} \times Shock^2_{pst}$				0.33		-2.42	-2.38
				(2.81)		(2.96)	(4.57)
Inc_{pst}					0.00***	0.01***	0.00**
					(0.00)	(0.00)	(0.00)
$Shock^S_{pst}$		0.37***					
		(0.12)					
$Inc_{pst} \times Shock^S_{pst}$		-0.30***					
		(0.09)					
R^2	0.092	0.092	0.207	0.207	0.225	0.227	0.082
N	428	428	428	428	428	428	428

All data are for elections to the lower-houses of state legislatures. The dependent variable is the change in a party's platform as measured by that of the median candidate. $Shock_{pst}$ measures the change in the median voter's preferences as defined in Equation 14. Inc_{pst} is a binary variable that is equal to 1 if a party won more than 50% of the seats at the previous election. $Shock^S_{pst}$ and $Inc_{pst} \times Shock^S_{pst}$ are standardised coefficients, and the dependent variable in the associated regression is also standardised. All columns include $State \times Party$ and $Party \times Year$ fixed-effects. Columns 3-7 additionally include $State \times Year$ fixed effects. Standard errors, clustered by both $State \times Party$ and $Party \times Year$ in parentheses. $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: First Differences Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
$Shock_{pst}$	0.07					
	(0.12)					
$Inc_{pst} \times Shock_{pst}$	-0.62***					
	(0.08)					
$Inc_{pst} \times Shock^2_{pst}$	0.33					
	(2.81)					
$\Delta Shock_{pst}$			0.17	0.17	0.22	0.22
			(0.12)	(0.12)	(0.14)	(0.14)
$\Delta(Inc_{pst} \times Shock_{pst})$			-0.68***	-0.67***	-0.67***	-0.68***
			(0.12)	(0.12)	(0.13)	(0.13)
$\Delta(Inc_{pst} \times Shock^2_{pst})$				2.56		-0.79
				(2.58)		(1.96)
ΔInc_{pst}					0.01***	0.01***
					(0.00)	(0.00)
$\Delta Shock^S_{pst}$		0.40***				
		(0.11)				
$\Delta(Inc_{pst} \times Shock_{pst})^S$		-0.34***				
		(0.10)				
R^2	0.207	0.107	0.219	0.221	0.248	0.248
N	428	366	366	366	366	366

The dependent variable is the first difference of the change in a party's plaform except for columns 1 and 2 where it is the change in a party's platform. Δ denotes first differences. All columns include $State \times Year, State \times Party$ and $Party \times Year$ fixed-effects except for column 2 which omits the $State \times Year$ fixed-effects. Other details as for Table 3.

Table 5: Robustness Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Shock_{pst}$ (Mean)	0.09	0.10						
	(0.12)	(0.12)						
$Inc_{pst} \times Shock_{pst}$ (Mean)	-0.70***	-0.70***						
	(0.08)	(0.08)						
Inc_{pst}		0.00***				0.00**		
		(0.00)				(0.00)		
$Inc_{pst} \times Shock^2_{pst}$ (Mean)		0.80						
		(3.33)						
$\Delta Shock_{pst}$ (Mean)			0.13	0.15				
			(0.13)	(0.14)				
$\Delta(Inc_{pst} \times Shock_{pst})$ (Mean)			-0.72***	-0.70***				
			(0.14)	(0.14)				
ΔInc_{pst}				0.01***				0.00***
				(0.00)				(0.00)
$\Delta(Inc_{pst} \times Shock^2_{pst})$ (Mean)				0.57				
				(2.82)				
$Shock_{pst}$					-0.07	-0.06		
					(0.06)	(0.06)		
$(Inc_{pst} \times Shock_{pst})$					-0.54***	-0.54***		
					(0.05)	(0.05)		
$(Inc_{pst} \times Shock^2_{pst})^2$						-2.59		
						(2.84)		
$\Delta Shock_{pst}$							-0.05	-0.04
							(0.04)	(0.05)
$\Delta(Inc_{pst} \times Shock_{pst})$							-0.52***	-0.51***
							(0.08)	(0.07)
$\Delta(Inc_{pst} \times Shock^2_{pst})^2$								-0.41
								(2.18)
R^2	0.198	0.220	0.202	0.236	0.150	0.158	0.143	0.151
N	428	428	366	366	552	552	471	471

(Mean) indicates that the voters' preferences are measured using those of the mean voter instead of the median voter. Columns 5-8 report results expanding the sample to include states which have multi-member districts. Δ denotes first differences. Other details as for Table 3.

