Loss Aversion in Politics*

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Abstract

We study loss aversion in elections. We investigate both a median voter model (full convergence in a two candidates election) and a model of partial divergence of policy proposals. First, we show a status quo bias, an endowment effect, and a moderating effect of policies. Second, we show the occurrence of "long term cycles" in policies with self-supporting movements to the right or the left. Finally, we prove that younger societies should be more prone to change and less affected by the status quo bias than older ones. Birth rates and immigration rates determine average age of society.

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1 Introduction

According to Kahneman and Tversky, (1979) individuals "perceive outcomes as gains and losses, rather than as final states of wealth or welfare" (p. 274). Gains and losses are relative to a reference point, and "losses loom larger than gains" (p. 279). Loss aversion in individual decision making is corroborated by wide experimental evidence.[1]

We apply this insight to voting and we show that loss aversion leads to significant and realistic deviations from results of "standard" voting models. We use a unidimensional model of political choice where the voters differ in their evaluation of the costs and benefits of the policy. We assume throughout the paper that the reference point is the "status quo". This seems realistic, since benefits and costs of political reforms are normally assessed relative to the current situation for given existing policies. Our definition of the reference point is therefore *backward-looking*.[2]

We begin with the standard median voter model. This case may represent two situations. One is that of a group of voters (with single peaked preferences) choosing by pairwise comparison amongst a set of alternatives; another one is a two candidate elections in which both candidates only care about winning. Without loss aversion, the policy chosen would be the one preferred by the median voter, and the status quo is irrelevant. Any, even small, change in the preferences of the median voter would lead to a policy change. With loss aversion the status quo matters. For any initial policy level, a mass of voters would vote for the status quo, even if their "rationally" preferred policy (i.e. the policy preferred in the absence of loss aversion) differed from it. A majority in favor of a change in the status quo materializes only

[1] See Barberis (2013), DellaVigna (2009) and Rabin (1998) for a discussion of loss aversion, and extensive references to the empirical literature. A seminal paper providing experimental evidence of loss aversion in political choice is Quattrone and Tversky (1988). Recently Charité et al. (2014) explore empirically how reference points and loss aversion shape individuals' preferences for redistribution. In a laboratory experiment they find that agents who are assigned the role of social planners redistribute much less from rich to poor when recipients are aware of their initial endowments. The authors claim that redistributors take into account that the loss experienced by the rich is larger than the benefit enjoyed by the poor.
Some authors (e.g. Plott and Zeiler, 2005) have raised the concern that existing evidence of loss aversion in riskless choice is de facto driven by subjects' misconceptions of experimental procedures rather than their loss aversion. Robustness of experimental procedures is still a debated issue (e.g. Fehr et al. (2015) report inability to replicate Plott and Zeiler's results).

[2] Of course one might believe that voters do not (or do not only) look backward when they evaluate policy reforms. They might instead contrast reforms against a *forward-looking* reference point reflecting their aspirations, goals, or expectations. For instance, Passarelli and Tabellini (2016) compute reference policies from an individual notion of fairness. Their paper is an instance of how political reference points may form endogenously. On endogenous reference points, Köszegi and Rabin (2006, 2007) and Ok et al. (2015) represent breakthrough contributions. DellaVigna et al. (2016) is an instance of reference point as a weighted average of past states of the world.

if a sufficiently large shock on the preferences of the median occurs. Once a reform adopted by the majority becomes the new status quo, a larger majority of voters does not want to undo it: a sort of *political endowment effect*. Moreover, if the status quo changes, the outcome is not independent of the initial status quo. Finally, loss aversion determines a *moderating effect*: the most extreme types prefer less extreme policies.

Needless to say this is not the only model delivering a status quo bias. In Krehbiel (1998) and in the extensive subsequent literature on pivotal voting, the status quo bias may occur because the majority's ability to act is tempered by the executive veto and filibuster procedures, which operate in practice as a super-majority threshold. Differently from us, this model predicts that the status quo is an equilibrium only when it is a moderate policy.[3] In our model the bias does not depend upon institutional details, order of voting, agenda setting, etc. It simply arises from voters' preferences. The size of the status quo bias does not depend on any institutional feature but only upon the psychological cost due to loss aversion.

In a multi-period setting, voters take the dynamic effect of their loss aversion in future periods into account, where a period is defined as the length of time in which the status quo becomes the new reference point. The voters put less weight on their current experience of loss, so that they are more prone to change the current status quo. Since this is more likely to happen among young voters with a longer horizon, we characterize an intergenerational conflict about policy reforms purely based upon the horizon of voters. The old do not want to bear the psychologically costly change today because their future horizon in which to enjoy the benefits of it is shorter. Loss aversion increases political cohesion (reduces ideological differences) amongst those with a shorter time horizon, raising their chance to play a pivotal role. Thus ageing societies should be less prone to change. We show in fact that a reduction in the birth rate would lower the likelihood of policy changes. However when a change occurs, younger societies are prone to more radical changes, an implication which is eminently testable and seems realistic. It can account for the "generation gap" that opened up over Scotland's independence referendum in 2014. The vast majority of young Scots voted for secession, while the final outcome was the status quo. Something similar occurred in the 2016 Brexit referendum. Young British voters were largely in favor of "Stay" within the EU, while the old ones favored the

[3] See Krehbiel (2008) for extensive references to other similar models. Other models predict a status quo bias, but for very different reasons. Fernandez and Rodrik (1991) show that when an individual cannot identify herself as winner or loser beforehand, even a reform that benefits a majority gets voted down, because pivotal individuals attach low probability to the event of being among the winners. Uncertainty plays a crucial role in their model. By contrast, with loss aversion the status quo bias does not hinge on uncertainty. In Alesina and Drazen (1990) an inefficient status quo may survive for a while, because of a war of attrition between conflicting groups which blocks policy reform

"Leave" option. "Stay" would have implied future big changes (e.g. relinquishing more sovereignty to the EU or implementing new EU common policies, like the ones on trade, immigration or refugees). "Leave" represented a defensive choice against these changes. The conservative alternative was the latter, which in fact was the one favored by the old voters. Our explanation is not alternative, but complementary, to others emphasizing the difference in the preferences of old and young (e.g., "their status quos were different", or "the young had more to lose from leaving the EU").

We also consider life expectancy growth. Longer residual life reduces perceived loss aversion of both young and old cohorts, making them more willing to change. In ageing societies, like western countries, long life expectancy may counterbalance, at least partially, the status quo bias due to low birth rates. In youthful societies, typically the least developed countries, increasing life expectancy and high birth rates yield favorable conditions for political changes (and perhaps political instability).[4] Another factor which would have the same effect as an increase of birth rate is more immigration, under the assumption that immigrants' average age is lower than that of natives and, as it often happens, immigrants have a higher birth rate than natives (say Europeans or Anglo-Americans).[5] More immigration would then lead to a decrease in the status quo bias and more radical policy changes, which, incidentally can be one of the reasons for an opposition of natives to large immigration flows.

The median voter model may be criticized on empirical grounds: we do not typically observe full convergence in a two party system. We then move to a model based upon Wittman (1977), Calvert (1985), Alesina (1988) and Alesina and Rosenthal (1998), in which candidates (or parties, terms which we use interchangeably) have policy preferences. They trade off the gain in the probability of winning by moving toward the median voter versus the cost of having to implement a policy, if elected, more distant from their preferred one. We assume throughout that a party is committed to implementing after a victory its announced platform.[6] In order for this model to generate interesting results we need to assume some uncertainty about the position of the median voter, otherwise with certainty the only equilibrium would

[4] In G7 countries, median population age rages between 40 (US) and 45 years (Japan). The median's expected residual life rages between 37 (Germany) and 40 years (US). Least developed coutries, display much lower median age (e.g. 30 in Brazil, Mexico and India, or 25 in South Africa) and slightly longer residual life for the median (48 for Mexico; 47 for Bazil; 43 for India; 41 for South Africa). Overall, life expectancy is lower but growing at a faster pace in LDCs than in western countries (Source: www.cia.gov).

[5] Within the US the percentage of foreign born population was 15% in 1990 and 20% in 2013. Voting age is substantially lower amongst naturalized voters than the rest of the population. In 2010, the percentage of naturalized voters within the 25-44 cohort was around 56%, while it was 35% in the rest of the population. Less than 8% of naturalized voters were over-65. This percentage was around 17% in the rest of the population (Source: U.S. Census Bureau, Current Population Survey, November 2004–2014.

[6] See Alesina (1988) for a discussion of this assumption.

be for the two candidates to converge to the median.[7] The moderation effect caused by loss aversion implies that the two candidates converge more relative to a model with no loss aversion. In addition, we derive a sort of *dynamic status quo bias.* Imagine the left-wing candidate wins an election. Then the status quo turns to the left. In the following election the expected policy outcome moves to the left. Under certain conditions both the left-wing and the right-wing candidates move to the left. The right-wing one needs to converge more to fight against the loss aversion of a mass of voters now in a left-wing status quo. The left-wing party instead has more latitude to move closer to its ideal policy. To put it differently, the voters become used to a left-wing status quo and it may take a more and more extreme realization of a right-wing median voter to switch the equilibrium to the right. Thus this model implies a sort of long term cycles in policies. Forward looking parties will internalize in their decision this dynamic effect. Therefore, relative to the case of a one-election horizon, they will converge more since they take into account that a loss in one election determines this intertemporal effect which worsens their prospect in the future, forcing them to move even farther form their most preferred policy.

Summarizing: in a standard two party system model with partial convergence the electoral outcome oscillates within the same two platforms of the two parties, which have no reason to change them. Loss aversion introduces a dynamic in which we have "long term movements" to the left (or the right) and then it would take more time to return to the right (the left) with policy swings in which each election is influenced by the outcome of the previous one. This seems a much more realistic prediction.

In the working paper version of the present paper we applied our model to the relationship between inequality and redistribution, using a Meltzer and Richard (1981) framework.[8] Our results imply a realistic example of status quo bias: even relatively large increase in inequality may not imply more redistribution, a situation which seems to capture well the last two decades in the US.[9] Also a right-wing government elected after a left-wing one may be "forced" to continue redistributive

[7]In fact, suppose not. Then one of the two parties (the one with a policy farther from the median) would lose for sure and that could not be an equilibrium strategy. See Alesina and Rosenthal (1995) for a detailed discussion.

[8]See also the Supplementary Material available from the authors.

[9]Along these lines Bénabou and Ok (2001) suggest that the reason why we do not observe large-scale expropriation in modern democracies is the *Prospect for Upward Mobility* (POUM) hypothesis; some evidence consistent with this hypothesis is provided in Alesina and La Ferrara (2005). Concern for fairness may also be critical as in Alesina and Angeletos (2005). Our explanation is different. Note that in those models even small changes in say social mobility or perception of fairness would lead to a change in policy; in our model a status quo bias implies stickiness of policies and a moderation effect helps making sense of non extreme forms of taxation in democracies. See Alesina and Giuliano (2011) for a review of the literature on preference for redistribution.

policies which have become the status quo. This seems consistent with European right-wing parties never "rocking the boat" too much in terms of cuts in welfare when elected. Perhaps the pro-market policies of Bill Clinton were in part determined by the post-Reagan status quo bias; perhaps the same applies to Tony Blair post-Thatcher (and Major).

A relatively small literature studies the role of loss aversion in collective choices. Herweg and Schmidt (2014) consider a bilateral monopoly (a buyer vs a seller). They show that, should a shock occur, loss aversion would reduce the chance of renegotiating an existing contract. In other words, parties would be likely to *unanimously* agree on keeping the current agreement (i.e., the status quo), even when it is materially inefficient with respect to a new agreement. Other papers which have studied how loss aversion may affect policy outcomes include Grillo (2016) regarding information transmission, Freund and Özden (2008) and Tovar (2009) regarding trade policy, Rees-Jones (2013) on tax sheltering and Bernasconi and Zanardi (2004) on tax evasion.

The present paper contributes to the recent but growing literature on behavioral political economy. Bendor et al. (2011) present political models with boundedly rational voters. Glaeser (2006) informally points out that the presence of bounded rationality makes the case for limiting the size of government. Krusell et al. (2010) examine government policies for agents who are affected by self-control problems. Lizzeri and Yariv (2014) study majority voting when voters are heterogeneous in their degree of self-control. Bisin et al. (2015) present a model of fiscal irresponsibility and public debt. Passarelli and Tabellini (2016) study how emotional unrest affects policy outcomes. DellaVigna et al. (2016) claim, and experimentally test, that voter turnout in large elections can be explained by the positive return of voting on citizens' social image. Ortoleva and Snowberg (2015) point at imperfect information processing which can exacerbate differences in ideology, fuelling extremeness in political behavior. Attanasi et al. (2016) claim that loss averse voters want more protection against the risk of being expropriated by the majority. This leads a society to prefer a constitution with high super-majority rules and overly protective checks and balances. Lockwood and Rockey (2015) propose and empirically test a probabilistic voting model predicting that loss aversion leads incumbents to adjust their platforms less than challengers in response to shocks affecting moderate voters' preferences.

The paper is organized as follows: section 2 lays out the voter's policy preferences with and without loss aversion; section 3 introduces loss aversion in a standard model adopting the majority rule and derives several results in a static setting; section 4 introduces overlapping generations and presents the intergenerational conflict due to loss aversion ; section 5 extends the static model to electoral competition with partial convergence; section 6 studies dynamic aspects of political competition in the presence of loss aversion. The last section concludes. Proofs for all propositions are in Appendix. Supplementary Material containing theoretical extensions, some data, and a parametric model is available on the authors' websites.

2 Policy preferences

2.1 Without Loss Aversion

Consider a society with a continuum of individuals/voters, heterogeneous in some parameter, t, which we call *type*. Let $F(t)$ be the distribution of t, which is common knowledge, at least for the moment. This society has to choose a unidimensional policy $p \in \mathbb{R}$. Any policy entails benefits and costs, which can be different across individuals. Let $V(t_i, p)$ be the indirect utility function of individual i:

$$V(t_i, p) = B(t_i, p) - C(t_i, p)$$

where $B(t_i, p)$ and $C(t_i, p)$ are indirect benefit and cost functions for individual i, respectively.[10] We also assume that, for any p and any t_i:

A1. Benefits are increasing and concave in the policy: $\frac{\partial B(t_i,p)}{\partial p} > 0$, $\frac{\partial^2 B(t_i,p)}{\partial p^2} < 0$;

A2. Costs are increasing and convex in the policy: $\frac{\partial C(t_i,p)}{\partial p} > 0$, $\frac{\partial^2 C(t_i,p)}{\partial p^2} \geq 0$;

A3. Types are indexed such that higher types bear lower marginal costs and/or enjoy higher marginal benefits from the policy: $\frac{\partial C_p(t_i,p)}{\partial t_i} \leq 0$, $\frac{\partial B_p(t_i,p)}{\partial t_i} \geq 0$ with at least one of these inequalities being strict.

