Loss Aversion in Politics*

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Abstract

We study loss aversion in majority voting. First, we show a status quo bias. Second, loss aversion implies a moderating effect. Third, in a dynamic setting, the effect of loss aversion diminishes with the length of the planning horizon of voters; however, in the presence of a projection bias, majorities are partially unable to understand how fast they will adapt. Fourth, in a stochastic environment, loss aversion yields a significant distaste for risk, but also a smaller attachment to the status quo. The application of these results to a model of redistribution leads to empirically plausible implications.

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1 Introduction

According to Kahnemann and Tversky, (1979) individuals "normally 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 experimental evidence.[1] However, loss aversion has not been much incorporated in social choice models.[2]

In the present paper we show that loss aversion leads to significant deviations from "standard" results of majority voting, which may also help explain some empirical puzzles when applied to choices regarding redistributive policies. We present a model of unidimensional political choice where the voters differ in their evaluation of the relative costs and benefits of different levels of such 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. Without loss aversion, the policy chosen would be the one preferred by the median voter, and the status quo is irrelevant. 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 differed from it. In fact changing policy implies losses and benefits, but the former weigh more. This generates a sort of *political endowment effect*: once the policy chosen by the majority becomes the new status quo, a larger majority of voters does not want to change it. A majority in favor of a change in the status quo materializes only if a sufficiently large shock in the environment occurs. Moreover, if the status quo changes, the voting outcome is still affected by the initial status quo. We then show that loss aversion determines a moderating effect: the most extreme types prefer less extreme policies.

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 a new intergenerational conflict about policy reforms; it is a conflict which does not hinge on differences in economic returns. It is instead a psychological reason: the old do not want to bear the psychologically costly commitment to a change today, because their future horizon in which to enjoy

[1] See Barberis (2013), DellaVigna (2009) and Rabin (1998) for a discussion of loss aversion, and extensive references to the empirical literature.

[2] "There are areas of economics where prospect theory has not been applied very extensively, even though it has the potential to offer useful insights. Public finance, health economics, and macroeconomics are three such fields." (Barberis, 2013, p. 190).

the benefits of it is shorter. In addition, loss aversion increases the political cohesion (reduces ideological differences) amongst those with a shorter time horizon, raising their chance to play a pivotal role.

If voters are also subject to a projection bias (Loewenstein et al., 2003), they are partially unable to understand how fast they will adapt to a new policy; only later they realize that they became accustomed to the new equilibrium faster than they thought, and that adaptation was also less painful than previously expected. We show that, in the presence of a projection bias, changes in any period are less radical than without it. However, thanks to the same mechanism of fast adaptation, voters are willing to make further changes in subsequent periods.

We then apply the model to a specific policy problem: the choice of a tax rate to provide a public good (in the text) or to finance a lump sum redistribution (in Appendix), in a model á la Meltzer and Richard (1981). The status quo bias discussed above implies that even a relatively large departure from the initial income distribution (and thus distribution of preferences for tax rates and public goods) leads to no changes in policy. This result may help rationalize why the well documented increase in income inequality in the US and in other countries, has not (thus far) lead to a radical increase in redistributive policies. Secondly, and related to that, even a relatively high level of inequality may not lead to "expropriatory" levels of the tax rates.[3] Third, we show results concerning the time horizon of voters: loss aversion weighs more in the decisions of individuals with a shorter horizon, say with a shorter life span (assuming imperfect intergenerational altruism). We use a simple overlapping generation model which clearly shows that societies which are growing older tend to exert more resistance to changes in policy.

We then move to considering a risky environment. We explore how loss averse voters make their choices when there is uncertainty about the outcome resulting from a policy. We address three questions: first of all how the behavior of loss averse voters is different from risk averse voters? Second, suppose a policy change is opposed to a safe status quo. When does the majority choose the reform? Third, how does risk affect the level of policy chosen? We show that when the environment is more uncertain loss averse voters are more prone to make reforms, but there is also more disagreement about what kind of reform to make.

Recent empirical literature suggests that indeed people display loss aversion when they make political decisions. 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

[3]The relationship between inequality and redistribution has generated much empirical research (see Acemoglu et al. (2013) for a survey). Several works report a negative relationship (e.g., Persson and Tabellini, 2003; Borge and Rattso, 2004). Other works point in the opposite direction (e.g., Perotti, 1996; Gil et al., 2004; Scheve and Stasavage, 2012).

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.