Table 6: Party Means

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Shock_{pst}$	0.01	0.05						
	(0.15)	(0.14)						
$Inc_{pst} \times Shock_{pst}$	-0.48***	-0.49***						
	(0.12)	(0.11)						
Inc_{pst}		0.01***				0.01***		
		(0.00)				(0.00)		
$Inc_{pst} \times Shock^2_{pst}$		-3.17						
		(3.64)						
$\Delta Shock_{pst}$			0.09	0.13				
			(0.17)	(0.17)				
$\Delta Inc_{pst} \times Shock_{pst}$			-0.54***	-0.53***				
			(0.16)	(0.16)				
ΔInc_{pst}				0.01**				0.01**
				(0.00)				(0.00)
$\Delta(Inc_{pst} \times Shock^2_{pst})$				0.27				
				(2.93)				
$Shock_{pst}$ (Mean)					0.14	0.14		
					(0.15)	(0.14)		
$Inc_{pst} \times Shock_{pst}$ (Mean)					-0.66***	-0.66***		
					(0.14)	(0.14)		
$Inc_{pst} \times Shock^2_{pst}$ (Mean)						0.34		
						(3.83)		
$\Delta Shock_{pst}$ (Mean)							0.22	0.24
							(0.17)	(0.16)
$\Delta(Inc_{pst} \times Shock_{pst})$ (Mean)							-0.76***	-0.73***
							(0.20)	(0.19)
$\Delta(Inc_{pst} \times Shock^2_{pst})$ (Mean)								3.74
								(3.47)
R^2	0.126	0.149	0.121	0.143	0.150	0.173	0.157	0.185
N	428	428	366	366	428	428	366	366

The dependent variable is the change in party position, or the first-difference of the change in party position in columns 3,4,7, and 8, measured using the position of a party's mean representative. (Mean) indicates that the voters' preferences are measured using those of the mean voter instead of the median voter. Other details as for Table 3.

References

Adams, J., M. Clark, L. Ezrow, and G. Glasgow (2004): "Understanding Change and Stability in Party Ideologies: Do Parties Respond to Public Opinion or to Past Election Results?" *British Journal of Political Science*, 34, 589–610.

Alesina, A. and F. Passarelli (2015): "Loss Aversion in Politics," Tech. rep., National Bureau of Economic Research, Cambridge, MA.

Aragones, E. (1997): "Negativity Effect and the Emergence of Ideologies," .

Ashworth, S. and E. Bueno De Mesquita (2014): "Is Voter Competence Good for Voters?: Information, Rationality, and Democratic Performance," *American Political Science Review*, 108, 565–587.

Banks, J. S. and J. Duggan (2008): "A Dynamic Model of Democratic Elections in Multidimensional Policy Spaces," *Quarterly Journal of Political Science*, 3, 269–299.

Baumeister, R. F., E. Bratslavsky, C. Finkenauer, and K. D. Vohs (2001): "Bad is stronger than good." *Review of General Psychology*, 5, 323–370.

Bernhardt, D., O. Cï£¡mara, and F. Squintani (2011): "Competence and Ideology," *The Review of Economic Studies*, 78, 487–522.

Bernhardt, D., S. Dubey, and E. Hughson (2004): "Term limits and pork barrel politics," *Journal of Public Economics*, 88, 2383–2422.

Bernhardt, D., J. Duggan, and F. Squintani (2009): "The Case for Responsible Parties," *American Political Science Review*, 103, 570.

Besley, T. and A. Case (2003): "Political Institutions and Policy Choices : Evidence from the United States," *Journal of Economic Literature*, XLI, 7–73.

Bisin, A., A. Lizzeri, and L. Yariv (2015): "Government Policy with Time Inconsistent Voters," *American Economic Review*, 105, 1711–1737.

Bloom, H. S. and H. D. Price (1975): "Voter response to short-run economic conditions: The asymmetric effect of prosperity and recession," *American Political Science Review*, 69, 1240–1254.

Bonica, A. (2014a): "Database on Ideology, Money in Politics, and Elections: Public version 1.0," .

——— (2014b): "Mapping the Ideological Marketplace," *American Journal of Political Science*, 58, 367–386.

Buttice, M. K. and W. J. Stone (2012): "Candidates Matter: Policy and Quality Differences in Congressional Elections," *The Journal of Politics*, 74, 870–887.

Callander, S. (2006): "Context-dependent Voting," .

Callander, S. and C. H. Wilson (2008): "Context-dependent voting and political ambiguity," *Journal of Public Economics*, 92, 565–581.

Campbell, J. E. (1986): "Presidential Coattails and Midterm Losses in State Legislative Elections," *The American Political Science Review*, 80, 45.