Thus, for all types, $V(t_i, p)$ is concave in p and, for any t_i, there is a unique policy maximizing indirect utility $V(t_i, p)$, call it p_i, which solves:[11]

$$B_p(t_i, p) = C_p(t_i, p) \tag{1}$$

By A3, higher types prefer higher policies: $\frac{\partial p_i}{\partial t_i} \geq 0$ (cf. the dotted line in Figure 1).

2.2 With Loss Aversion

Let p^S be the status quo policy. *Increasing* the policy (i.e., $p > p^S$) entails more benefits and larger costs (like paying more taxes for more public good). Let $\lambda > 0$ be the parameter which captures loss aversion. Higher costs yield a psychological

[10]This assumption that individuals bracket separately benefits and costs is without loss of generality under rationality. It becomes a relevant assumption under loss aversion. We further discuss this point below.

[11]By A1 and A2 the SOC is satisfied.

experience of loss, which amounts to $\lambda\left[C(t_i,p)-C(t_i,p^S)\right]$. Vice versa, *reducing* the policy (i.e., $p<p^S$) entails a loss in terms of lower benefits (less public good). The psychological component of the loss of benefits is $\lambda\left[B(t_i,p^S)-B(t_i,p)\right]$. The *reference point* for the voters is the status quo.

The indirect utility with loss aversion, $V(t_i,p\mid p^S)$, is given by the material indirect utility of the policy, $V(t_i,p)$, minus the psychological loss due to possible departures from the status quo:

$$V(t_i,p\mid p^S)=\begin{cases} V(t_i,p)-\lambda\left[C(t_i,p)-C(t_i,p^S)\right] & \text{if} \quad p\geq p^S \\ V(t_i,p)-\lambda\left[B(t_i,p^S)-B(t_i,p)\right] & \text{if} \quad p<p^S \end{cases}$$

This formulation implies reference dependent utility as in Köszegi and Rabin (2006).[12] When computing losses and gains, individuals bracket *indirect* benefits and costs separately. This is the case when the primitive utility function of $V(t_i,p\mid p^S)$ satisfies the *decomposability* property (Tversky and Kahneman, 1991). Not only is this property common in reference dependence literature, but it is essential to derive implications from loss aversion.[13]

The optimality condition (w.r.t. p) is then:

$$\begin{array}{lll} B_p(t_i,p)-(1+\lambda)C_p(t_i,p)\gtreqless 0 & \text{if} & p\geq p^S \\ (1+\lambda)B_p(t_i,p)-C_p(t_i,p)\gtreqless 0 & \text{if} & p<p^S \end{array} \tag{2}$$

Voter i sets her desired policy, p_i, according to the following rule:

$$p_i \ \text{ solves } \begin{cases} (1+\lambda)B_p(t_i,p)-C_p(t_i,p)=0 & \text{if} \quad t_i<\check{t} \\ p=p^S & \text{if} \quad \check{t}\leq t_i\leq\hat{t} \\ B_p(t_i,p)-(1+\lambda)C_p(t_i,p)=0 & \text{if} \quad t_i>\hat{t} \end{cases} \tag{3}$$

where $\check{t}$ is implicitly determined by $(1+\lambda)B_p(t,p^S)-C_p(t,p^S)=0$, and $\hat{t}$ is implicitly determined by $B_p(t,p^S)-(1+\lambda)C_p(t,p^S)=0$. Note that $\check{t}<\hat{t}$, and both $\hat{t}$ and $\check{t}$ depend on the status quo policy. By (3), an individual's most preferred policy depends not only on her type, but also on the current level of the policy, the status

[12] Experienced indirect utility, $V(t_i,p\mid p^S)$, has two additively separable components: standard indirect utility, $V(t_i,p)$, and an *indirect* gain-loss utility $\mu(x(p))$, where

$$\mu(x(p))\equiv-\lambda\left\{\left[C(t_i,p)-C(t_i,p^S)\right]^+ +\left[B(t_i,p^S)-B(t_i,p)\right]^+\right\}$$

with $z^+\equiv\max\{0,z\}$. Our $V(t_i,p)$ is related to what Köszegi-Rabin define consumption utility. Our indirect gain-loss utility, $\mu(x(p))$, meets three out of four of Köszegi-Rabin's assumptions (2006, p. 1139). Their assumption A3 does not hold here: we do not assume any change in the concavity of $V(t_i,p\mid p^S)$. We focus on loss aversion only, and we do not consider diminishing sensitivity.

[13] Cf. Köszegi and Rabin (2006, 2007) and Herweg and Schmidt (2014).

quo. There are two differences with the case of no loss aversion. First, ideal policies are closer to each other; we call it "moderation effect", and it is stronger when the loss aversion parameter λ is larger (cf. Proposition 1-iii below). Second, some types' ideal policy is just the status quo.[14] Specifically, the population is split in three groups (cf. the solid line in Figure 1): 1. a group of *intermediate* types (i.e., all i such that $\check{t} \leq t_i \leq \hat{t}$) who prefer to keep the status quo; 2. a group of *high* types (i.e., $t_i > \hat{t}$) who want a higher policy level relative to the status quo; 3. a group of *low* types (i.e., $t_i < \check{t}$) who prefer a smaller level of the policy relative to the status quo. The size of the intermediate type group is bigger when the loss aversion parameter λ is larger.[15]

Our (standard) modelling of loss aversion implies the unbundling of cost and benefits of the policy. This assumption applies in a straightforward way to many policy issues. For instance increasing taxes to provide more public goods; or introducing regulation which increases production costs, to protect the environment; or more generally any limitation of individual freedom to provide a common good (say speed limits to reduce the probability of accidents, etc.). In some cases the unbundling is more subtle. Imagine an increase in progressivity of the tax system to reduce inequality. The rich may bear the cost of more taxes but may have the benefits of achieving "more fairness".[16] The poor instead have only benefits, lower taxes and less inequality (or more fairness). In principle one could extend our model to a case in which for some voters the cost and benefit of policy can be unbundled, for others they cannot. The former would have a loss aversion preference structure as above. The latter would not.[17]

3 The static median voter model

We begin with basic median voter model in which the decisive voter is the median. This model can be interpreted as capturing a group of voters choosing by majority rule on pairwise comparison of proposals and single peaked preferences; or as the result of a large two candidate election in which candidates are concerned only about winning the election converge to the preferences of the median voter; or in the case of two candidates with policy preferences who converge to the median since any other choice would lead to a sure loss for one of them.

[14] It is worth mentioning that if $p_i \neq p^S$, then the preferred policy p_i solves a FOC which is independent of p^S (cf. the first or the third line in (3)). Thus p_i depends on p^S only indirectly.

[15] Herweg and Schmidt (2014) have similar expressions for the range of intertia, but in a completely different setting. Their range is a subset of the possible states of the world. Ours is a subset of the set of voters' types.

[16] See Alesina and Angeletos (2005) for a model with this implication.

[17] Milkman et al. (2009) present laboratory evidence that policy bundling reduces the harmful consequences of loss aversion.

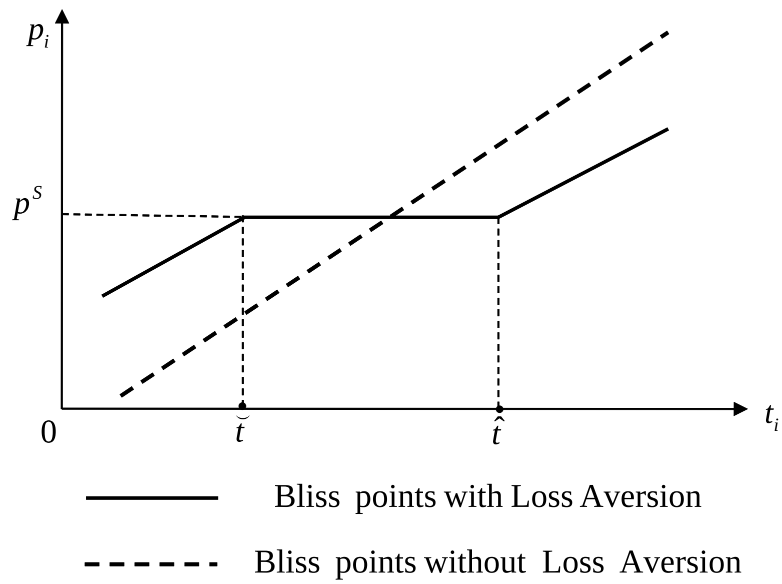

Figure 1: The relationship between bliss points and types

Our main results with loss aversion are the following:

Proposition 1 (Median voter equilibrium)
i) (Status quo bias) *The policy outcome is the status quo if the median voter is an intermediate type; i.e.* $t_m \in \left[\check{t}, \hat{t}\right]$.
ii) (Inertia) *If* $t_m \in \left[\check{t}, \hat{t}\right]$*, a shock affecting the preferences of the median will lead to a policy change only if it is sufficiently large. The size of the "inertia" interval* $\left[\check{t}, \hat{t}\right]$ *increases in the loss aversion parameter* λ.
iii) (Moderation) *Voters' ideal policies are less dispersed with loss aversion than without it. If* $t_m \notin \left[\check{t}, \hat{t}\right]$*, a policy change occurs, but it is smaller than with no loss aversion.*
iv) (Entrenchment) *Suppose a) the status quo is low and the majority decides for a higher policy; or suppose b) the status quo is high and the same majority decides to change it for a lower policy. In the first case the majority chooses a lower policy, compared to the second case.*
v) (Political endowment) *Once a new policy has been approved and becomes the status quo, more than the strict majority of people do not want to return to the previous status quo.*
vi) (In-efficiency) *Let* p^{**} *be the policy level that maximizes utilitarian social welfare without loss aversion. The highest social welfare inclusive of loss aversion is achieved when the policy is* p^{**} *and it is also the status quo. A society whose median type*

behaves as a benevolent social planner never chooses p^{**} unless it is already the status quo.

Parts *i)* and *ii)* of the proposition characterize a status quo bias. Part *iii)* says that loss aversion yields a *moderation effect* on voters' preferences. It implies that the distances among voters' ideal policies are lower, dampening polarization within society (compare solid and dotted lines in Figure 1). If $t_m \notin [\check{t}, \hat{t}]$, moderation leads the majority to make smaller changes than with no loss aversion.[18] Statement *iv)* says that the status quo continues to exert an influence on the policy outcome even when the majority would like to abandon it, if $t_m \notin [\check{t}, \hat{t}]$. If the status quo is a relatively high policy, the majority will make a change. But it will opt for a relatively high policy (e.g. from p^{S1} to p_m^1 in Figure 2). If the status quo is a low policy, that *same* majority will choose a relatively low policy (e.g. from p^{S2} to p_m^2, and $p_m^2 < p_m^1$). This might explain why societies are unable to eradicate certain kinds of ingrained policies (e.g., high level of redistribution, generous welfare state, strict regulation), even when they make reforms. This result might also be derived from a habit formation model. In such a model the preferences of voters would be positively affected by the habit (i.e. the history of past policies), leading more people to vote for policies that are close to the habit. Note however an important and testable difference between the two models. In a standard habit formation model (e.g. Campbell and Cochrane, 1999) a high level of past policies would not lead to smaller differences in voters' bliss points.[19] Then one would not observe the moderation effect, which instead characterizes the loss aversion model. Since most of dynamic implications of loss aversion rely on the moderation effect (see section 5), they would not apply to habit formation model.

Statement *v)* of the proposition is what we call the *political endowment effect*. Suppose a sufficiently large shock leads to an increase in the policy. Only the bare majority of voters cast votes in favor of the new policy. All voters to the left of the median would prefer a lower policy. All those to the right would prefer a higher one. Once the new policy has been set up, this policy becomes the new reference point. Some of the voters to the left of the median change their minds and start considering this new policy as their most preferred one. This means that a new lower policy needs more than the simple majority to beat the status quo, while a higher policy only requires the simple majority. The political endowment might help explain "ice-breaking" effects in politics. Reforms that had hard time to be

[18] There are two reasons why $t_m \notin [\check{t}, \hat{t}]$. First, an exogenous shock in the voters' preferences leads *the same* median to prefer a different policy than the previously preferred policy, p^S. Second, a shock in the type distribution $F(t)$ changes the identity of the median, such that *the new* median wants to change the status quo.

[19] In some other models (e.g. Abel, 1990), a high level of past policies might even exacerbate the differences in voters' preferences.

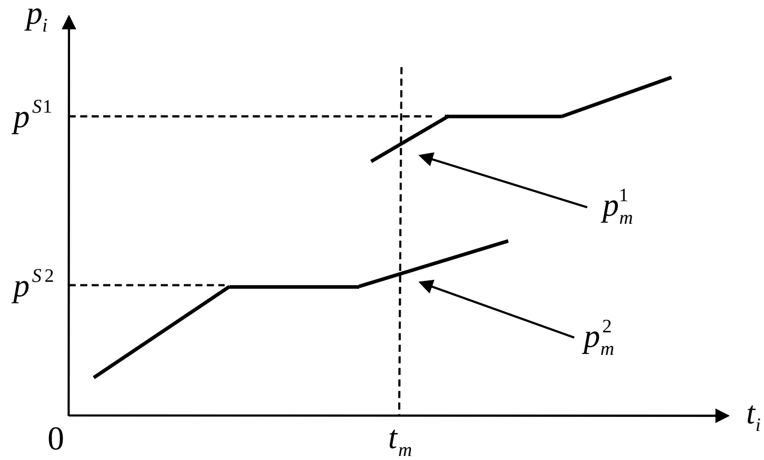

Figure 2: Equilibria with different status quo policies

approved gain popularity some time later, leading to further more ambitious reforms in subsequent periods.[20]

Benthamite social welfare *inclusive of* loss aversion is maximized when the median behaves as a benevolent planner that takes individuals' loss aversion into account.[21] Is this a first best for society? The answer is "No", except when $p^S = p^{**}$. Call p^{**} the "optimal" status quo (as defined by Proposition 1-*vi*). If society was already living in this status quo it would be optimal not to change it and welfare would be at the highest level. This would be a *first best*. Suppose now society is living in a suboptimal status quo, $p^S \neq p^{**}$. A majority behaving as a benevolent social planner chooses a policy different from p^{**}. It maximizes social welfare, but it is a *second best*. Remarkably, this majority never chooses policy p^{**} unless it is already the status quo. Quite intuitively, the "social cost" of loss aversion is the welfare loss due to living with a suboptimal status quo, which in turn implies the impossibility to reach the first best. A majority behaving as the social planner is unable to "escape" from a suboptimal status quo. It never chooses today a policy that will represent the optimal status quo tomorrow. We will come back to this point in the next section.

[20] Note the connection between our model of voting on a political reform, and *renegotiating* an existing contract in a market situation. Our idea that the status quo is a political reference point parallels the idea that an existing contract represents a reference point in case of renegotiation (Hart and Moore, 2008; Herweg and Schmidt, 2014; Bartling and Schmidt, 2015).