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. 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.[4]

In our dynamic model, a voter chooses the policy today taking into account that it will represent the status quo policy tomorrow (i.e., tomorrow's reference point). By choosing the policy today, voter also choose their tomorrow's reference point. Then, they are able to dampen, at least partially, the adverse consequences of loss aversion. This policy behavior is reminiscent of an optimal commitment strategy when individuals suffer self-control problems (e.g., Laibson, 1997; Amador et al., 2006). The idea that voters predict that in the future they will "acclimate" to the policy chosen today ties our model to the literature on endogenous reference points (Köszegi and Rabin, 2006 and 2007). Specifically, their idea of *choice acclimating personal equilibrium* is similar to our idea that the psychological cost of changing the policy today is borne only today, and not tomorrow. Differently from us, that literature focuses on stochastic environments; we rather point at multiperiod choices and intergenerational conflict, which constitutes a realistic political environment. In an intertemporal choice setting with loss averse individuals, Köszegi and Rabin (2009) show that if an agent cares much more about contemporaneous rather than prospective gain-loss utility, then the ex ante optimal plan may not be time consistent. In our model, time inconsistency eventually derives from a projection bias.

A rich theoretical literature considers the relationship between inequality and redistribution, based upon the Meltzer and Richard (1981) model. Particularly relevant for us are the papers which rationalize why a majority would not expropriate (or at least tax at very high rate) the rich. 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

[4]See Krehbiel (2008) for extensive references to other similar models.

fairness may also be critical as in Alesina and Angeletos (2005).[5] 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.

A relatively small literature studies the role of loss aversion in collective choice. Herweg and Smith (2014) consider 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 the latter is materially inefficient with respect to a new agreement. Likewise we show that, also in a *majority* voting model, the status quo is quite likely to be the outcome when there are shocks. But, as stated above, the status quo bias is only one (and perhaps the less unexpected one) of the consequences of introducing loss aversion into a majority voting model. Other papers which have studied how loss aversion may affect policy outcomes include Grillo (2014) regarding information transmission, Freund and Ozden (2008) and Tovar (2009) regarding trade policy, Rees-Jones (2013) on tax sheltering and Bernasconi and Zanardi (2004) on tax evasion. Milkman et al. (2009) present laboratory evidence that policy bundling reduces the harmful consequences of loss aversion.

Finally, this 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 (2012) 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 (2013) study how emotional unrest affects policy outcomes. DellaVigna et al. (2014) 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.

The outline of the paper is as follows: section 2 lays out the basic model; section 3 introduces loss aversion and derives several results in a static setting; section 4 generalizes the model to a multiperiod setting; section 5 presents a specific example of how loss aversion shapes individual preferences for public good provision and income taxation; section 6 introduces uncertainty about policy outcomes and investigates the relationship between loss aversion and risk aversion; the last section concludes. The Appendix contains proofs for all Propositions, as well as extensions

[5] See Alesina and Giuliano (2011) for a review of the literature on preference for redistribution.

of sections 5 and 6.

2 A Model of Social Choice

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. Heterogeneity may arise because of any aspect which affects individual preferences (e.g., income, wealth, ideology, productivity, etc.). 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.[6] In order to ensure the existence of a unique majority voting equilibrium, 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 higher marginal costs and/or enjoy lower marginal benefits from the policy: $\frac{\partial B_p(t_i,p)}{\partial t_i} \leq 0$, $\frac{\partial C_p(t_i,p)}{\partial t_i} \geq 0$;

A4. The equilibrium is interior: $\frac{\partial B(t_i,0)}{\partial p} > \frac{\partial C(t_i,0)}{\partial p}$.

Thus, for all types, $V(t_i, p)$ is concave in p and, for any t_i, there is a unique policy which maximizes indirect utility $V(t_i, p)$, call it p_i, which solves:[7]

$$B_p(t_i, p) = C_p(t_i, p)$$

By A3, we have that:

$$\frac{\partial p_i}{\partial t_i} \leq 0 \tag{1}$$

This implies that higher types vote for lower policies.[8] Then, under majority rule, the policy outcome is the median type's bliss point (p_m). This is not necessarily

[6] 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.

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

[8] We use this convention of higher types preferring lower policies because it will immediately link to our application to a voting model on tax rate, and income will be the identifier of types (cf. section 5).

the choice of a social planner. The latter would maximize the sum of individuals' utilities:

$$\int [B(t,p) - C(t,p)]\, dF(t) \tag{2}$$

Then the first best (p^*) solves the following equation:

$$\bar{B}_p(p) = \bar{C}_p(p) \tag{3}$$

The social planner sets the policy in order to equalize average marginal benefits, $\bar{B}_p(p)$, and average marginal costs, $\bar{C}_p(p)$.