Caughey, D. and J. S. Sekhon (2011): "Elections and the Regression Discontinuity Design: Lessons from Close U.S. House Races, 1942-2008," *Political Analysis*, 19, 385–408.

Chiang, C.-F. and B. Knight (2011): "Media Bias and Influence: Evidence from Newspaper Endorsements," *The Review of Economic Studies*, 78, 795–820.

de Meza, D. and D. C. Webb (2007): "Incentive Design under Loss Aversion," *Journal of the European Economic Association*, 5, 66–92.

Duggan, J. (2000): "Repeated Elections with Asymmetric Information," *Economics & Politics*, 12, 109–119.

Ellis, A. (2011): "Condorcet meets Ellsberg," 1–41.

Erikson, R. S., G. C. Wright, and J. P. McIver (1993): *Statehouse Democracy: Public Opinion and Policy in the American States*, Cambridge University Press.

Fowler, J. H. (2005): "Dynamic Responsiveness in the U. S. Senate," *American Journal of Political Science*, 49, 299–312.

Freund, C. and c. Ì. Özden (2008): "Trade policy and loss aversion," *American Economic Review*, 98, 1675–1691.

Ghirardato, P. and J. Katz (2006): "Indecision Theory: Weight of Evidence and Voting Behavior," *Journal of Public Economic Theory*, 8, 379–399.

Gomez, B. T., T. G. Hansford, and G. A. Krause (2008): "The Republicans Should Pray for Rain: Weather, Turnout, and Voting in U.S. Presidential Elections," *The Journal of Politics*, 69.

Healy, A. and G. S. Lenz (2014): "Substituting the End for the Whole: Why Voters Respond Primarily to the Election-Year Economy," *American Journal of Political Science*, 58, 31–47.

Jervis, R. (1992): "Political Implications of Loss Aversion," *Political Psychology*, 13, 187.

Kam, C. D. and D. R. Kinder (2012): "Ethnocentrism as a Short-Term Force in the 2008 American Presidential Election," *American Journal of Political Science*, 56, 326–340.

Kappe, R. (2013): "Asymmetric Evaluations : Government Popularity and Economic Performance in the United Kingdom -," 13–15.

Kernell, G. (2009): "Giving order to districts: Estimating voter distributions with national election returns," *Political Analysis*, 17, 215–235.

Kőszegi, Botond and Rabin, Matthew (2007): "Reference-Dependent Risk Attitudes," *American Economic Review*, 97, 1047–1073.

——— (2009): "Reference-Dependent Consumption Plans," *American Economic Review*, 99, 909–936.

Klarner, C., W. Berry, T. Carsey, M. Jewell, R. Niemi, L. Powell, and J. Snyder (2013): "State Legislative Election Returns (1967-2010)," .

Klein, J. G. (1991): "Negativity Effects in Impression Formation: A Test in the Political Arena," *Personality and Social Psychology Bulletin*, 17, 412–418.

Kőszegi, B. and M. Rabin (2006): "A Model of Reference-Dependent Preferences," *The Quarterly Journal of Economics*, 121, 1133–1165.

Lau, R. R. (1985): "Two Explanations for Negativity Effects in Political Behavior," *American Journal of Political Science*, 29, 119.

Levy, G. and R. Razin (2015): "Correlation Neglect, Voting Behavior, and Information Aggregation," *American Economic Review*, 105, 1634–1645.

Lockwood, B. (2015): "Confirmation Bias , Media Slant , and Electoral Accountability," .

Nannestad, P. and M. Paldam (1997): "The grievance asymmetry revisited: A micro study of economic voting in Denmark,1986âĂŞ1992," .

Ortoleva, P. and E. Snowberg (2013): "Overconfidence in Political Behavior," *American Economic Review*, 105, 504–535.

Osborne, M. J. (1995): "Spatial Models of Political Competition under Plurality Rule: A Survey of Some Explanations of the Number of Candidates and the Positions They Take," *The Canadian Journal of Economics*, 28, 261.

Passarelli, F. and G. Tabellini (2013): "Emotions and political unrest," .

Persson, T. and G. Tabellini (2000): *Political Economics: Explaining Economic Policy*, Zeuthen Lecture Books, Cambridge MA: The MIT Press, 1st ed.

Poole, K. T. (2007): "Changing minds? Not in Congress!" *Public Choice*, 131, 435–451.

Poole, K. T. and H. Rosenthal (2006): *Ideology and Congress*, Edison, NJ: Transaction Publishers, 1st ed.

Razin, R. and G. Levy (2015): "Does Polarization of Opinions Lead to Polarization of Platforms? The Case of Correlation Neglect," *Quarterly Journal of Political Science*.

Soroka, S. and S. McAdams (2015): "News, Politics, and Negativity," *Political Communication*, 32, 1–22.