[21] The assumption that the social planner takes individuals' loss aversion into account is common in the literature (e.g. Freund and Özden, 2008, or Charité et al., 2014). A median behaves as this social planner if $B_p(t_m, p_m) - C_p(t_m, p_m) = \int B_p(t, p_m) - C_p(t, p_m) dF(t)$ (cf. The proof of Proposition 1-*vi)* in Appendix for details).

4 *Old* and *Young* Voters

This section presents a model with loss aversion in which young voters are more likely to vote for a change even when there are no differences in material interests between them and old voters.

Suppose population is split in two overlapping generations, the young and the old. In order to focus on the specific effects of loss aversion, the two generations are identical in all respects except residual life: the loss aversion parameter, λ, is the same for young and old; the distribution of types, $F(t)$, is the same in the two groups; for any individual voter i, the "material" benefit and cost functions, $B(t_i, p)$ and $C(t_i, p)$, are the same independently of age. Without loss aversion there would be no difference in the policy preferences of the two groups. We show that this is no longer true with loss aversion because of the different time horizon of young and old voters. This is a relevant issue since the age composition of the electorate is changing rapidly, and in different ways across the world. Old cohorts become larger and larger in rich countries, while in poor countries the young cohorts are still growing fast.[22]

To study the effect of loss aversion, suppose the old live only one period and the young live two periods, and in period 0 society is equally split in old and young. Let $b \gtreqless 0$ be the constant population birth rate.[23] At the beginning of period $k \geq 1$ the number of young has increased by a factor $(1 + b)^k$, the number of old (who were young one period earlier) has increased by $(1 + b)^{k-1}$. The young's share in the population, σ, and old's share, $1 - \sigma$, are the following ($k \geq 1$),

$$\sigma = (1 + b)/(2 + b) \tag{4}$$
$$1 - \sigma = 1/(2 + b) \tag{5}$$

[22] In 2015, annual population growth rate was 0.5% within the EU, and 0.8% within US. The shares of over-65 were 19.9% and 14.7%, respectively. In low income countries, population growth was 2.7%, while the over-65's share was 3.41%.

Such demographic patterns are radically transforming the age structure of the electorate in many countries. For instance, in 2006 US Congressional elections, the share of voting population below the age of 65 was 77.5%. In 2014, this share dropped to 71.6%, while the share of those above the age of 65 raised from 22.5% to 28.4%. Only a small part of the increase in the over-65's share is due to higher voting participation of the elderly. (Data source: Indexmundi.com-World Bank data; U.S. Census Bureau, Current Population Survey, November 2004–2014).

[23] More precisely, $1 + b$ is the births/population ratio. For expositional convenience, here we refer to b as the "birth rate". A negative natural increase of the population (RNI) corresponds to a negative value of parameter b. In the G7 group, fertility rate (number of children born to each woman) dropped significantly in early Sixties, stabilizing between 1.5 and 2 in subsequent decades. This drop resulted in a negative RNI in some G7 countries (e.g. Germany and Japan).
Less developed countries, especially in Africa and in Arabic countries, display high and positive RNI values (cf. Supplementary Material on the authors' websites).

By (4), $\sigma = S(b)$, with $S_b > 0$. The higher the birth rate, the larger the young's share.[24]

Voting takes place at the beginning of each period $k \geq 1$. The status quo is the policy set up in the previous period. Proposition 2-*i* below states (and Appendix proves) that, since the young live two periods, their *perceived* loss aversion is $\lambda^y = \lambda/2$, while loss aversion *perceived* by old voters is $\lambda^o = \lambda$. Loss aversion derives from a psychological cost that is borne at the time the change occurs. The psychological cost of a policy change today is borne today only, while the material benefits of that change are enjoyed also in the future. Living for two periods gives young voters the chance to *spread* the psychological cost over two periods. This is why, despite λ is the same in both groups, the young perceive less loss aversion than the old. This result can easily be extended to the case in which a voter's residual life consists in n periods. In this case, her perceived loss aversion is $\frac{\lambda}{n}$.

By Proposition 1-*ii)*, there are fewer young voters entrenched in the status quo, compared to old voters ($\check{t}^o < \check{t}^y$ and $\hat{t}^o > \hat{t}^y$). It may happen that the majority of young voters want a change in policy, but the majority of old voters do not. This is the case shown by Figure 3, where $\hat{t}^y < t^m < \hat{t}^o$ implies that the majority of young voters want a higher policy while the majority of the old ones prefer the status quo (recall that t^m is the same in the two groups). The status quo changes if there is a majority supporting the change; i.e., if either those who want a higher policy, $p > p^S$, or those who want a lower policy, $p < p^S$, are a majority. Formally,

$$p > p^S \quad \text{iff} \quad (1-\sigma)F(\hat{t}^o) + \sigma F(\hat{t}^y) < 0.5 \tag{6}$$

$$p < p^S \quad \text{iff} \quad (1-\sigma)(1-F(\check{t}^o)) + \sigma(1-F(\check{t}^y)) < 0.5 \tag{7}$$

Consider the inequality in (6). The first term is the percentage of old voters blocking an increase in the policy, where $1-\sigma$ is the old voters' share in the population and $\hat{t}^o$ is the highest old blocking type (cf. Figure 3). The second term, $\sigma F(\hat{t}^y)$, is the percentage of young blocking voters in the entire population. If these two blocking groups represent less than 50% of the population, the inequality in (6) is satisfied. The majority will choose a *higher* policy than the status quo. Condition (7), says that a *lower* policy will pass if those who prefer the status quo or any higher policy are less than a half of the population. Of course the two conditions are mutually exclusive (i.e. if there is a majority willing to increase the policy there cannot be a majority willing to decrease it). If neither of the two conditions is satisfied, then the status quo remains. The following proposition says that this is more likely to occur when the birth rate is lower.

[24] Assume the initial size of each group is one. After k periods the size of the young group is $(1+b)^k$ and the size of the old group is $(1+b)^{k-1}$. The population size is $(2+b)(1+b)^{k-1}$. The young's share is then $\sigma = (1+b)/(2+b)$.

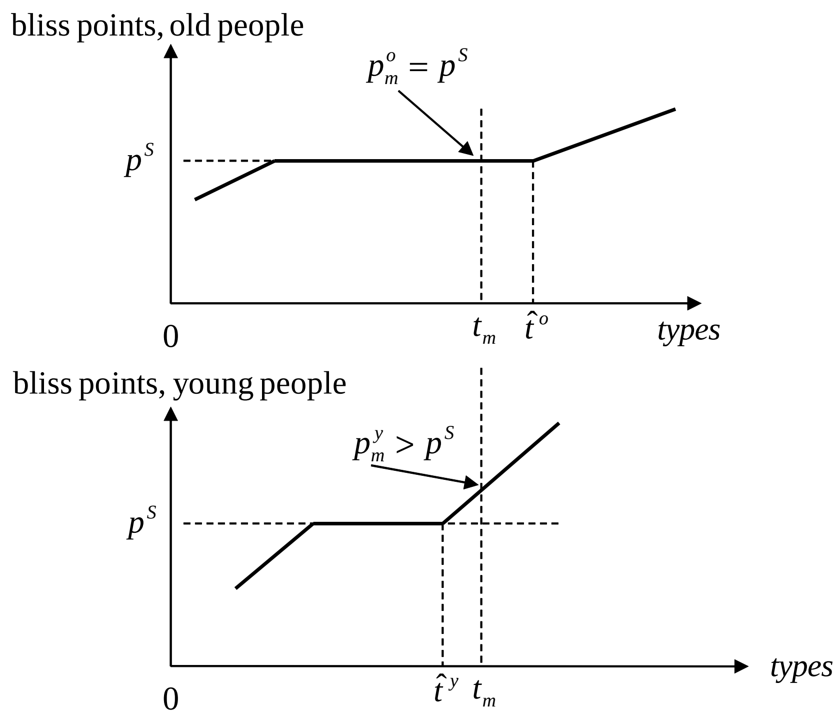

Figure 3: The intergenerational conflict

Proposition 2 (Chance and size of reforms)
i) The young generation perceives a lower degree of loss aversion than the old one: $\lambda^y = \lambda/2$ *and* $\lambda^o = \lambda$. *The share of people who want the status quo is always larger amongst the old generation than the young one.*
ii) The status quo remains unless either (6) or (7) is satisfied.
iii) The lower the birth rate, b, the larger the set of parameter values for which the status quo remains.
iv) Assume a constituency for a reform exists in period $k \geq 1$. *The reform is smaller in absolute value if the birth rate is lower.*

The reason of these results is the combination of status quo bias and moderation effect. Since the old perceive a higher loss aversion, more old voters than young voters do not want to change, and those who want to change want to do it by a lesser amount. With a lower birth rate the cohort of old people is bigger. The bliss point of the pivotal voter shifts towards the status quo. This has two implications. First, the chance to make a reform is smaller. Second, whenever there is a majority in favor of a change, the reform is less ambitious.

According to this model one should expect more frequent changes, and perhaps more political instability, in youthful societies than in older ones.

4.1 Life expectancy

A 65 year old voter at the middle of the 20th century was probably looking at her future in a different way than a same age voter in the 21st century. In 1965, her residual life was 12-13 years. In 2013, it was close to 20 years (G7 group countries). Life expectancy at birth in the G7 countries was 70-71 years in 1965, while now it ranges between 79 and 84 years. Almost everywhere in the world life expectancy has been growing almost linearly over the last half a century, and it is still growing.[25]

In order to account for these patterns, we add to the model a constant and positive parameter, e, capturing life expectancy growth.[26] In period 0 the old live only one period; the young live two periods. Their shares in the population are $1-\sigma$ and σ, respectively (cf. expressions (4-5)). At the beginning of period $k \geq 1$ the young expect to live next $2 \cdot (1+ek) = 2+2ek$ periods, while the old expect to live $2 \cdot (1+l(k-1)) - 1 = 1+2e(k-1)$ periods.[27] Their *perceived* loss aversion parameters are then

$$\lambda^y = L^y(e,k) = \frac{\lambda}{2+2ek} \quad \text{and} \quad \lambda^o = L^o(e,k) = \frac{\lambda}{1+2e(k-1)} \tag{8}$$

Perceived loss aversion now negatively depends on k. The reason is simple: after k periods have elapsed, residual life is longer making an individual less loss averse and more willing to make a change. This happens both to young and old (in an asymmetric way). This effect is stronger if life expectancy grows faster (higher e).

As periods pass, the inertia intervals in both cohorts, $\left[\check{t}^o, \hat{t}^o\right]$ and $\left[\check{t}^y, \hat{t}^y\right]$, get smaller and smaller. An increasingly larger number of young *and* old voters want to change because their residual life is getting sufficiently long to desire a change. As soon as this group represents the majority, a change will occur. Thus there will be a "ripe" period k^* when a reform actually takes place, even though no shock has occurred in the meantime.

Proposition 3 (Ripe times for reforms)
i) If life expectancy grows, there exists a "ripe time" k^* such that a change in the status quo becomes politically feasible;
ii) k^* is decreasing in life expectancy growth rate, e, and in the birth rate, b.[28]

[25] In the US, the median age is 40 and residual life at that age is 40 years. In Brazil, median age is 30 with 47 years of residual life (cf. Supplementary Material on the author's webpages).

[26] We discuss what happens if $e < 0$ in a footnote below.

[27] As mentioned earlier, a period is defined as the lenght of time a new policy becomes the reference point. Thus, in the model k is an integer.

[28] If $e < 0$ the inertia intervals $\left\{\check{t}^o, \hat{t}^o\right\}$ and $\left\{\check{t}^y, \hat{t}^y\right\}$ get increasingly larger. Thus k^* does not exist. This means that society is stuck in the status quo. A larger and larger shock is needed to change it.

A higher life expectancy growth and a higher birth rate imply that a constituency for a reform materializes earlier, but for different reasons. A higher birth rate leads to a bigger young cohort, relative to the old one. Young voters are more willing to change, hence for any $e > 0$ a reform becomes feasible after a shorter number of periods. A higher life expectancy growth implies that the desire to change in both young and old cohorts grows faster. Thus, despite ageing, the "ripe time" comes sooner.[29]

4.2 Extensions

4.2.1 Immigration

Immigration may have the same effect of an increase of the birth rate because of the lower age and higher fertility of immigrants compared to natives. In 2013, the US fertility rate was 62 births per thousand immigrant women, and 50 per thousand native women. Without immigration since 1965, median age in 2015 would be three years older. Over the last decade about 28 states in the Northeast and Midwest had population declines in the under-45 age group. Over the same period, 12 states in the South and West saw decreases in median ages, mostly due to immigration of Hispanics. Naturalized young voters are younger than natives. Those below the age of 45 represent 66% of all naturalized eligible voters; a much higher share than the 47% amongst all US voters.[30] In the Old Continent, immigration flows were smaller in the past compared to US. However, in the last decades higher immigration has been increasingly affecting the age structure of the European electorate.

So immigration has a long term effect on the ratio of young versus old voters. Specifically, more immigration yields a higher value of the parameter σ, leading to a decrease in the status quo bias and more radical policy changes. Old natives may be especially averse to this. Needless to say there are many other reasons why an increase in immigration of individuals with different cultures or preferences from natives would lead to policy changes, but here we highlight one that relies purely on age structure. It would occur even if the immigrants were identical to the locals in any dimension except for their average age and birth rate.

4.2.2 Projection bias

So far we have assumed that young and old voters correctly assess their future reference points, and fully understand how their choices today will affect their pref-

[29] Among other factors, a longer life expectancy might help explain why party loyalty is decreasing in many countries across all cohorts, and why even old voters are more and more eager for political changes than they were in the past (e.g. Lisi, 2015, and references therein).

[30] Source: US Census Bureau, Center for Immigration Studies (www.cis.org), and Pew Research Centre (www.pewresearch.org).

erences in the future. Loewenstein et al. (2003) cast doubt on this kind of ability: they claim, and verify experimentally (see also Loewenstein and Adler, 1995), that individuals are subject to a projection bias, which leads them to systematically overestimate the extent to which their future preferences resemble their current ones.

Including a projection bias in the model with young and old voters would imply that their preferences are less diverse, and age structure is less influential in determining the status quo bias. A formal treatment is in the Supplementary Material available from the authors, but the intuition is the following. Let $\alpha \in [0, 1]$ be the parameter capturing projection bias: a voter thinks that with probability α she will not accustom to future policies, thus her preferences will not change in the future. Old voters live one period, thus projection bias is not relevant for them. Their perceived loss aversion is $\lambda^o = \lambda$, as in the model above. The young live two periods, and now their perceived loss aversion is $\lambda^y = \frac{\lambda(1+\alpha)}{2}$. The reason is that a young voter thinks that with probability α her preferences will not change, thus she will bear the cost of change both today *and* tomorrow, while with probability $(1 - \alpha)$ she will bear that cost today only.[31] The higher the projection bias α the smaller the young's propensity to change: they behave more myopically, thus they are more similar to old voters.