3 Social Choice 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, thus higher costs yield a psychological 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 gain as lower costs (e.g., less taxes), but also 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. In reference-dependent models, the way one defines the reference point is obviously critical. Here we use the status quo, not only for the sake of simplicity, but also because it appears sufficiently realistic: in the political debate benefits and costs of reforms are normally assessed against current policy. Our definition of the reference point is then *backward-looking*. 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.[9]

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:

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

[9] For instance, Passarelli and Tabellini (2013) compute reference policies from an individual notion of fairness. They claim that citizens engage in protests when they feel they have been trated unfairly. 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.

This formulation implies reference dependent utility as in Köszegi and Rabin (2006).[10] 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 Kahnemann, 1991). For instance, the primitive utility functions in the public finance model of section 5, and the model with lump sum redistribution in Appendix satisfy decomposability. This property is common in reference dependence literature, and it is essential to derive implications from loss aversion.[11]

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

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

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

$$p_i \;\; \text{solves} \;\; \begin{cases} B_p(t_i,p) - (1+\lambda)C_p(t_i,p) = 0 & \text{if} \quad t_i < \check{t} \\ p = p^S & \text{if} \quad \check{t} \leq t_i \leq \hat{t} \\ (1+\lambda)B_p(t_i,p) - C_p(t_i,p) = 0 & \text{if} \;\; t_i > \hat{t} \end{cases} \tag{4}$$

where $\check{t}$ is implicitly determined by $B_p(t,p^S) - (1+\lambda)C_p(t,p^S) = 0$, and $\hat{t}$ is implicitly determined by $(1+\lambda)B_p(t,p^S) - C_p(t,p^S) = 0$. Observe that $\check{t} < \hat{t}$, and both $\hat{t}$ and $\check{t}$ depend on the status quo policy.

3.1 Status quo bias

By (4), an individual's most preferred policy depends not only on her type, but also on the current level of the policy, the status quo. Specifically, the population is split in three groups (cf. Figure 1): 1. a group of *intermediate* types (i.e., all i such that $\check{t} \leq t_i \leq \hat{t}$) who want to keep the status quo; 2. a group of *high* types (i.e., $t_i > \hat{t}$) who want a lower level of the policy; 3. a group of *low* types (i.e., $t_i < \check{t}$) who want a higher amount of the policy.[12]

[10] 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

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

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.

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

[12] 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.

If the median is in the first group, the policy outcome is the status quo. Note that $\check{t}$ is decreasing in λ and $\hat{t}$ is increasing in it. Thus the size of the range of types voting for the status quo is increasing in the amount of loss aversion λ.

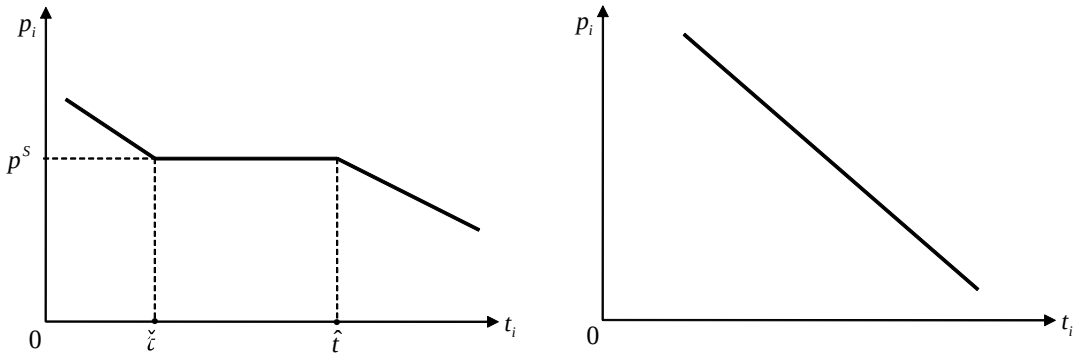


Figure 1: The relationship between bliss points and types

Proposition 1 (Equilibrium)
i) If $t_m \in [\check{t}, \hat{t}]$*, then the policy is the status quo;*
ii) If $t_m < \check{t}$*, then the policy outcome is* $p_m > p^S$*;*
iii) If $t_m > \hat{t}$*, then the policy outcome is* $p_m < p^S$*.*

Hence, we have shown a status quo bias: the status quo policy does not change even when a majority of voters without loss aversion would change it.