Soroka, S. N. (2006): "Good news and bad news: Asymmetric responses to economic information," *Journal of Politics*, 68, 372–385.

Spiegler, R. (2013): "Placebo reforms," *American Economic Review*, 103, 1490–1506.

Stone, W. J. (1980): "The dynamics of constituency electoral control in the house," *American Politics Research*, 8, 399–424.

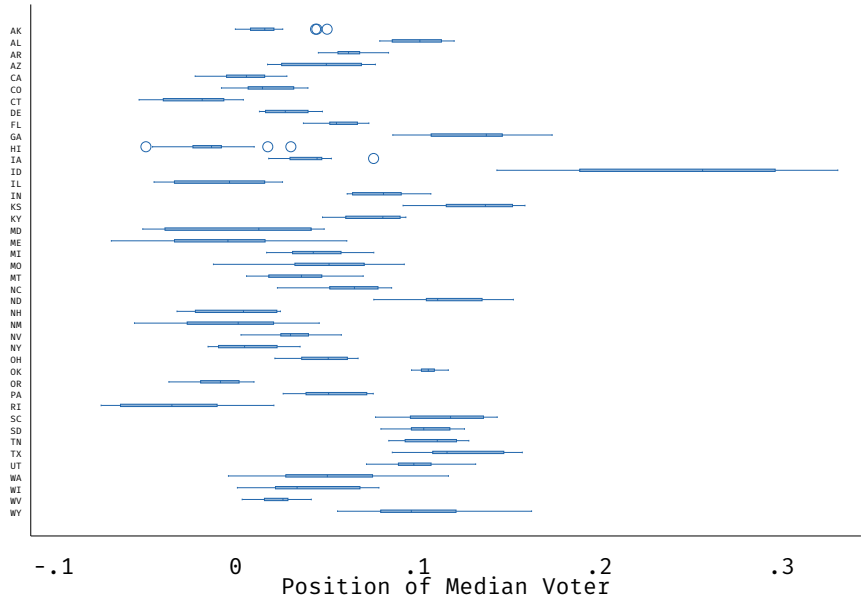
Tukey, J. (1977): *Exploratory data analysis*, Reading, Mass.

Wittman, D. (1983): "Candidate Motivation: A Synthesis of Alternative Theories," *The American Political Science Review*, 77, 142–157.

Wooldridge, J. M. (2010): *Econometric Analysis of Cross Section and Panel Data*, Cambridge, MA: The MIT Press, 2nd ed.

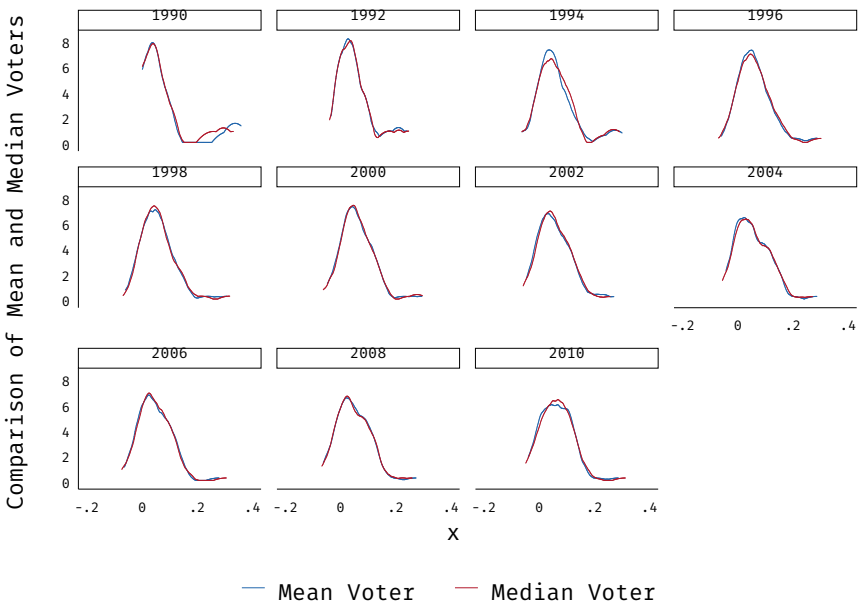
A Appendix

Figure A.1: 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 $x_i > 1.5*IQR+X_{75}$ and $x_i < 1.5*IQR+X_{25}$ 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 A.2: Comparison of Mean and Median Voters



A.1 Proofs of Propositions and Other Results.