4.2.3 Social welfare

Suppose a social planner maximizes social welfare (inclusive of loss aversion) of current *and future* generations. The long planning horizon leads this planner to perceive a low degree of loss aversion. It might want to change today, sacrificing the current generations' welfare so as to secure future generations a better status quo. However, an ageing democracy is much less prone to change than this social planner. The old cohorts have a short planning horizon. They perceive high loss aversion, hampering the young's desire to change. This conflict replicates in subsequent periods because the today's young will be the tomorrow's old. They will lose their incentive to change and will foist their status quo bias on tomorrow's young. The cost for society can be very high because a bad status quo can endure for long periods of time.

5 Policy motivated parties

We now move to a model of candidates/parties (terms used interchangeably) having policy preferences. They trade off the probability of winning versus the distance

[31] In other words, with probability α her perceived loss aversion is λ, and with probability $1 - \alpha$ her perceived loss aversion is $\lambda/2$. Hence, perceived loss aversion is $\lambda^y = \frac{\lambda(1+\alpha)}{2}$. Supplementary Material shows that if a young voter lives n periods her perceived loss aversion is $\lambda^y = \frac{\lambda(1+\alpha(n-1))}{n}$.

of their platforms from their "type". For expositional convenience, we first present a static general model in which we introduce loss aversion. Then we study how loss aversion affects the equilibrium in a dynamic framework. In what follows we assume that parties can make binding commitments to their proposed platforms.[32] As discussed above, in order for this model to be interesting there has to be some uncertainty about the distribution of preferences of the voters in order to have a non degenerate trade off between the degree of convergence to the median and the probability of victory.

5.1 The equilibrium with no loss aversion

Let l and r label the two candidates, and let $\bar{l}$ and $\bar{r}$ be their most preferred policies (with $\bar{l} < \bar{r}$). We can think of them as the policy preferred by their core party members. We assume that $\bar{l} < p_m < \bar{r}$ where p_m is the bliss point of the expected type of the median, t_m. This assumption is not necessary to solve the model but we make it to reduce the number of cases to consider. It also appears realistic. We refer to l as the left-wing candidate/party and to r as the right-wing one. Let x be the platform proposed by candidate l, and y the platform proposed by r. Given these two platforms, there will be an "indifferent" type t_{ind} enjoying the same utility from the two platforms:

$$V(t_{ind}, x) = V(t_{ind}, y) \tag{9}$$

By (9), $t_{ind} = T(x, y)$. It represents the "cutoff type". All types higher than t_{ind} strictly prefer the right-wing platform y; all types lower than t_{ind} prefer the left-wing platform x. Candidate l wins if the indifferent type t_{ind} is higher than the median. The two candidates do not know the exact location of the median. By choosing their platforms they can only affect the probability of winning. Specifically, the median type's location is $t_m + \epsilon$, and we assume ϵ to be uniformly distributed on $[-\delta, \delta]$.[33] As such, l's probability of winning, call it $P(x, y)$, is given by the probability that the indifferent type is above the median:

$$P(x, y) \equiv \Pr\{T(x, y) > t_m + \epsilon\} = \frac{1}{2\delta}(T(x, y) - t_m + \delta) \tag{10}$$

Of course l's probability of losing is $1 - P(x, y)$. By (10), $P_x(x, y) = P_T \cdot T_x = \frac{1}{2\delta} T_x > 0$, where $T_x > 0$ can be computed by implicit differentiating the indifference

[32] See Alesina (1988) for a discussion of commitment. See Drouvelis et al. (2014) for thorough analysis and extensive references of this kind of model.

[33] Uniform distribution simplifies algebra, and it is common in this literature; nothing important hinges on it.

condition (9).[34] The idea is that, given the right-wing party's platform, the left-wing candidate can increase his chance to win by proposing a "more right-wing" policy, thus moving x rightward. Equivalently, $1 - P_y(x,y) = -P_T \cdot T_y = -\frac{1}{2\delta}T_y < 0$. This means that also the right-wing candidate has incentive to move his platform towards the center of the policy space in order to increase his chance of winning.

Let $u^l = U(p,l)$ be candidate l's utility function and let it be decreasing in p for any $p > \bar{l}$. He chooses his platform x so as to maximize the following expected utility:

$$U^l(x,y) = U(x,l) \cdot P(x,y) + U(y,l) \cdot [1 - P(x,y)] \tag{11}$$

$U(x,l)$, is candidate l's utility in case of victory, and $U(y,l)$ is his utility in case the other candidate wins.

Candidate r's utility is $u^r = U(p,r)$, with $U_p(p,r) > 0$, for any $p < \bar{r}$. His objective function is:

$$U^r(x,y) = U(x,r) \cdot P(x,y) + U(y,r) \cdot [1 - P(x,y)] \tag{12}$$

The following two FOCs to maximize (11) and (12) implicitly define the reaction functions of the two candidates:

$$U_x(x,l) \cdot P(x,y) + [U(x,l) - U(y,l)] \cdot P_x(x,y) = 0 \tag{13}$$

$$U_y(y,r) \cdot [1 - P(x,y)] - [U(y,r) - U(x,r)] \cdot P_y(x,y) = 0 \tag{14}$$

The equilibrium platforms, x^* and y^*, converge partially towards the expected median of the political space. Specifically, $x^* < t_m < y^*$. High enough concavity in the two parties' utility functions ensures stability at the equilibrium point (cf. Appendix for details).

5.2 The equilibrium with loss aversion

Suppose $x < p^S < y$.[35] The indifference condition which pins down the cutoff voter, call her t^{LA}_{ind}, is now

$$V(t^{LA}_{ind}, x) - \lambda \left[B(t^{LA}_{ind}, p^S) - B(t^{LA}_{ind}, x)\right] = V(t^{LA}_{ind}, y) - \lambda \left[C(t^{LA}_{ind}, y) - C(t^{LA}_{ind}, p^S)\right] \tag{15}$$

[34] Specifically, $T_x = -\frac{V_x(t_{ind},x)}{V_t(t_{ind},x) - V_t(t_{ind},y)} > 0$. This derivative is positive because the denominator is negative (i.e. a marginally higher type than t_{ind} is not indifferent, rather she prefers y to x) and the numerator is positive (since t_{ind}'s bliss point is larger than x). Following the same steps, $T_y = -\frac{-V_y(t_{ind},y)}{V_t(t_{ind},x) - V_t(t_{ind},y)} > 0$.

[35] This is perhaps the most interesting case. The Appendix considers the other two cases, when both equilibrium platforms are either above or below the status quo (cf. Cases 1 and 2 in the proof of Proposition 4 therein). Results for these two cases are consistent with those presented here.

The LHS of (15) is the utility of the cutoff type t_{ind}^{LA} when policy x is implemented. Since $x < p^S$, it includes the feeling of loss due to lower benefits with respect to the status quo. The RHS is the utility when policy $y > p^S$ is adopted, inclusive of the feeling of loss attached to raising cost. By (15), $t_{ind}^{LA} = T^{LA}(x, y, p^S)$, with $T_x^{LA}, T_y^{LA} > 0$. If, say, either candidate l or r propose a more right-wing policy the cutoff type shifts rightward leading more voters to vote for candidate l.[36]

Consider the case in which only voters are loss averse but the parties are not. Loss aversion yields a moderation effect. This concentration of preferences implies that a candidate can "gain" a lot of new voters if he moves marginally his platform towards the center of the policy space (i.e. towards the bliss point of the expected median). Hence, in equilibrium platforms are more similar, compared the case with no loss aversion:

Proposition 4 (Convergence)
Loss aversion leads the two candidates to propose closer platforms than without loss aversion.

We can also show that if not only the voters but also the party activists and candidates are loss averse we have even more convergence than in the previous case (cf. Appendix - Case 3 in the proof of Proposition 4) but for simplicity from now on we assume that only the voters are loss averse.

6 Dynamic Electoral Competition

We now move towards a dynamic model of elections to show that loss aversion can generate "political cycles" in which holding the material preferences of the voters constant the political equilibrium moves towards one direction, until some sufficiently large shock brings it back. Thus the model has built in a sort of "dynamic status quo bias" which might lead the equilibrium in one direction for several elections. In order to prove this result we begin with a comparative static result which is very useful. The following proposition shows the correlation between current status quo and platforms.

Proposition 5 (Equilibrium platforms)
i) (Status quo bias) *If both candidates' utility functions are sufficiently steep and concave, then equilibrium platforms x^* and y^* positively depend on the status quo.*
ii) (Expected policy) *If in addition the loss aversion parameter λ is sufficiently large, the expected policy outcome is positively affected by the status quo.*

[36] Cf. Appendix for details. Moreover, by Proposition 5-*i)* below, $T_{p^S}^{LA} < 0$: a more right-wing status quo leads more voters to prefer right-wing policies, thus the cutoff voter is a more left-wing type.

To see the intuition, suppose the status quo is a more right-wing policy. The right-wing candidate is favored by the right-wing status quo because more voters vote for him. He can propose a more right-wing platform y that is closer to his ideal policy $\bar{r}$. The left-wing candidate faces a trade-off. On the one hand, a more right-wing status quo implies that a marginal change in his platform will affect the decision of a smaller number of voters; this leads him to propose a *lower* x.[37] On the other hand, losing the elections is now a worse prospect than before, since y is a more right-wing policy. The fear of losing leads the left-wing candidate to propose a *higher* x. If her utility function is sufficiently concave and decreasing the fear of losing is so strong that he finally chooses to propose a higher x; i.e., a more right-wing platform. Thus if say the status quo is a right-wing policy the political equilibrium "moves" to the right. Both parties move to the right and the expected policy outcome moves to the right as well, even though we are holding constant the material preferences of the voters.[38]

Based upon this result we can move to a two period model of electoral competition. As above a "period" is defined as the length of time in which a new policy becomes the status quo and reference point for the voters. We derive a sort of *dynamic status quo bias* or in different words *"long term cycles"* in policies.

We assume two periods, $k = 1, 2$. Loss aversion is sufficiently strong so that Proposition 5-*i)* holds. Let $V(t_i, p^k \mid p^{k-1})$ denote voter i's indirect utility in period k. The status quo in period 1, p^0, is exogenous, while the status quo policy in period 2, p^1, is an endogenous state variable set by the winning party in period 1. Thus p^1 is a policy variable in period 1, but it is predetermined in period 2. For simplicity, there is no discounting, the two parties' bliss points are fixed, and all voters live one period. We characterize the equilibrium, working backwards.

Period 2

At the start of period 2, voters observe the realization of the policy in period 1, p^1, and adopt this policy as reference point. Since they live one period, they perceive a loss aversion parameter λ. Candidates propose their policy platforms, x^2

[37] This hinges on assumption A3, namely $\frac{\partial B_p(t_i,p)}{\partial t_i} \geq 0$. Since p^S is higher, the cutoff type is lower. By A3 her marginal benefits in the policy are lower: increasing the policy has a smaller impact on the cutoff voter's benefits. As a result, the left-wing candidate has a lower leverage when he tries to shift the cutoff voter upwards by proposing a higher x. This is the reason why a marginal change in his platforms affects a smaller number of voters.

[38] A large λ insures that the rightward movements of both equilibrium platforms are sufficiently large. This yields a positive correlation between expected policy and the status quo for any set of parameter values. Otherwise one might have cases in which, despite both platforms move rightward, the left-wing one becomes more likely so that the expected policy is actually a more left-wing one. The Supplementary Material available from the authors presents a parametric model computing closed form and numerical equilibria of Sections 3-6.

and y^2 to maximize their expected payoffs:

$$U^{2l}(x^2, y^2, p^1) = U(x^2, l) \cdot P^2 + U(y^2, l) \cdot \left[1 - P^2\right] \tag{16}$$
$$U^{2r}(x^2, y^2, p^1) = U(x^2, r) \cdot P^2 + U(y^2, r) \cdot \left[1 - P^2\right] \tag{17}$$

where $P^2 \equiv P(x^2, y^2, p^1)$ is the the winning probability of the left-wing candidate. Note that this probability depends on the status quo policy, $p^1 \in \{x^1, y^1\}$, which is the realization of the *probabilistic* voting at period 1.

Winning the election in period 1 puts the winner in a favorable position in period 2, because the expected policy outcome is closer to his ideal policy (cf. Proposition 5). Specifically, suppose the right-wing candidate won the elections in period 1. The status quo in period 2 is the relatively right-wing policy he proposed in period 1, $p^1 = y^{*1} > x^{*1}$. Due to loss aversion, voters become attached to that policy and more willing to vote for the right-wing candidate in period 2. The expected policy outcome, $\boldsymbol{E}(p^{*2}, p^1)$, will be a more right-wing policy.[39] Because of loss aversion the electoral outcome in period 1 affects the outcome in period 2. This is the dynamic status quo bias defined by the following proposition:

Proposition 6 (Dynamic status quo bias)
If a candidate wins the election in the first period, then the expected policy in period 2, $\boldsymbol{E}(p^{*2}, p^1)$, is closer to his ideal policy, compared to the case he loses that election: $\boldsymbol{E}(p^{*2}, x^{*1}) < \boldsymbol{E}(p^{*2}, y^{*1})$.

This positive relationship between the winner's policy in period 1 and the expected outcome of subsequent periods may trigger "long term cycles in politics". A sequence of victories of say the right-wing candidate may bring the status quo far to the right. A victory of the left-wing candidate might not be sufficient to bring it back.

Period 1

In period 1 candidates set x^1 and y^1 to maximize the following lifetime utilities, respectively:

$$U^{1l}(x^1, y^1, p^0) + P^1 \cdot U^{2l}(X^2(x^1), Y^2(x^1), x^1) + \left(1 - P^1\right) \cdot U^{2l}(X^2(y^1), Y^2(y^1), y^1) \tag{18}$$

$$U^{1r}(x^1, y^1, p^0) + P^1 \cdot U^{2r}(X^2(x^1), Y^2(x^1), x^1) + \left(1 - P^1\right) \cdot U^{2r}(X^2(y^1), Y^2(y^1), y^1) \tag{19}$$

$P^1 \equiv P(x^1, y^1, p^0)$ is the winning probability of the left-wing candidate in the first period, and $x^{*2} = X^2(p^1)$, $y^{*2} = Y^2(p^1)$ are the equilibrium platforms in period 2.

[39] Given the status quo in the second period, p^1, the expected policy outcome is defined as $\boldsymbol{E}(p^{*2}, p^1) = x^{*2} \cdot P(x^{*2}, y^{*2}, p^1) + y^{*2} \cdot (1 - P(x^{*2}, y^{*2}, p^1))$.

The first term in (18) is the expected utility of the left-wing candidate in the first period. The second term is the expected utility in period 2 in case he wins in the first period (cf. expression (16)). The platform x^1 is implemented and it represents the status quo of the second period. This event occurs with probability P^1. The third term is the left-wing candidate's expected utility of the second period in case the right-wing candidate wins in the first period. This happens with probability $(1 - P^1)$ and the status quo of the second period is y^1. The three terms in (19) have similar meanings.