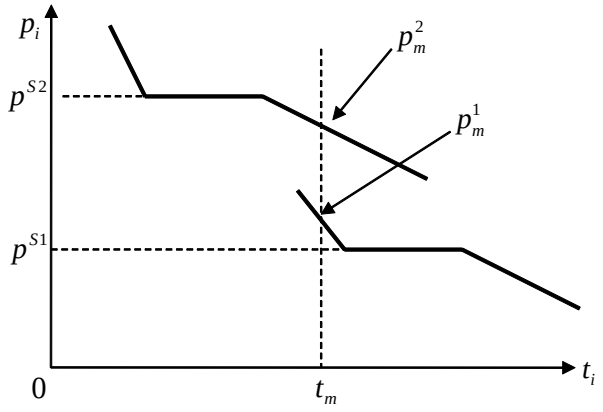


Figure 2: Equilibria with different status quo policies

The existing status quo also influences how the majority would like to change it if $t_m \notin [\check{t}, \hat{t}]$. More specifically, suppose p^S is so low that the median wants to increase the policy. In this case she "overweighs" the increases in the costs, and chooses a relatively low policy. Now suppose that p^S is so high that the median wants to reduce it. She now overweighs the sacrifice of giving up the policy. Then she chooses a however high policy. Thus, the *same* median will choose a low policy when p^S is low, and higher policy when p^S is high. This point is shown in Figure 2. If the status quo is low (p^{S1}) the majority chooses p_m^1. If the status quo is high (p^{S2}) that same majority chooses $p_m^2 > p_m^1$. In a way, the status quo continues to exert an influence on the policy outcome even when the majority is willing to abandon it. The following Proposition establishes this result.

Proposition 2 (Entrenchment)
Consider two cases: a) the majority decides to change a low status quo for a higher policy; b) the same majority decides to change a high status quo for a lower policy. In the first case the majority ends up choosing a policy that is lower, compared to the second case.

Under loss aversion, societies which had chosen, "high" policies in the past (e.g., high level of redistribution, generous welfare state, strict regulation) will continue to opt for rather high levels of it, even when they choose to reduce those levels. Vice versa, societies with a history of low levels of the policy, will keep choosing rather low levels when they opt for an increase. This is an additional explanation of policy entrenchment; similar patterns might be caused, for instance, by habit formation.

3.2 Moderation

With this framework it is possible to prove a *moderating effect*. When individuals are loss averse, the distances among their ideal policies are lower: those who demand more p overweigh the increases in cost; this dampens their demand for a policy expansion. On the contrary, those who would like to reduce p overweigh the loss of benefits; thus they desire to reduce the policy by a lesser amount. As individuals become more loss averse, the number of those who prefer the status quo increases,[13] thus further dampening polarization.

Proposition 3 (Moderation)
Loss aversion leads all low types (i.e., $t_i < \check{t}$) to demand for less p, and all high types (i.e., $t_i > \hat{t}$) to demand for more p.

[13]Recall that $\check{t}$ is decreasing in λ and $\hat{t}$ is increasing in it (cf. the proof of Proposition 3 in Appendix).

Lower polarization implies that if the median's tastes are far from the average, the political distortion is smaller in the presence of loss aversion.

Ortoleva and Snowberg (2015) claim that, in case of imperfect information, voters might display overconfidence; i.e., they might underestimate the degree of correlation of their signals. The consequence would be ideological extremeness, rather than moderation. Thus loss aversion and overconfidence yield opposite predictions. Of course our finding and theirs are not mutually inconsistent, since they are driven by two totally different behavioral distortions, loss aversion instead of overconfidence, whose relative relevance might be different in different contexts.

3.3 Inertia

The standard model without loss aversion predicts that even small shocks that affect the median of the distribution would lead to a change in policy. That is no longer true in the presence of loss aversion. Suppose at time 1 the majority has set a new status quo, p^{S1}. This new status quo defines the interval $\left[\check{t}^1, \hat{t}^1\right]$, and the median (t_m^1) is approximately at the center of this interval. When the majority sets a new status quo, there will be a number of types both above and below t_m^1 that prefer the status quo. At time 2, a shock θ that affects the median of the type distribution occurs. If θ is small, the median still lies in the interval. Thus, the status quo set at time 1 survives the shock. In order to change the status quo, the shock at time 2 has to be sufficiently large. In a way, the majority waits until times are ripe for a change, even when a majority of voters would be better off with a different status quo. More formally,