Concavity of π_L, π_R in x_L, x_R. W.l.o.g., we consider only π_R. First, from (6), at all points of differentiability

$$\frac{\partial \pi_R}{\partial x_R} = \frac{\partial p}{\partial x_R}(u_R(x_R) + M - u_R(x_L)) + p(x_L, x_R)u_R'(x_R) \tag{20}$$

So, differentiating (20), we get;

$$\frac{\partial^2 \pi_R}{\partial x_R^2} = 2\frac{\partial p}{\partial x_R}u_R'(x_R) + p(x_L, x_R)u_R''(x_R) + \frac{\partial^2 p}{\partial x_R^2}(u_R(x_R) + M - u_R(x_L)) \tag{21}$$

Now, by inspection of (5), plus $u(x) = -x$ when $x > 0$, we can write generally that

$$\frac{\partial p}{\partial x_R} = -(1+\lambda)f(z) < 0$$

where $\lambda = 1$ or $\lambda > 1$, and where $z = u(x_R) + v(x_R; x_S) - u(x_L) - v(x_L; x_S)$. So, from (21), as $u_R'(x_R) > 0$, and also $u_R''(x_R) \leq 0$ from A2, strict concavity follows as long as $\frac{\partial^2 p}{\partial x_R^2} \leq 0$. But differentiating again, and recalling again that $\frac{\partial z}{\partial x_R} = -(1+\lambda)$ from A1,

$$\frac{\partial^2 p}{\partial x_R^2} = -(1+\lambda)^2 f'(z)$$

So, for concavity we just need $f'(z) \geq 0$, which is guaranteed by A2. □

Proof of Lemma 1. (a) To prove uniqueness, let

$$g(x;\lambda) = 0.5u_R'(x) - (1+\lambda)f(0)(u_R(x) + M - u_R(-x)) \tag{22}$$

Then, suppose to the contrary that $g(x;\lambda) = 0$ has two solutions, x^* and $x^{**} > x^*$. Then, as g is differentiable, by the fundamental theorem of calculus,

$$g(x^{**};\lambda) - g(x^*;\lambda) = \int_{x^*}^{x^{**}} g_x(x;\lambda)d\lambda = 0. \tag{23}$$

But, by differentiation of (22):

$$g_x(x;\lambda) = 0.5u_R''(x) - (1+\lambda)f(0)(u_R'(x) + u_R'(-x)) < 0,\ x \in [-1,1] \tag{24}$$

So, $\int_{x^*}^{x^{**}} g_x(x;\lambda)d\lambda < 0$, which contradicts (23).

(b) To prove $x^+ > x^-$, note that from $g(x;\lambda) = 0$,

$$\frac{dx}{d\lambda} = \frac{g_\lambda(x;\lambda)}{-g_x(x;\lambda)} = -\frac{f(0)(u_R(x) + M - u_R(-x))}{-g_x(x;\lambda)} < 0$$

So, as $g(x^-;\lambda)=0, g(x^+;1)=0$, the result follows.

(c) to prove that $x^->0$, note that at $x\le 0, u_R(x)-u_R(-x)\le 0$, so

$$\begin{aligned} g(0;\lambda) &= 0.5u_R'(x)-(1+\lambda)f(0)(u_R(x)+M-u_R(-x)) \\ &\ge 0.5u_R'(x)-(1+\lambda)f(0)M \\ &\ge 0.5u_R'(0)-(1+\lambda)f(0)M \\ &> 0 \end{aligned}$$

where the third inequality follows from concavity of $u_R(.)$, and the last by assumption A3. So, $g(x;\lambda)$ cannot have a negative or zero solution. □

Proof of Proposition 1. (a) Assume a symmetric equilibrium with $x^*\neq|x_S|$. Then starting at this equilibrium, from (5), if $u(x^*)>u(x_S)$, any small change in x_R of Δ generates a change $-\Delta 2f(0)$ in p. Thus, starting at the symmetric equilibrium, the change in π_R is

$$\Delta\pi_R = 0.5u_R'(x^*)\Delta - 2f(0)(u_R(x^*)+M-u_R(-x^*))\Delta$$

So, the symmetric equilibrium x^* must satisfy

$$0.5u_R'(x^*)-2f(0)(u_R(x^*)+M-u_R(-x^*))=0 \tag{25}$$

Because π_R is concave in x_R, by A2, condition (25) is also sufficient for x^* to be the equilibrium. By Lemma 1, (25) has a unique solution $x^*=x^+$. So, this is the equilibrium if $u(x^+)>u(x_S)$ or $x^+<|x_S|$.