At an interior optimum the platforms proposed by the two candidates in period 1, x^{*1} and y^{*1}, satisfy the following optimality conditions:

$$U_{x1}^{1l}(.., p^0) + P_{x1}^1 \cdot \left[U^{2l}(.., x^1) - U^{2l}(.., y^1)\right] + P^1 \cdot U_{x1}^{2l}(.., x^1) = 0 \tag{20}$$

$$U_{y1}^{1r}(.., p^0) - P_{y1}^1 \cdot \left[U^{2r}(.., y^1) - U^{2r}(.., x^1)\right] + (1 - P^1) \cdot U_{y1}^{2r}(.., y^1) = 0 \tag{21}$$

Take the left-wing candidate. $U_{x1}^{1l}(.., p^0)$ in (20) is the first-order condition of the static model. The second term is positive. It says that in period 1 the left-wing candidate has incentive to propose a higher x^1 in order to increase his chance to win and then benefit from a more favorable status quo (x^1 instead of y^1) in the second period. The third term may be either positive or negative. The Appendix proves that if the candidate's utility function is sufficiently concave, which we assume, entire expression (20) is positive at the equilibrium point of the static model. This implies that the left-wing candidate has incentive to propose a higher x^1 than the equilibrium in the static model. A similar incentive leads the right-wing candidate to propose a lower y^1. In a dynamic framework political competition is tougher than in a static framework, leading the candidates to propose more convergent platforms. This is what Proposition 7 says.

Proposition 7 (Equilibrium Period 1)
Compared to the static model with loss aversion, candidates propose more convergent platforms in the first period.

Winning in period 1 brings about the expectation of a more favorable equilibrium in the second period. With the intent to achieve this political gain, each candidate strives to increase his chance to win in period 1, finding it optimal to propose more "competitive" platforms than in the static model. The entire mechanism hinges on the dynamic effects of a policy change today, which leads to an endogenous change in voters' preferences tomorrow.

Summarizing: in a standard two-party system model with partial convergence the electoral outcome oscillates within the same two platforms of the two candidates, who have no reason to change them. Loss aversion introduces a dynamic in which we have "long term movements", say, to the left. Then it might take more than one election to return to the right with policy swings in which each election is influenced by the outcome of the previous election. This seems much more a realistic prediction.

6.1 Extensions

6.1.1 Forward-looking voters

Thus far we have assumed that parties are forward-looking while voters myopically care only about current elections. Using the same approach one could also extend the model to the case of forward-looking voters. The Supplementary Material available on the authors' websites presents a formal treatment. The intuition is the following. Suppose voters have a two-period planning horizon. In period 1 they are less subject to loss aversion, because they anticipate the effect of their current choice on future equilibrium policy. Lower loss aversion yields less moderation. Thus their preferences are more dispersed. The two parties then propose less moderate platforms in period 1, compared to the case of myopic voters. As a result, regardless of the winner in period 1, the status quo of period 2 is a less moderate policy, which in turn pushes the political competition of period 2 more towards one of the two extremes of the political space. Thus, the possibility of long term political cycles towards one or the other extreme of the political space is larger with forward-looking voters than with myopic voters.

6.1.2 Old and Young voters

Consider an ageing society and compare it with a younger one. Here is the difference. Voters in the former society are more moderate because they perceive a higher loss aversion. Then candidates converge more in this society than in the younger society. Suppose in the first period the left-wing candidate wins. In the ageing society he implements a relatively moderate policy, not too far away from the center of the political space. In period 2, this policy becomes the status quo and voters become attached to it, more than they would be in the younger society. As a result, the probability that the left-wing candidate wins for a second time is higher in the ageing society than in the younger one. In other words, despite policies are more moderate in the ageing society, reversing a political cycle once it has occurred is less likely. A testable implication is that political cycles should be smaller but more persistent in ageing societies than in younger ones. The Supplementary Material available from the authors provides a formal proof of this result.

7 Conclusions

In this paper we have explored how loss aversion with the status quo as reference point affects the political equilibrium in voting. We have derived several results both in a median voter equilibrium and in one in which parties do not fully converge. First we derived a status quo bias result. Differently from the previous literature this status quo bias is not due to any assumption about voting rules. We then moved to a model of policy motivated parties with partial convergence. Here we showed moderating effects: the electoral platforms of the two parties are closer with loss aversion rather than without it. We also showed a sort of dynamic status quo bias. When, say, the left party wins an election it moves the status quo to the left. In the following period the expected policy moves to the left and in some cases both the platforms of the two parties move to the left relative to the platforms of the previous election. Then policy swings in each election are influenced by the outcome of the previous election. This generates long term political cycles even though the preferences of the voters are unchanged.

We also showed that ageing societies (with low birth rates or low immigration) are more subject to the status quo bias. Also when policy does change away form the status quo the changes are more radical in younger societies, a result which is testable and seems quite realistic. Young voters are more likely to vote for a change even when there are no differences in material interests between them and old voters.

Finally our analysis has been (almost) exclusively positive. Many normative aspects spring to mind. To begin with how can one evaluate the costs of loss aversion in a majority rule model? To what benchmark should welfare be compared? Are certain voting rules more effective than others to mitigate the welfare cost of loss aversion? These subjects are left for future research.

8 Appendix

Proof. Proposition 1

i) Implicit differentiating (3) w.r.t. t_i, and using A1-A3 yield

$$\frac{\partial p_i}{\partial t_i} = \begin{cases} -\frac{(1+\lambda)B_{pt}(t_i,p_i)-C_{pt}(t_i,p_i)}{(1+\lambda)B_{pp}(t_i,p_i)-C_{pp}(t_i,p_i)} > 0 & \text{if} \quad t_i < \check{t} \\ 0 & \text{if} \quad \check{t} \leq t_i \leq \hat{t} \\ -\frac{B_{pt}(t_i,p_i)-(1+\lambda)C_{pt}(t_i,p_i)}{B_{pp}(t_i,p_i)-(1+\lambda)C_{pp}(t_i,p_i)} > 0 & \text{if} \quad t_i > \hat{t} \end{cases}$$

Therefore bliss points are unique and (weakly) monotone in types. The policy outcome is the median's bliss point, p_m. If $\check{t} \leq t_m \leq \hat{t}$ then $p_m = p^S$; thus the outcome is the status quo.

ii) Let $t_m^1 \in \left[\check{t}, \hat{t}\right]$ be the median of the type distribution at time 1, and let θ be a shock affecting the median at time 2: $t_m^2 = t_m^1 + \theta$. A policy change occurs at time 2 only if $\theta > \hat{t} - t_m^1 \geq 0$, or $\theta < \check{t} - t_m^1 \leq 0$. Inertia is more likely if λ is larger. This follows from the fact that the size of the group of intermediate types is increasing in loss aversion, which we show below. Recall that $\check{t}$ is implicitly determined by $(1+\lambda)B_p(t,p^S) - C_p(t,p^S) = 0$, and $\hat{t}$ is implicitly determined by

$B_p(t,p^S)-(1+\lambda)C_p(t,p^S)=0$. Implicit differentiation yields

$$\frac{\partial\check{t}}{\partial\lambda}=-\frac{B_p(\check{t},p^S)}{(1+\lambda)B_{pt}(\check{t},p^S)-C_{pt}(\check{t},p^S)}<0 \quad\text{and}\quad \frac{\partial\hat{t}}{\partial\lambda}=-\frac{-C_p(\hat{t},p^S)}{B_{pt}(\hat{t},p^S)-(1+\lambda)C_{pt}(\hat{t},p^S)}>0 \tag{22}$$

where inequalities follow from the fact that, by A3, the denominators of the two above expressions are positive. Therefore, as λ increases some "small" shocks might not be sufficient to lead an intermediate median t_m^1 to desire a policy change.
iii) Suppose $t_i<\check{t}$, then by (3) $p_i\neq p^S$ solves the FOC $(1+\lambda)B_p(t_i,p)-C_p(t_i,p)=0$. Then $B_p(t_i,p)-C_p(t_i,p)=-\lambda B_p(t_i,p)<0$. Voter i's bliss point with loss aversion is higher than i's bliss point with no loss aversion. Similarly, if $t_i>\hat{t}$ then i's bliss point with loss aversion is lower than with no loss aversion. Thus loss aversion yields a moderating effect on voter's preferences. It is easy to see that this moderating effect is increasing in the loss aversion parameter.
Consider now the equilibrium outcome. If $t_m<\check{t}$, then by (3) $p_m<p^S$ solves $(1+\lambda)B_p(t_m,p)-C_p(t_m,p)=0$. It follows that $B_p(t_m,p)-C_p(t_m,p)=-\lambda B_p(t_m,p)<0$. This means that the policy that maximizes the median's indirect utility with loss aversion would be too high if there was no loss aversion. Thus the policy outcome is a higher policy, compared to the case with no loss aversion. Following the same steps, if $t_m>\hat{t}$ the median's optimality condition is $B_p(t_m,p)-C_p(t_i,p)=\lambda C_p(t_m,p)>0$. In this case the policy outcome p_m is lower compared to the case with no loss aversion. Note that this moderation effect is stronger if the loss aversion parameter λ is larger. To see it, consider that, by (3), bliss points represent interior solutions for high and low types. By A1-A2, implicit differentiating of (3) for $i=m$ yields,

$$\begin{array}{lll} \frac{\partial p_m}{\partial\lambda}>0 & \text{if} & t_m<\check{t} \\ \frac{\partial p_m}{\partial\lambda}<0 & \text{if} & t_m>\hat{t} \end{array}$$

iv) Let the "high" and the "low" status quo be, respectively, p^{S1} and p^{S2} (with $p^{S1}>p^{S2}$), and let the inertia interval under p^{S1} and p^{S2} be $\left[\check{t}^1,\hat{t}^1\right]$ and $\left[\check{t}^2,\hat{t}^2\right]$, respectively. By the definition of $\check{t}$ and $\hat{t}$ (cf. the proof of part *ii)* above),

$$\frac{\partial\check{t}}{\partial p^S}=-\frac{(1+\lambda)B_{pp}(\check{t},p^S)-C_{pp}(\hat{t},p^S)}{(1+\lambda)B_{pt}(\check{t},p^S)-C_{pt}(\check{t},p^S)}>0 \quad\text{and}\quad \frac{\partial\hat{t}}{\partial p^S}=-\frac{B_{pp}(\check{t},p^S)-(1+\lambda)C_{pp}(\hat{t},p^S)}{B_{pt}(\hat{t},p^S)-(1+\lambda)C_{pt}(\hat{t},p^S)}>0$$

Thus both $\check{t}$ and $\hat{t}$ are increasing in the status quo. Therefore, $\check{t}^2<\check{t}^1$ and $\hat{t}^2<\hat{t}^1$. Suppose $\hat{t}^2<t_m<\check{t}^1$. In this case the median wants to increase the policy under p^{S2}, but she wants to decrease it under p^{S1}. By (3), in the former case she chooses a level of the policy, call it p_m^2, that solves $B_p(t_i,p)-(1+\lambda)C_p(t_i,p)=0$; in the latter cases she chooses a level p_m^1 that solves $(1+\lambda)B_p(t_i,p)-C_p(t_i,p)=0$. Then $p_m^1>p_m^2$.
Following the same steps, if $p^{S1}<p^{S2}$ and $\hat{t}^1<t_m<\check{t}^2$ then $p_m^1<p_m^2$.

v) Suppose in period 1 a shock on the voters' preferences leads the median to prefer a higher policy than the status quo: $t_m > \hat{t}^1$. By (3), the new policy $p^1 = p_m$ solves $B_p(t_m, p) - (1+\lambda)C_p(t_m, p) = 0$. In period 2, p^1 becomes the status quo: $p^1 = p^{S2}$. By statement *iv)* above, $\hat{t}^2 > \hat{t}^1$. Specifically, $\hat{t}^2$ solves $B_p(t, p^{S2}) - (1+\lambda)C_p(t, p^{S2}) = 0$. Since $p_m = p^1 = p^{S2}$, we have $B_p(t, p_m) - (1+\lambda)C_p(t, p_m) = 0$. Then $\hat{t}^2 = t_m$. Thus in period 2 the median type is the upper limit of the inertia range $\left[\check{t}^2, \hat{t}^2\right]$. This implies that the new status quo $p^{S2} = p_m$ beats any lower alternative with more than the simple majority of votes in favor. Following the same steps it is possible to prove that if $t_m > \hat{t}^1$, then $\check{t}^2 = t_m$. Once a *lower* policy becomes the status quo, it beats any higher alternative with more than the simple majority of votes in favor.
vi) Let Benthamite social welfare *inclusive of* loss aversion be

$$W(p \mid p^S) = \begin{cases} \int \left[B(t,p) - C(t,p) - \lambda \left[C(t,p) - C(t,p^S)\right]\right] dF(t) & \text{if} \quad p \geq p^S \\ \int \left[B(t,p) - C(t,p) - \lambda \left[B(t,p^S) - B(t,p)\right]\right] dF(t) & \text{if} \quad p < p^S \end{cases}$$

The socially optimal policy, p^*, solves the following optimality condition,

$$\begin{cases} \bar{B}_p(p) = (1+\lambda)\bar{C}_p(p) & \text{if} \quad p > p^S \\ p^* = p^S & \text{otherwise} \\ (1+\lambda)\bar{B}_p(p) = \bar{C}_p(p) & \text{if} \quad p < p^S \end{cases} \tag{23}$$

where $\bar{B}_p(p) = \int B_p(t,p)dF(t)$ and $\bar{C}_p(p) = \int C_p(t,p)dF(t)$. If $B_p(t_m, p_m) - C_p(t_m, p_m) = \bar{B}_p(p_m) - \bar{C}_p(p_m)$, the median behaves as the benevolent social planner. Then she chooses p^*.
Benthamite social welfare *without* loss aversion is

$$W(p) = \int \left[B(t,p) - C(t,p)\right] dF(t)$$

The policy p^{**} maximizing $W(p)$ solves

$$\bar{B}_p(p) = \bar{C}_p(p) \tag{24}$$

It is easy to see that $W(p) = W(p \mid p^S)$ if and only if $p = p^S$, while $W(p) > W(p \mid p^S)$ for any $p \neq p^S$.
If $p^* > p^S$, then the FOC in the first line of (23) is satisfied, but the FOC in (24) is not. If $p^* < p^S$, then the FOC in the third line of (23) is satisfied, but the FOC in (24) is not. This means that when the social planner or a median voter behaving as the social planner chooses a social optimal policy that is different from the status quo, welfare without loss aversion cannot be maximized. In other words, if $p^* \neq p^S$ then $p^{**} \neq p^*$ and $W(p^* \mid p^S) < W(p^{**}) = W(p^{**} \mid p^{**})$. If $p^{**} = p^S$, then $W(p^{**}) = W(p^{**} \mid p^S)$. Since $W(p \mid p^S)$ cannot attain any higher level than $W(p^{**} \mid p^S)$, it follows that $p^{**} = p^*$. This proves that the highest social welfare

inclusive of loss aversion is achieved when $p^{**} = p^S$. The social planner or a median behaving as a social planner chooses the first best, $p^{**} = p^*$, if and only if it is already the status quo. ■

Proof. Proposition 2

i) Consider a young voter i in period 1. For simplicity there is no discounting for future utility. Bliss points in period 1 are sequentially rational and maximize lifetime utility. First we prove that i's bliss point is the same in both periods. We proceed backwards: in period 2, the bliss point maximizes residual lifetime utility, $V(t_i, p^2 \mid p^1)$:

$$p_i^2 \in \arg\max_{p^2} \begin{cases} V(t_i,p^2) - \lambda\left[C(t_i,p^2) - C(t_i,p^1)\right] & \text{if} \quad p^2 \geq p^1 \\ V(t_i,p^2) - \lambda\left[B(t_i,p^1) - B(t_i,p^2)\right] & \text{if} \quad p^2 < p^1 \end{cases}$$

Thus,

$$p_i^2 \;\; \text{solves} \;\; \begin{cases} B_p(t_i,p^2) - (1+\lambda)C_p(t_i,p^2) = 0 & \text{s.t.} \quad p^2 > p^1 \\ p^2 = p^1 & \text{otherwise} \\ (1+\lambda)B_p(t_i,p^2) - C_p(t_i,p^2) = 0 & \text{s.t.} \quad p^2 < p^1 \end{cases} \tag{25}$$

This ideal policy is a function of the state variable, p^1. Let $p_i^2 = G(p^1)$ denote this function.