(b) Similarly, if $u(x^*)<u(x_S)$, from (5), starting at this equilibrium, any small change in x_R of Δ generates a change $-\Delta(1+\lambda)f(0)$ in p. Thus, starting at the symmetric equilibrium, the change in π_R is

$$\Delta\pi_R = 0.5u_R'(x^*)\Delta - (1+\lambda)f(0)(u_R(x^*)+M-u_R(-x^*))\Delta$$

So, the symmetric equilibrium x^* must satisfy

$$0.5u_R'(x^*)-(1+\lambda)f(0)(u_R(x^*)+M-u_R(-x^*))=0 \tag{26}$$

Because π_R is concave in x_R, by A2, condition (26) is also sufficient for x^* to be the equilibrium. By Lemma 1, (26) has a unique solution $x^*=x^-$. So, this is the equilibrium if $u(x^-)<u(x_S)$ or $x^->|x_S|$.

(c) Now, if $u(x^+)\le u(x_S)\le u(x^-)$, conjecture that the equilibrium is $x_R=-x_L=x_S$. W.l.o.g., to lighten notation, assume that $x_S>0$. Starting at this equilibrium, an increase (decrease) in x_L will decrease (increase) p_L by $2f(0)$ (resp. $(1+\lambda)f(0)$). So, for an

equilibrium we require

$$0.5u_R'(x_S)-(1+\lambda)f(0)(u_R(x_S)+M-u_R(-x_S))\Delta \leq 0 \leq 0.5u_R'(x_S)-2f(0)(u_R(x_S)+M-u_R(-x_S)) \tag{27}$$

Because π_R is concave in x_R, by A2, condition (27) is also sufficient for x_S to be the equilibrium. But, by the definitions of x^+ and x^-, any x_S with $u(x^+) \leq u(x_S) \leq u(x^-)$ or $x^+ \geq |x_S| \geq x^-$ will satisfy (27).

Finally, for $u(x^+) \leq u(x_S) \leq u(x^-)$, suppose that there is some equilibrium $x^* \neq x_S$. If $u(x^*) > u(x_S)$, then it must be that $x^* = x^+$; but this contradicts the assumption that $u(x^+) \leq u(x_S)$. If $u(x^*) < u(x_S)$, then it must be that $x^* = x^-$; but this contradicts the assumption that $u(x^-) \geq u(x_S)$.

(d) Finally, note that from (8), (24) that

$$\frac{dx^-}{d\lambda} = -\frac{f(0)\,(u_R(x^-) - u_L(-x^-) + M)}{-g_x(x^-;\lambda)} \tag{28}$$

Again from (24) , $g_x(x^-;\lambda) < 0$. Also, $u_R(x^-) + M > -u_L(-x^-)$. So, from (28), x^- is decreasing in λ. Moreover, from inspection of (7), x^+ is independent of λ. Thus, the interval $[x^-, x^+]$ is increasing in λ. □

Proof of Proposition3. (a) Due to symmetry, we can focus on party R. We assume a symmetric cutoff equilibrium at $t+1$ as described in the Proposition. Now the argument follows the proof of Proposition 1, noting that (12) must be added to party payoffs, also noting that in (11), $\tilde{x}^+ = x^+$ by assumption.

(b) Let x_S be the status quo at the beginning of period t. Assume a symmetric equilibrium in t with $x^* < |x_S|$. Then as $x^* < |x_S|$, i.e. $u(x^*) > u(x_S)$, from (5) , any small change in (say) x_R of Δ generates a change $\Delta 2f(0)$ in p. Moreover, in the event that party R wins the election, which occurs with probability 0.5 at the symmetric equilibrium, next period's status quo will change by Δ, inducing an effect $\delta\beta V'(x^*)$ on payoffs. So, deviation from x^* is not profitable if and only if

$$2f(0)(u_R(x^*) + M - u_R(-x^*)) + 0.5u_R'(x^*) + 0.5\delta\beta V'(x^*) = 0 \tag{29}$$

Let the solution to (29) be $\tilde{x}^+$. Now suppose that at $x^* = \tilde{x}^+$, $x^+ \geq x^* \geq \tilde{x}^-$, so from (11), $V'(x^*) = 0.5(u_R'(x^*) - u_R'(-x^*)) < 0$, where the last inequality follows from the strict concavity of $u_L(.)$. Then, from (29),

$$2f(0)(u_R(x^*) + M - u_R(-x^*)) + 0.5u_R'(x^*) > 0$$

But then, from concavity of π_R in x_R, $x^* > x^+$, a contradiction. So, in (29), $V'(x^*) = 0$, and consequently, $x^* = x^+$, as claimed. So, we have proved that if $|x_S| > x^+$, $x^* = x^+$.