At time 1, voter i chooses her bliss point p_i^1 taking into account the consequences of her choice today on her future preferences:

$$p_i^1 \in \arg\max_{p^1} \left\{ V(t_i, p^1 \mid p^0) + V(t_i, G(p^1) \mid p^1) \right\}$$

We now prove she has no incentive to choose $p^1 \neq G(p^1)$; i.e., in period 1 her ideal policy is not different from her ideal policy in period 2. Suppose, by contradiction she does. Say, $p^1 < G(p^1)$. Assume also that $p^1 > p^0$. In this case, after some algebraic manipulation, we can re-write the above objective function as:

$$\begin{aligned} &B(t_i,p^1) - C(t_i,p^1) + B(t_i,G(p^1)) - C(t_i,G(p^1)) \\ &- \lambda\left[C(t_i,G(p^1)) - C(t_i,p^0)\right] \end{aligned}$$

Recall that $p^1 > p^0$. Thus the interior solution solves:

$$\frac{\partial B(t_i,p^1)}{\partial p^1} - \frac{\partial C(t_i,p^1)}{\partial p^1} + \frac{\partial B(t_i,p_i^2)}{\partial p_i^2}\frac{\partial p_i^2}{\partial p^1} - (1+\lambda)\frac{\partial C(t_i,p_i^2)}{\partial p_i^2}\frac{\partial p_i^2}{\partial p^1} = 0$$

Since $p^1 < p_i^2 = G(p^1)$, by implicit differentiating (25) above, $G'(p^1) = \frac{\partial p_i^2}{\partial p^1} = 0$. Thus, if $p^0 < p^1 < p_i^2$, the last two terms of the above equation are zero. Then the equation which pins down the median's most preferred policy in period 1 is

$$\frac{\partial B(t_i,p^1)}{\partial p^1} - \frac{\partial C(t_i,p^1)}{\partial p^1} = 0$$

Observe that in this case the policy is chosen rationally, i.e., the ideal policy is the same as in the case with no loss aversion. But this is a contradiction, because if voter i chooses the policy rationally in period 1, then she will have no chance to increase her utility in period 2 other than keeping that policy unchanged. Thus, the policy she chooses in period 1 must be the same as the policy she chooses in period 2. But this contradicts the assumption that $p^1 < p_i^2$. Applying the same rationale, it can be proved that a contradiction arises also in the other three cases: 1. $p^0 > p^1 < p_i^2$; 2. $p^0 < p^1 > p_i^2$; 3. $p^0 > p^1 > p_i^2$. This proves that $p_i^1 = p_i^2$: in period 1 voter i's ideal policy is the same as in period 2.
In period 1, voter i sets p_i^1 so as to maximize her lifetime utility at period 1, $V(t_i, p^1 \mid p^0) + V(t_i, G(p^1) \mid G(p^1))$, which can be rewritten as:

$$\begin{cases} 2\,B(t_i,p^1) - 2\,C(t_i,p^1) - \lambda\,[C(t_i,p^1) - C(t_i,p^0)] & \text{if} \quad p^1 \geq p^0 \\ 2\,B(t_i,p^1) - 2\,C(t_i,p^1) - \lambda\,[B(t_i,p^1) - B(t_i,p^0)] & \text{if} \quad p^1 < p^0 \end{cases}$$

Therefore

$$p_i^1 \;\; \text{solves} \;\; \begin{cases} B_p(t_i,p^1) - (1+\frac{\lambda}{2})C_p(t_i,p^1) = 0 & \text{s.t.} \quad p^1 > p^0 \\ p^1 = p^0 & \text{otherwise} \\ (1+\frac{\lambda}{2})B_p(t_i,p^1) - C_p(t_i,p^1) = 0 & \text{s.t.} \quad p^1 < p^0 \end{cases}$$

$$\text{and} \;\; p_i^2 = p_i^1$$

this proves that a young voter i sets her ideal policy "as if" her perceived loss aversion was $\frac{\lambda}{2}$. Thus $\lambda^y = \lambda/2$. This result can easily be extended to the case in which a voter's residual life consists in n periods. In this case, her perceived loss aversion is λ/n. By $\lambda/2 = \lambda^y < \lambda^o = \lambda$ and by (22), it follows that $\hat{t}^o > \hat{t}^y$ and $\check{t}^y > \check{t}^o$. Thus the mass of young voters who want the status quo $(F(\hat{t}^y) - F(\check{t}^y))$ is smaller than the mass of old voters who want the status quo $(F(\hat{t}^o) - F(\check{t}^o))$.
ii) The proof of this statement coincides with the discussion in the main text, thus we omit it.
iii) Since $\hat{t}^o > \hat{t}^y$, then $F(\hat{t}^o) > F(\hat{t}^y)$. By (4-5), the term in the LHS of (6), $(1-S(b))F(\hat{t}^o) + S(b)F(\hat{t}^y)$, is decreasing in b. Thus, the lower b, the smaller the set of parameter values for which a constituency in favor of $p > p^S$ exists. Following the same steps, also the term in the LHS of (7) is decreasing in b. Thus, the lower b, the smaller the set of parameter values for which (7) is satisfied. Summing up, with a lower birth rate, a constituency for a policy reform is less likely to form.
iv) Suppose in a given period k a constituency for a reform exists. For instance, a shock in preferences/distribution/birth rate is such that either condition (6) or (7) is satisfied. We prove here that the reform will be more different from the status quo the more numerous are the young. The equations that pin down the equilibrium

policy p are:

$$\text{if (6) holds, } p > p^S \text{ solves: } \quad (1-\sigma)F(H^{-1o}(p)) + \sigma F(H^{-1y}(p)) = 0.5 \tag{26}$$

$$\text{if (7) holds, } p < p^S \text{ solves: } \quad (1-\sigma)(1 - F(H^{-1o}(p))) + \sigma(1 - F(H^{-1y}(p))) = 0.5 \tag{27}$$

$$\text{if neither (6) nor (7) hold, } \quad p = p^S \tag{28}$$

where $H^{-1o}(p)$ is the inverse function of (3) in the old group (in which perceived loss aversion is $\lambda^o = \lambda$). It yields the type of old voter whose bliss point is p. Thus $F(H^{-1o}(p))$ is the share of old voters who want a lower policy than p. Similarly, $H^{-1y}(p)$ is the inverse function of (3) in the young group (with perceived loss aversion $\lambda^y = \lambda/2$), and $F(H^{-1y}(p))$ is the share of young voters who want a lower policy than p. Note that $H^{-1o}(p)$ and $H^{-1o}(p)$ are not defined at the point $p = p^S$. Equations in (26) and (27) say that the reform is a new policy $p \neq p^S$ such that exactly a half of the population want a lower policy (and the other half want a higher policy). Specifically, the median type is the same in both generations, the young median wants a different policy than the old median. Thus the equilibrium p^k is in between their bliss points, and it is set according to (26)-(27).
If (6) holds, then equation (26) pins down the equilibrium policy $p^k > p^S$. By (4), implicit differentiating (26) w.r.t. b yields

$$\frac{\partial p^k}{\partial b} = -\frac{S_b \cdot \left[F(H^{-1y}(p^k) - F(H^{-1o}(p^k))\right]}{(1-\sigma)f(H^{-1o}(p^k))H_p^{-1o}(p^k) + \sigma f(H^{-1y}(p^k))H_p^{-1y}(p^k)} > 0 \qquad \text{for } p^k > p^S$$

where the inequality follows from the fact that $S_b > 0$ and $F(H^{-1y}(p) < F(H^{-1o}(p))$ for any $p > p^S$, and the denominator is positive since all terms are positive (specifically, by (3) the relations between bliss points and types are strictly positive for young and old, thus their inverses derivatives are positive: $H_p^{-1y}(p), H_p^{-1o}(p) > 0$).
Following the same steps, by implicit differentiation of (27) w.r.t. b and taking into account that, for any $p < p^S$, $F(H^{-1y}(p) > F(H^{-1o}(p))$, we have

$$\frac{\partial p^k}{\partial b} = -\frac{S_b \cdot \left[F(H^{-1o}(p^k) - F(H^{-1y}(p^k))\right]}{-(1-\sigma)f(H^{-1o}(p^k))H_p^{-1o}(p^k) - \sigma f(H^{-1y}(p^k))H_p^{-1y}(p^k)} < 0 \qquad \text{for } p^k < p^S$$

Hence, in case of a policy change, the lower b, the lower the distance between the equilibrium policy p^k and the status quo. ■

Proof. Proposition 3
i) Let $c = y, o$. Note that $\check{t}^c$is implicitly determined by $(1+\lambda^c)B_p(\check{t}^c, p^S) - C_p(\check{t}^c, p^S) = 0$, and $\hat{t}^c$ is implicitly determined by $B_p(\hat{t}^c, p^S) - (1+\lambda^c)C_p(\hat{t}^c, p^S) = 0$. By (8), $\check{t}^c = \check{T}^c(k, e)$ and $\hat{t}^c = \hat{T}^c(k, e)$. By (22), $\check{T}_k^c = \frac{\partial \check{T}^c}{\partial L} \cdot L_k^c > 0$ and $\hat{T}_k^c = \frac{\partial \hat{T}^c}{\partial L} \cdot L_k^c < 0$.

Moreover, by (8) for any $k, e > 0$, $\lambda^y < \lambda^o$. Thus, $\hat{t}^o > \hat{t}^y$ and $\check{t}^y > \check{t}^o$ (cf. the proof of Proposition 2).
Define period k^* the one at which a constituency for a reform forms. Thus either (6) or (7) is satisfied. Consider the case in which (6) is satisfied. Thus a majority wants to increase the policy. Since k^* is an integer, it is the integer part of $\tilde{k}$ implicitly defined by

$$(1 - S(b))F(\hat{T}^o(\tilde{k}, e)) + S(b)F(\hat{T}^y(\tilde{k}, e)) = 0.5 \tag{29}$$

$\tilde{k}$ exists and it is a finite number. This is easily shown by the fact that $\lim_{k\to\infty} \hat{T}^c(k, e) - \check{T}^c(k, e) = 0$. In words, as k gets larger and larger the inertia intervals for both young and old become negligibly small. Thus the two groups behave as a majority with no loss aversion. Thus, if $p_m \neq p^S$ a constituency for a reform exists eventually.
ii) Implicit differentiating (29) yields a negative relationship between $\tilde{k}$ and e and b, respectively:

$$\frac{\partial \tilde{k}}{\partial e} = -\frac{[L_e^o \frac{\partial \hat{T}^o}{\partial L}\frac{\partial F}{\partial \hat{T}^o}(1 - S(b)) + L_e^y \frac{\partial \hat{T}^y}{\partial L}\frac{\partial F}{\partial \hat{T}^y} S(b)]}{[L_k^o \frac{\partial \hat{T}^o}{\partial L}\frac{\partial F}{\partial \hat{T}^o}(1 - S(b)) + L_k^y \frac{\partial \hat{T}^y}{\partial L}\frac{\partial F}{\partial \hat{T}^y} S(b)]} < 0$$

$$\frac{\partial \tilde{k}}{\partial b} = \frac{S_b[F(\hat{T}^o(\tilde{k}, e)) - F(\hat{T}^y(\tilde{k}, e)]}{[L_k^o \frac{\partial \hat{T}^o}{\partial L}\frac{\partial F}{\partial \hat{T}^o}(1 - S(b)) + L_k^y \frac{\partial \hat{T}^y}{\partial L}\frac{\partial F}{\partial \hat{T}^y} S(b)]} < 0$$

The fact that k^* is weakly increasing in $\tilde{k}$, completes the proof. ■

Proof. Proposition 4
With loss aversion, the two candidates' objective functions are

$$U^l \equiv U(x, l) \cdot P(x, y, p^S) + U(y, l) \cdot \left[1 - P(x, y, p^S)\right] \tag{30}$$

$$U^r \equiv U(x, r) \cdot P(x, y, p^S) + U(y, r) \cdot \left[1 - P(x, y, p^S)\right] \tag{31}$$

where $P(x, y, p^S) \equiv \Pr\left\{T^{LA}(x, y, p^S) > t_m + \epsilon\right\} = \frac{1}{2\delta}(T^{LA}(x, y, p^S) - t_m + \delta)$. Nash equilibrium, $\{x^*, y^*\}$, is found by simultaneously solving the following two FOCs

$$U_x^l = U_x(x, l) \cdot P(x, y, p^S) + [U(x, l) - U(y, l)] \cdot P_x(x, y, p^S) = 0 \tag{32}$$

$$U_y^r = U_y(y, r) \cdot \left[1 - P(x, y, p^S)\right] - [U(y, r) - U(x, r)] \cdot P_y(x, y, p^S) = 0 \tag{33}$$

The two SOCs are satisfied if $U(p, l)$ and $U(p, r)$ are sufficiently concave. For the stability condition, see the proof of Proposition 5 below.
By (15), the loss aversion parameter λ affects the type of the indifferent voter, t_{ind}^{LA}. As t_{ind}^{LA} changes, the candidates' incentive to propose higher or lower platform change accordingly. Thus, we can compare what happens with and without loss aversion

if we let the indifferent voter with loss aversion be "sufficiently close" to the indifferent voter with no loss aversion. For simplicity, assume $t_{ind}^{LA} = t_{ind}$ (results below go through if t_{ind}^{LA} and t_{ind} are sufficiently close). By (15-9), $t_{ind}^{LA} = t_{ind}$ implies that $B(t_{ind}^{LA}, p^S) - B(t_{ind}^{LA}, x) = C(t_{ind}^{LA}, y) - C(t_{ind}^{LA}, p^S)$. Thus, $T_x^{LA} = -\frac{V_x(t_{ind}^{LA}, x) + \lambda B_x(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, x) - V_t(t_{ind}^{LA}, y)} > T_x = -\frac{V_x(t_{ind}, x)}{V_t(t_{ind}, x) - V_t(t_{ind}, y)}$ and $T_y^{LA} = -\frac{-V_y(t_{ind}^{LA}, x) + \lambda C_y(t_{ind}^{LA}, y)}{V_t(t_{ind}^{LA}, x) - V_t(t_{ind}^{LA}, y)} > T_y = -\frac{-V_y(t_{ind}^{LA}, x)}{V_t(t_{ind}, x) - V_t(t_{ind}, y)}$. This implies that, for any x and y, $P_x(x, y, p^S) > P_x(x, y)$ and $P_y(x, y, p^S) > P_y(x, y)$; i.e. under loss aversion a marginal change in a candidate's platform has a bigger impact on his winning probability. Note that $t_{ind}^{LA} = t_{ind}$ also implies that $P(x, y, p^S) = P(x, y)$. The two equilibrium strategies with no loss aversion solve (13-14), but they cannot solve (32-33). Specifically, at the equilibrium point with no loss aversion, the LHS of (32) is strictly positive, and the LHS of (33) is strictly negative. This implies that, with loss aversion, the left-wing candidate has incentive to propose a higher platform than with no loss aversion, while the right-wing candidate has incentive to propose a lower platform. Now we complete the proof by showing that the equilibrium with loss aversion implies more similar platforms. Let (x^{*1}, y^{*1}) be the equilibrium with no loss aversion, and (x^{*2}, y^{*2}) the equilibrium with loss aversion. Assume by contradiction that the latter entails less convergence: $x^{*2} < x^{*1} < y^{*1} < y^{*2}$. The assumption of sufficiently high concavity yields $U_{xy}^l, U_{yx}^r \geq 0$. Therefore $U_x^l(x^{*2}, y^{*2}) \geq U_x^l(x^{*2}, y^{*1}) > U_x^l(x^{*1}, y^{*1}) > 0$ where the first inequality follows from $U_{xy}^l \geq 0$ and the second one follows from $U_{xx}^l < 0$. Hence, at the point (x^{*1}, y^{*1}) candidate l has incentive to increase his platform. This yields a contradiction. Finally, assume $x^{*2} < x^{*1} < y^{*2} < y^{*1}$. In such a case, $t_{ind}^{LA} < t_{ind}$, violating the hypothesis. Therefore, by contradiction, with loss aversion equilibrium platforms are more similar.

Special cases.

We consider now how equilibrium is affected by loss aversion when both equilibrium platforms are either above or below the status quo. We will prove that in these cases the equilibrium platforms unaffected by changes in the status quo, but they are closer to the status quo, than with no loss aversion.

Case 1: both platforms are below the status quo

If $\{x, y\} \in [0, p^S]^2$, the indifference condition that pins down the indifferent type, t_{ind}^{LA}, is

$$V(t_{ind}^{LA}, x) - \lambda \left[B(t_{ind}^{LA}, p^S) - B(t_{ind}^{LA}, x)\right] = V(t_{ind}^{LA}, y) - \lambda \left[B(t_{ind}^{LA}, p^S) - B(t_{ind}^{LA}, y)\right]$$

which simplifies into

$$V(t_{ind}^{LA}, x) + \lambda \left[B(t_{ind}^{LA}, x)\right] = V(t_{ind}^{LA}, y) + \lambda \left[B(t_{ind}^{LA}, y)\right]. \tag{34}$$

As a result $t_{ind}^{LA} = T^{LA}(x, y)$ is independent of the status quo. Thus also the probability that candidate left wins $P(x, y) = \frac{1}{2\delta}(T^{LA}(x, y) - t_m + \delta)$ does not depend of p^S. Hence, equilibrium platforms are independent of the status quo, $\frac{\partial x^*}{\partial p^S} = 0$, $\frac{\partial y^*}{\partial p^S} = 0$.

Now we prove that loss aversion implies that both equilibrium platforms are closer to the status quo. Implicit differentiation of (34) yields

$$T_\lambda = \frac{B((t_{ind}^{LA}, x) - B(t_{ind}^{LA}, y)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x) + \lambda[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)]} < 0.$$

This means that, for any $\{x, y\} \in [0, p^S]^2$ we have that $T^{LA}(x, y) < T(x, y)$. This implies that given an equilibrium with no loss aversion (x^1, y^1), if there exists a parameter λ such that the equilibrium with loss aversion (x^*, y^*) is such that $T^{LA}(x^*, y^*) = T(x^1, y^1)$, then $(x^*, y^*) \neq (x^1, y^1)$. Moreover, it must be the case that $x^1 < x^* < y^1 < y^*$, i.e. the policies with loss aversion are closer to the Status Quo p^S. Notice that

$$\begin{aligned} T_x^{LA} &= \frac{V_x(t_{ind}^{LA}, x) + \lambda B_x(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x) + \lambda[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)]} = \\ &= \frac{(1+\lambda)B_x(t_{ind}^{LA}, x) - C_x(t_{ind}^{LA}, x)}{(1+\lambda)[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} > \\ &> \frac{B_x(t_{ind}^{LA}, x) - C_x(t_{ind}^{LA}, x)}{[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} = \\ &= \frac{V_x(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x)} = T_x \end{aligned}$$

Moreover:

$$\begin{aligned} T_y^{LA} &= -\frac{V_y(t_{ind}^{LA}, y) + \lambda B_y(t_{ind}^{LA}, y)}{V_t(y, t_{ind}^{LA}) - V_t(x, t_{ind}^{LA}) + \lambda[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)]} = \\ &= \frac{C_y(t_{ind}^{LA}, x) - (1+\lambda)B_y(t_{ind}^{LA}, x)}{(1+\lambda)[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} < \\ &< \frac{C_y(t_{ind}^{LA}, x) - B_y(t_{ind}^{LA}, x)}{[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} = \\ &= -\frac{V_y(t_{ind}^{LA}, y)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x)} = T_y. \end{aligned}$$

Where T_x and T_y are the derivatives of the indifferent type with no loss aversion. Let a, b, c, d be positive numbers such that $\frac{a-b}{c+d} > 0$. Take $k > 1$. Then $\frac{ka-b}{kc+d} > \frac{ka-kb}{kc+kd} > \frac{a-b}{c+d}$: which implies the first inequality $T_x^{LA} > T_x$. Moreover $\frac{a-kb}{kc+d} < \frac{a-b}{c+d}$ implies the second inequality $T_y^{LA} < T_y$.

To see this, set $a = B_x(t_{ind}^{LA}, x)$; $b = C_x(t_{ind}^{LA}, x)$; $c = [B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)]$; $d = -[C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]$;and $k = (1+\lambda)$ for the first inequality; set $a = C_y(t_{ind}^{LA}, x)$ and $b = B_y(t_{ind}^{LA}, x)$ for the second inequality.
The two inequalities above imply that, for any x and y, and any $\lambda > 0$, $P_x(x, y) < P_x(x, y, \lambda)$, and $P_y(x, y, \lambda) < P_y(x, y)$. We already know that, if $t_{ind}^{LA} = t_{ind}$, the equilibrium with no loss aversion (x^1, y^1) is different from the equilibrium under loss aversion (x^*, y^*). Moreover, it does not satisfy the FOCs with loss aversion, because $P_x(x^1, y^1, \lambda) > P_x(x^1, y^1)$ and $P_y(x^1, y^1, \lambda) < P_y(x^1, y^1)$. Specifically: $0 = U_x^l(x^1, y^1) < U_x^l(x^1, y^1, \lambda)$ and $0 = U_y^r(x^1, y^1) < U_y^r(x^1, y^1, \lambda)$. Thanks to the enough concavity assumption of U that is invoked throughout the discussion: $U_{xy}^l > 0$, $U_{yx}^r > 0$, and $U_{xx}^l < 0$, $U_{yy}^r < 0$.
Now, suppose the equilibrium is such that $x^* < x^1 < y^1 < y^*$. Thus $0 < U_x^l(x^1, y^1, \lambda) < U_x^l(x^1, y^*, \lambda) < U_x^l(x^*, y^*, \lambda)$ where the first inequality comes from $U_{xy}^l > 0$ and the second from $U_{xx}^l < 0$. So this one cannot be an equilibrium. Next, $x^1 < x^* < y^* < y^1$. Then $0 < U_y^r(x^1, y^1, \lambda) < U_y^r(x^*, y^1, \lambda) < U_y^r(x^*, y^*, \lambda)$ where the first inequality comes from $U_{xy}^r > 0$ and the second from $U_{yy}^r < 0$.Thus, it cannot be an equilibrium either. Finally, suppose $x^* < x^1 < y^* < y^1$: in such a case $t_{ind}^{LA} \neq t_{ind}$ in contradiction with the hypothesis. Therefore, any equilibrium (x^*, y^*) where $T^{LA}(x^*, y^*, \lambda) = T(x^1, y^1)$, must be such that $x^1 < x^* < y^1 < y^*$. This proves that with loss aversion both equilibrium platforms are closer to the status quo, than with no loss aversion.

Case 2: both platforms are above the status quo

If $\{x, y\} \in [0, p^S]^2$, the indifference condition that pins down the indifferent type, t_{ind}^{LA}, is

$$V(t_{ind}^{LA}, x) - \lambda \left[C(t_{ind}^{LA}, x) - C(t_{ind}^{LA}, p^S) \right] = V(t_{ind}^{LA}, y) - \lambda \left[C(t_{ind}^{LA}, y) - C(t_{ind}^{LA}, p^S) \right]$$

which simplifies into

$$V(t_{ind}^{LA}, x) - \lambda \left[C(t_{ind}^{LA}, x) \right] = V(t_{ind}^{LA}, y) - \lambda \left[C(t_{ind}^{LA}, y) \right]. \tag{35}$$

Following the same steps as in Case 1 above, $\frac{\partial x^*}{\partial p^S} = 0$, $\frac{\partial y^*}{\partial p^S} = 0$.
Implicit differentiation of 35 yields

$$T_\lambda = \frac{C((t_{ind}^{LA}, y) - C(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x) - \lambda [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} > 0.$$

following the same steps as above, we can show that $x^* < x^1 < y^* < y^1$, i.e. the policies under loss aversion are closer to the Status Quo p^S :

$$T_x^{LA}(x, y, \lambda) = \frac{V_x(t_{ind}^{LA}, x) - \lambda C_x(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x) - \lambda [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} =$$

$$= \frac{B_x(t_{ind}^{LA}, x) - (1+\lambda) C_x(t_{ind}^{LA}, x)}{[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - (1+\lambda)[C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} <$$

$$< \frac{B_x(t_{ind}^{LA}, x) - C_x(t_{ind}^{LA}, x)}{[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} =$$

$$= \frac{V_x(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x)} = T_x(x, y)$$

Moreover

$$T_y^{LA}(x, y, \lambda) = -\frac{V_y(t_{ind}^{LA}, x) - \lambda C_y(t_{ind}^{LA}, x)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x) - \lambda[C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} =$$

$$= \frac{(1+\lambda) C_y(t_{ind}^{LA}, x) - B_y(t_{ind}^{LA}, x)}{[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - (1+\lambda)[C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} >$$

$$> \frac{C_y(t_{ind}^{LA}, x) - B_y(t_{ind}^{LA}, x)}{[B_t(t_{ind}^{LA}, y) - B_t(t_{ind}^{LA}, x)] - [C_t(t_{ind}^{LA}, y) - C_t(t_{ind}^{LA}, x)]} =$$

$$= -\frac{V_y(t_{ind}^{LA}, y)}{V_t(t_{ind}^{LA}, y) - V_t(t_{ind}^{LA}, x)} = T_y(x, y).$$

Using the same argument as in Case 1, $0 = U_x^l(x^1, y^1) > U_x^l(x^1, y^1, \lambda)$ and $0 = U_y^r(x^1, y^1) > U_y^r(x^1, y^1, \lambda)$. Assume $x^1 < x^* < y^* < y^1$. Then $0 > U_x^l(x^1, y^1, \lambda) > U_x^l(x^1, y^*, \lambda) > U_x^l(x^*, y^*, \lambda)$ where the first inequality follows from $U_{xy}^l > 0$ and the second one from $U_{xx}^l < 0$. So, it cannot be an equilibrium.
Now, assume $x^* < x^1 < y^1 < y^*$. We have $0 > U_y^r(x^1, y^1, \lambda) > U_y^r(x^*, y^1, \lambda) > U_y^r(x^*, y^*, \lambda)$ where the first inequality follows from $U_{xy}^r > 0$ and the second one from $U_{yy}^r < 0$. As a result, it is not an equilibrium. Finally, assume $x^1 < x^* < y^1 < y^*$. This implies that $t_{ind}^{LA} \neq t_{ind}$, which is in contradiction with the hypothesis. Therefore, any equilibrium (x^*, y^*) where $T^{LA}(x^*, y^*, \lambda) = T(x^1, y^1)$, must be such that $x^* < x^1 < y^* < y^1$: with loss aversion, equilibrium platforms are closer to the status quo.
Results for Cases 1 and 2 are consistent with the idea presented in the main text that with loss aversion candidates fix their platforms to accommodate voters' attachment to the status quo (moderation effect).

Case 3: core party members are subject to loss aversion

We now show that equilibrium platforms are more similar when core party members are subject to loss aversion. We assume that the candidates' objective functions are the same as the indirect utility functions of their core party members :

$$U(p, l \mid p^S) = \begin{array}{ll} V(p, l) - \lambda\left[B(p^S, l) - B(p, l)\right] & \text{if} \quad p < p^S \\ V(p, l) - \lambda\left[C(p, l) - C(p^S, l)\right] & \text{if} \quad p \geq p^S \end{array} \tag{36}$$

$$U(p, r \mid p^S) = \begin{array}{ll} V(p, r) - \lambda\left[B(p^S, r) - B(p, r)\right] & \text{if} \quad p < p^S \\ V(p, r) - \lambda\left[C(p, r) - C(p^S, r)\right] & \text{if} \quad p \geq p^S \end{array} \tag{37}$$

where the type of the left-wing (right-wing) core party members is l (r, respectively). Let the two parties' ideal policies with loss aversion be $\bar{l}^{LA} < p^S$ and $\bar{r}^{LA} > p^S$. They maximize the two above functions, respectively. With no loss aversion, the two most preferred policies are $\bar{l}$ and $\bar{r}$ which maximize $V(p,l)$ and $V(p,r)$, respectively. It is easy to see that $\bar{l}^{LA} > \bar{l}$ and $\bar{r}^{LA} < \bar{r}$. Let $\tilde{x}^*$ and $\tilde{y}^*$ be the equilibrium platforms when core party members are subject to loss aversion, with $\tilde{x}^* < p^S < \tilde{y}^*$. They solve the following two FOCs

$$U_x^{lLA} = U_x(x,l \mid p^S) \cdot P(x,y,p^S) + \left[U(x,l \mid p^S) - U(y,l \mid p^S)\right] \cdot P_x(x,y,p^S) = 0 \tag{38}$$

$$U_y^{rLA} = U_y(y,r \mid p^S) \cdot \left[1 - P(x,y,p^S)\right] - \left[U(y,r \mid p^S) - U(x,r \mid p^S)\right] \cdot P_y(x,y,p^S) = 0 \tag{39}$$

where $P(x,y,p^S)$ is defined as in the proof of Proposition 5.