(c) Now assume a symmetric equilibrium with $x^* > |x_S|$. Then as $x^* > |x_S|$, i.e. $u(x^*) < u(x_S)$, from (5), any small change in (say) x_R of Δ generates a change $\Delta(1+\lambda)f(0)$ in p. Moreover, as in case (b), in the event that party R wins the election, which occurs with probability 0.5 at the symmetric equilibrium, next period's status quo will change by Δ, inducing an effect $\delta\beta V'(x^*)$ on payoffs. So, deviation from x^* is not profitable if and only if

$$(1+\lambda)f(0)(u_R(x^*)+M-u_R(-x^*))+0.5u_R'(x^*)+0.5\delta\beta V'(x^*)=0 \tag{30}$$

Let the solution to (30) be $\tilde{x}^-$. Now suppose that at $x^*=\tilde{x}^-, x^+ < x^*$ so from (11), $V'(x^*)=0$. Then, from (30),

$$2f(0)(u_R(x^*)+M-u_R(-x^*))+0.5u_R'(x^*)=0 \tag{31}$$

But then, from (31), $x^*=x^-$, so $x^*=x^- < x^+$, a contradiction. So, in (30), it must be that $V'(x^*)=0.5(u_R'(x^*)-u_R'(-x^*))$, and consequently, $x^*=\tilde{x}^-$, where $\tilde{x}^-$ solves

$$2f(0)(u_R(x^*)+M-u_R(-x^*))+0.5u_R'(x^*)+\beta\delta 0.25(u_R'(x^*)-u_R'(-x^*))=0 \tag{32}$$

as claimed. So, we have proved that if $|x_S| < \tilde{x}^-$, $x^*=\tilde{x}^-$.

(d) Now, if $x^+ \geq |x_S| \geq \tilde{x}^-$, we need to show that the only equilibrium is $x^*=|x_S|$. Suppose first that this is the case. To lighten notation, assume that $x_S > 0$, so $|x_S| = x_S$. Then, starting at x_S, an increase (decrease) in x_R will increase (decrease) p_R by $2f(0)$ (resp. $(1+\lambda)f(0)$). So, for $x^*=x_S$ at equilibrium, we require

$$\begin{aligned} 2f(0)(u_R(x_S)+M-u_R(-x_S))+ & \\ 0.5u_R'(x_S)+0.5\delta\beta V'(x_S) & \leq 0 \\ & \leq (1+\lambda)f(0)(u_R(x_S)+M-u_R(-x_S)) \\ & \quad +0.5u_R'(x_S)+0.5\delta\beta V'(x_S) \end{aligned} \tag{33}$$

Moreover, as $x^+ \geq x_S \geq \tilde{x}^-$, from (11), we must have $V'(x_S)=0.5(u_R'(x_S)-u_R'(-x_S))$. Thus, from (33), we must have

$$(1+\lambda)f(0)(u_R(x_S)+M-u_R(-x_S))+0.5u_R'(x_S)+\delta\beta 0.25(u_R'(x_S)-u_R'(-x_S)) \geq 0$$

Thus, from the definition of $\tilde{x}^-$, $x_S \geq \tilde{x}^-$ as required. It remains to prove that $x_S \leq x^+$. Suppose to the contrary that $x_S > x^+$. Then from (11), we must have $V'(x_S)=0$. But then from (33),

$$2f(0)(u_R(x_S)+M-u_R(-x_S))+0.5u_R'(x_S) \leq 0$$

But, then by concavity of π_R in x_R, $x_S < x^+$, a contradiction.

(e) Finally, for $u(x^+) \leq u(x_S) \leq u(x^-)$, suppose that there is some equilibrium $x^* \neq x_S$.

If $u(x^*) > u(x_S)$, then it must be that $x^* = x^+$; but this contradicts the assumption that $u(x^+) \leq u(x_S)$. If $u(x^*) < u(x_S)$, then it must be that $x^* = x^-$; but this contradicts the assumption that $u(x^-) \geq u(x_S)$. □

Proof of Proposition 4. Without loss of generality, we focus on a change in β.From (32), we know that $\tilde{x}^-$ is the unique solution to

$$(1+\lambda)f(0)(u_R(x) + M - u_R(-x)) + 0.5u_R'(x) + 0.5\delta\beta V'(x) = 0$$

Totally differentiating this expression, we get

$$\frac{d\tilde{x}^-}{d\beta} = \frac{0.5\delta V'(x)}{-g_x(x;\lambda) - 0.5\delta\beta V''(x)} \tag{34}$$

where $g_x(x;\lambda)$ is defined in (24). As noted there, $g_x(x;\lambda) < 0$, and moreover, from A4, $V''(x) \leq 0$. So, the denominator in (34) is positive. Finally, from the concavity of $u_L(.)$, $V'(x) < 0$. So, from (34), $\frac{d\tilde{x}^-}{d\beta} < 0$, as required. □

A.2 Equilibrium with a Koszegi-Rabin Reference Point.