We want to show that the equilibrium when core party members are not loss averse cannot be the equilibrium when they are loss averse. Let $\{x^*, y^*\}$ be the equilibrium platforms when core party members are not loss averse. We show that $\{x^*, y^*\}$ solve (32-33) but they do not solve (38-39). If x^* and y^* are sufficiently symmetrical with respect to the status quo, then $\left[U(x^*,l \mid p^S) - U(y^*,l \mid p^S)\right] - \left[V(x^*,l) - V(y^*,l)\right]$ and $\left[U(y^*,r \mid p^S) - U(x^*,r \mid p^S)\right] - \left[V(y^*,r) - V(x^*,r)\right]$ are sufficiently small. Thus the signs of (38) and (39) are determined by $U_x(x^*,l \mid p^S)$ and $U_y(y^*,r \mid p^S)$, respectively. Since $x^* < p^S$, by (36), $V_x(x,l) < U_x(x,l \mid p^S)$. Since $y^* \in (p^S, \bar{r}^{LA})$, by (37), $U_y(y,r \mid p^S) > V_y(x,l) > 0$. Thus, at the point $\{x^*, y^*\}$ (38) is positive, and (39) is negative. The left- wing candidate has incentive to propose a higher policy and the right-wing has incentive to propose a lower policy. Therefore, the equilibrium when core party members are not loss averse cannot be an equilibrium when they are loss averse. The equilibrium policies are more convergent when core party members are loss averse. ■

Proof. Proposition 5

i) By (32-33), $x^* = X^{LA}(p^S)$ and $y^* = Y^{LA}(p^S)$. We can derive comparative statics by solving for the derivatives of X^{LA} and X^{LA}:

$$\frac{\partial x^*}{\partial p^S} = \frac{\begin{vmatrix} -U^l_{xp^S} & U^l_{xy} \\ -U^r_{yp^S} & U^r_{yy} \end{vmatrix}}{|A|} \tag{40}$$

$$\frac{\partial y^*}{\partial p^S} = \frac{\begin{vmatrix} U^l_{xx} & -U^l_{xp^S} \\ U^r_{yx} & -U^r_{yp^S} \end{vmatrix}}{|A|}$$

where $|A| = U^l_{xx}U^r_{yy} - U^l_{xy}U^r_{yx} > 0$ is the standard regularity condition which ensures stability at the equilibrium point. We show below that it is satisfied if $U(p,l)$

and $U(p,r)$ are sufficiently concave. Since $|A| > 0$, the sign of $\frac{\partial x^*}{\partial p^S}$ is the same as the sign of $-U^l_{xp^S}U^r_{yy} + U^l_{xy}U^r_{yp^S}$. The sign of $\frac{\partial y^*}{\partial p^S}$, it is the same as the sign of $-U^r_{yp^S}U^l_{xx} + U^r_{yx}U^l_{xp^S}$. By U^l_x and U^r_y defined in (32-33),

$$U^l_{xx} = U_{xx}(x,l)\cdot P + 2U_x(x,l)\cdot P_x + [U(x,l) - U(y,l)]\cdot P_{xx} \tag{41}$$
$$U^r_{yy} = U_{yy}(y,r)\cdot[1-P] - 2P_y\cdot U_y(y,r) + [U(x,r) - U(y,r)]\cdot P_{yy} \tag{42}$$
$$U^l_{xy} = U_x(x,l)\cdot P_y - U_y(y,l)\cdot P_x + [U(x,l) - U(y,l)]\,P_{xy} \tag{43}$$
$$U^r_{yx} = -U_y(y,r)\cdot P_x + U_x(x,r)\cdot P_y + [U(x,r) - U(y,r)]\cdot P_{yx} \tag{44}$$
$$U^l_{xp^S} = U_x(x,l)\cdot P_{p^S} + [U(x,l) - U(y,l)]\cdot P_{xp^S} \tag{45}$$
$$U^r_{yp^S} = -U_y(y,r)\cdot P_{p^S} + [U(x,r) - U(y,r)]\cdot P_{yp^S} \tag{46}$$

In order to determine the signs of (41-46), we need to study the derivatives of the winning probability function, $P(x,y,p^S)$.
By implicit differentiation of (15),

$$T^{LA}_{p^S} = \frac{\partial t^{LA}_{ind}}{\partial p^S} = -\frac{-\lambda\left[B_p(t^{LA}_{ind},p^S) + C_p(t^{LA}_{ind},p^S)\right]}{M} < 0 \tag{47}$$

where $M < 0$ and it is defined by

$$\begin{aligned} M \equiv\ & V_t(t^{LA}_{ind},x) - V_t(t^{LA}_{ind},y) - \\ & \lambda\left[B_t(t^{LA}_{ind},p^S) - B_t(t^{LA}_{ind},x)\right] + \\ & \lambda\left[C_t(t^{LA}_{ind},y) - C_t(t^{LA}_{ind},p^S)\right] \end{aligned}$$

The inequality $M < 0$ follows from the fact that a marginally higher type than t^{LA}_{ind} prefers y more than x.
Following the same steps, $T^{LA}_x = -\frac{V_x(t^{LA}_{ind},x)+\lambda B_x(t^{LA}_{ind},x)}{M} > 0$ and $T^{LA}_y = -\frac{-V_y(t^{LA}_{ind},y)+\lambda C_y(t^{LA}_{ind},y)}{M} > 0$.
Therefore, $P_x = \frac{1}{2\delta}T^{LA}_x > 0$, $P_y = \frac{1}{2\delta}T^{LA}_y > 0$, and $P_{p^S} = \frac{1}{2\delta}T^{LA}_{p^S} < 0$ (by (47)).
As for second order derivatives, signs are ambiguous:
$T^{LA}_{xx} = -\frac{(V_{xx}+\lambda B_{xx}+(V_{tx}+\lambda B_{tx})T^{LA}_x)M-(V_x+\lambda B_x)(V_{tx}+\lambda B_{tx}+M_t T^{LA}_x)}{M^2} \lesseqgtr 0$;
similarly, $T^{LA}_{yy}, T^{LA}_{xy} \lesseqgtr 0$. Moreover,

$$T^{LA}_{xp^S} = -\frac{\left[V_{xt} + \lambda B_{xt}\right]T^{LA}_{p^S}M - (V_x + \lambda B_x)\lambda(-B_{tp^S} - C_{tp^S} + M_t T^{LA}_{p^S})}{M^2} \lesseqgtr 0 \tag{48}$$

and $T^{LA}_{yp^S} \lesseqgtr 0$. Therefore $P_{xx} = \frac{1}{2\delta}T^{LA}_{xx} \lesseqgtr 0$, and $P_{yy}, P_{xp^S}, P_{yp^S}, P_{yx} \lesseqgtr 0$.
By (41-42), if function $U(p,.)$ is sufficiently steep and concave in the policy p, then $U^l_{xx}, U^r_{yy} < 0$. Moreover, by (43-44), enough concavity also ensures $U^l_{xy}, U^r_{yx} > 0$.

Therefore, the stability condition $|A| > 0$ is satisfied. Note that if $\lambda = 0$, this model coincides with the model in subsection (5.1). Also in that model a sufficient degree of concavity of $U(p, .)$ ensures that the standard regularity condition is satisfied. By (45, 46), if $|U_x(x, l)|$ and $|-U_y(y, r)|$ are large enough, then $U^l_{xp^S}, U^r_{yp^S} > 0$, irrespective of the sign of P_{xp^S} and P_{yp^S}. Since $U^l_{xx}, U^r_{yy} < 0$ and $U^r_{yx}, U^l_{xy} > 0$, then $-U^l_{xp^S} U^r_{yy} + U^l_{xy} U^r_{yp^S} > 0$ and $-U^r_{yp^S} U^l_{xx} + U^r_{yx} U^l_{xp^S} > 0$. Hence, $\frac{\partial x^*}{\partial p^S}, \frac{\partial y^*}{\partial p^S} > 0$: equilibrium platforms are increasing in the status quo. Finally, observe that by (48), if $|B_{xt}|$ and $|C_{xt}|$ are sufficiently small, then $\left|P_{xp^S}\right| = \frac{1}{2\delta}\left|T^{LA}_{xp^S}\right|$ is small and, similarly, $\left|P_{yp^S}\right|$ is small. In this case, a larger set of parameters would ensure $U^l_{xp^S}, U^r_{yp^S} > 0$. The reason is that small values of $|B_{pt}|$ and $|C_{pt}|$ imply that a change in the status quo does not have a strong effect on the number of voters that candidates can affect by changing their platforms at the margin. Thus both candidates have strong incentive to move their platforms in the same direction as the status quo.

ii) The expected equilibrium policy outcome is $\boldsymbol{E}(p^*, p^S) = x^* \cdot P(x^*, y^*, p^S) + y^* \cdot (1 - P(x^*, y^*, p^S))$, where

$$P(x^*, y^*, p^S) = \frac{1}{2\delta}\left[T^{LA}(x^*, y^*, p^S) - t_m + \delta\right] \tag{49}$$

and $x^* = X^{LA}(p^S)$ and $y^* = Y^{LA}(p^S)$, with $\frac{\partial x^*}{\partial p^S}, \frac{\partial y^*}{\partial p^S} > 0$. Differentiating $\boldsymbol{E}(p^*, p^S)$ w.r.t. p^S yields,

$$\frac{\partial \boldsymbol{E}(p^*, p^S)}{\partial p^S} = \frac{\partial x^*}{\partial p^S} \cdot P + \frac{\partial y^*}{\partial p^S} \cdot (1 - P) + \frac{\partial P}{\partial p^S} \cdot (x^* - y^*)$$

where $\frac{\partial P}{\partial p^S} = \frac{1}{2\delta}\left[T^{LA}_{p^S} + T^{LA}_x \frac{\partial x^*}{\partial p^S} + T^{LA}_y \frac{\partial y^*}{\partial p^S}\right]$. We want to show that $\frac{\partial \boldsymbol{E}(p^*, p^S)}{\partial p^S} > 0$. By statement *i)* in this proposition, the first two terms are positive. The sign of the last term is ambiguous, because $T^{LA}_{p^S} < 0$ and $T^{LA}_x, T^{LA}_y > 0$ (cf. proof of statement *i)* above). Thus $\frac{\partial P}{\partial p^S} \cdot (x^* - y^*) = \frac{1}{2\delta}\left[T^{LA}_{p^S} + T^{LA}_x \frac{\partial x^*}{\partial p^S} + T^{LA}_y \frac{\partial y^*}{\partial p^S}\right] \cdot (x^* - y^*) \lesseqgtr 0$. However, by Proposition 4, equilibrium platforms converge under loss aversion. Hence, if λ is sufficiently large, $|x^* - y^*|$ is small enough, so that the sign of $\frac{\partial \boldsymbol{E}(p^*, p^S)}{\partial p^S}$ is determined by the sign of the first two terms. Thus $\frac{\partial \boldsymbol{E}(p^*, p^S)}{\partial p^S} > 0$. Note that large enough steepness and concavity of the candidates' utility functions is a sufficient condition to show that $\frac{\partial \boldsymbol{E}(p^*, p^S)}{\partial p^S} > 0$. It is perfectly plausible that this derivative is positive despite $\frac{\partial x^*}{\partial p^S}$ and $\frac{\partial y^*}{\partial p^S}$ have opposite signs. Supplementary Material available from the authors includes two parametric examples, one of which showing that expected policy is positively related to status quo, while $\frac{\partial x^*}{\partial p^S} < 0$ and $\frac{\partial y^*}{\partial p^S} > 0$. ■

Proof. Proposition 6

As mentioned earlier, the expected policy outcome is defined as $\boldsymbol{E}(p^{*2}, p^1) = x^{*2} \cdot$

$P(x^{*2}, y^{*2}, p^1) + y^{*2} \cdot (1 - P(x^{*2}, y^{*2}, p^1))$. The status quo in period 2 is the winner's equilibrium platform in period 1: $p^1 \in \{x^{*1}, y^{*1}\}$, with $x^{*1} < y^{*1}$. By Proposition 5, there is a positive relationship between expected policy and status quo. Thus, $\boldsymbol{E}(p^{*2}, x^{*1}) < \boldsymbol{E}(p^{*2}, y^{*1})$. ■

Proof. Proposition 7

Let $\{x^{01}, y^{01}\}$ be the equilibrium of the static model, where both candidates maximize their expected utility in period 1 only. We want to show that the FOCs for the equilibrium in the dynamic model are not satisfied at $\{x^{01}, y^{01}\}$. Consider candidate l. We show that enough concavity of $U(p,l)$ ensures that the LHS of (20) is positive at the point $\{x^{01}, y^{01}\}$. By (32-33), the first term of (20) is zero by definition. The second term is positive because $P^1_{x1} > 0$ and by Proposition 5 $U^{2l}(.., x^1) > U^{2l}(.., y^1)$. This term is large if concavity of $U(p,l)$ is high. As for the third term, recall that the winning probability in the second period depends on equilibrium policies and the second period status quo, $P^2 = P^2(x^{*2}, Y^2(x^1), x^1)$. Thus, by (30), and by the envelope theorem, the third term is

$$P^1 \cdot U^{2l}_{x1}(., x^1) = P^1 \cdot \left\{ \left[U(x^{*2}, l) - U(Y^2(x^1), l) \right] \left[P^2_{y2} Y^2_{x1} + P^2_{x1} \right] + U_{y2}(y^2, l) \cdot \left[1 - P^2 \right] Y^2_{x1} \right\}$$

The above expression characterizes a trade-off about the policy outcome in period 2. On the one hand, a marginal increase in x^1 yields a higher y^{*2}, which in turn raises the left-wing candidate's chance to win also in the second period ($P^2_{y2} Y^2_{x1} > 0$). On the other hand, holding x^{*2} and y^{*2} constant, a marginal increase in the status quo, x^1, lowers the left-wing candidate's probability to win in period 2 ($P^2_{x1} < 0$). Moreover, in the case the left-wing candidate is defeated in period 2, a higher y^{*2} implies a lower utility in the second period. Summing up, the third term of (20) can be either positive or negative. A sufficiently high concavity of $U(p,l)$ ensures that the second term of (20) is large enough, making entire expression (20) positive at the point $\{x^{01}, y^{01}\}$.

Following the same steps, expression (21) is strictly negative at the point $\{x^{01}, y^{01}\}$.

■

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