We follow Kőszegi and Rabin (2006) in characterizing the voter reference point. From the point of the individual voter, the reference point is stochastic with support (x_L, x_R) and probabilities $1-p$, p. We also assume A1 and A2 throughout, so in particular, $u(x_R) = -|x|$ throughout. Also, we assume the following variant of A3 above, which ensures that there is less than full convergence of equilibrium platforms:

A3'. $u_R(0) = -u_L(0) = l'(1) > \frac{(1+\lambda)f(0)}{1+(1+\lambda)f(0)}M$.

(i)The individual voter can choose to vote for party R or party L. We now consider three cases.

Case 1: $u(x_R) > u(x_L)$. Then given the reference point, expected utilities from voting for R, L respectively are

$$\begin{aligned} Eu_R &= pu(x_R) + (1-p)(2u(x_R) - u(x_L)), \\ Eu_L &= p(u(x_L) + \lambda(u(x_L) - u(x_R)) + (1-p)u(x_L) \end{aligned}$$

So, a moderate will vote for R if

$$Eu_R - Eu_L = (2 - p(1+\lambda))(u(x_R) - u(x_L)) \geq \varepsilon$$

So, p is defined by

$$p = F((2 - p(1+\lambda))(u(x_R) - u(x_L))) \tag{35}$$

Case 2: $u(x_R) < u(x_L)$. Then

$$\begin{aligned} Eu_R &= pu(x_R) + (1-p)(u(x_R) + \lambda(u(x_R) - u(x_L)), \\ Eu_L &= p(2u(x_R) - u(x_L)) + (1-p)u(x_L) \end{aligned}$$

So, a moderate will vote for R if

$$Eu_R - Eu_L = (1 + \lambda - p(1+\lambda))(u(x_R) - u(x_L)) \geq \varepsilon$$

So, p is defined by

$$p = F\left((1 + \lambda - p(1+\lambda))(u(x_R) - u(x_L))\right) \tag{36}$$

Case 3. $u(x_R) = u(x_L)$.Then clearly, all gain-loss utility terms disappear, and so a moderate will vote for R if $(u(x_R) - u(x_L)) \geq \varepsilon$. So, in this case, p is defined by

$$p = F((u(x_R) - u(x_L))$$

(ii) Now consider a symmetric equilibrium where $x_R = -x_L = x^* > 0$. From Case 3, in this case, $p = F(0) = 0.5$. It is sufficient to study the behavior of one party, and we choose the R party. So, the effects on R–party welfare of a small increase and decrease in x_R, starting at $x_R = -x_L = x^*$, $p = 0.5$, are

$$\begin{aligned} 0.5u_R'(x^*) + \left(\frac{dp}{dx_L}\right)^+ (u_R(x^*) - u_R(-x^*) + M) &= 0 \\ 0.5u_R'(x^*) + \left(\frac{dp}{dx_L}\right)^- (u_R(x^*) - u_R(-x^*) + M) &= 0 \end{aligned}$$

respectively, where$\left(\frac{dp}{dx_L}\right)^+$, $\left(\frac{dp}{dx_L}\right)^-$ are the right-hand and left-hand derivatives of p w.r.t. x_L at $x_R = -x_L = x^*$, $p = 0.5$. Computing these explicitly from (35), (36), using the fact that $u(x_L) > u(x_R)$ for the right-hand derivative, and vice versa, we get

$$\left(\frac{dp}{dx_L}\right)^+ = \left(\frac{dp}{dx_L}\right)^- = -\frac{0.5f(0)(1+\lambda)}{1 + f(0)(1+\lambda)}$$

So, at equilibrium, the LH and RH derivatives are the same. So, any equilibrium must satisfy

$$g(x^*, \lambda) \equiv 0.5u_R'(x^*) - \frac{0.5f(0)(1+\lambda)}{1 + f(0)(1+\lambda)}(u_R(x^*) - u_R(-x^*) + M) = 0 \tag{37}$$

Following the argument in Lemma 1, given assumptions A1, A2, A3', it is easily established that there exists a unique solution to (37) with $x^* > 0$. Moreover, given A1-A3', $g_x(x^*, \lambda) < 0$,

and by inspection, $g_\lambda(x^*, \lambda) < 0$, so

$$\frac{dx^*}{d\lambda} = -\frac{g_\lambda(x^*, \lambda)}{g_x(x^*, \lambda)} < 0$$

So, there is no policy rigidity, but the policy moderation result continues to hold, as claimed. □