Proposition 4 (Inertia and political endowment)
i) Let the median a time 2 *be* $t_m^2 = t_m^1 + \theta$. *The majority changes the policy only if the shock* θ *that hits type distribution is sufficiently large. Specifically, the change occurs only if either* $\theta > \hat{t}^1 - t_m^1 \geq 0$, *or* $\theta < \check{t}^1 - t_m^1 \leq 0$.
ii) After the new policy has been set up at time 2, *more than the strict majority of people do not want to change it.*

The second part of the Proposition is what we call the *political endowment effect*. The idea is the following. If the shock at time 2 is sufficiently large, the policy changes. But only the bare majority of voters cast votes in favor. All voters to the left of the median would prefer a lower policy. All those to the right prefer a higher one. Once the new policy has been set up and a certain amount of time has passed, this policy becomes the new reference point. The latter shapes voters' preferences. Specifically, some voters to the left and to the right of the median change their minds and start considering this new policy their most preferred one. This means that, if no other big shocks occur, that same policy would beat any other alternative with more than the simple majority cast votes in favor.

The political endowment effect hinges on the fact that a change in the policy yields a change in the reference point for subsequent periods, and the latter yields a change in voters' (reference dependent) preferences. It might help explain why reforms that had hard time to be approved, gain popularity amongst people some time later.

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, then 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).

4 A Dynamic Model

In a multi period economy, in any period the policy set by the majority represents the status quo of the next period. In fact, we define a *period* the length of time in which a certain outcome becomes the status quo. Voters have an incentive to choose the policy taking that into account, in order to dampen the adverse effects of loss aversion. However, this fully holds only if individuals correctly assess their future preferences, and take into account how their choices today will affect those preferences 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.

In this new dynamic setting, all individuals live n periods, indexed by k ($k = 1, .., n$), with no discounting for future utility. The majority choose the policy in each period. At period k, the policy of period $k-1$ (p^{k-1}) becomes the new the status quo. Thus, p^{k-1} is a policy variable in period $k-1$, while in period k it is a predetermined state variable. In period 1, the (exogenous) status quo policy is $p^0 = p^{-1}$.[14] In each period bliss points are sequentially rational and maximize residual lifetime utility from that period onwards. In order to account for a projection bias, we follow Loewenstein et al. (2003) in assuming that predicted utility is a weighted average between two utility functions with different reference points: the current status quo, and the one-period lagged status quo. More precisely, in period k, voter i's *predicted* utility is an average of i's true preferences (with the current reference point, p^{k-1})

[14] For simplicity we assume that $p^{-2} = p^{-1}$.

and her past preferences (with reference point p^{k-2}):[15]

$$\tilde{V}(t_i, p^k \mid p^{k-2}, p^{k-1}) = (1-\alpha)\, V(t_i, p^k \mid p^{k-1}) + \alpha\, V(t_i, p^k \mid p^{k-2}) \tag{5}$$

α parametrizes the projection bias ($0 \leq \alpha \leq 1$): if $\alpha = 1$, then i perceives that her preferences in period k will not change as a result of a change in the status quo, p^{k-1}; when $\alpha = 0$, she has no projection bias. With this formulation, a voter thinks ex ante she will need two periods to get completely accustomed to the new policy, while ex post she actually accustoms after a single period. Loss aversion is λ, and projection bias is α. Proposition 5 below states (and Appendix proves) that the median makes her policy choice *as if* her loss aversion were $\frac{\lambda(1+\alpha)}{n}$. Suppose there is no projection bias ($\alpha = 0$). Then voters choose according to $\frac{\lambda}{n}$, rather than λ. The reason is the following. 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. In a way, living for n periods gives the voter the chance to *spread* the psychological cost over n periods. This is why *perceived* loss aversion is lower if residual life is longer. This implies that harmful consequences of loss aversion are lower if residual life is longer.

Suppose there is projection bias ($\alpha > 0$). Perceived loss aversion is $\frac{\lambda(1+\alpha)}{n}$. The higher the projection bias the smaller the propensity to change. The reason is that ex ante the voter thinks she will bear the cost of change for two periods, while ex post the cost is gone after one single period. The projection bias also yields dynamic inconsistency: suppose the median changes the policy in period $k = 1$. In the second period, she realizes that she has fully adapted to the new policy, faster than she thought. Thus in period 2 her actual utility turns out to be different from the predicted one. Had she known that, she would have made a different plan, with a bigger change. Her first period plan was optimal ex ante, but it turns out to be suboptimal ex post.

Proposition 5 (Time inconsistency)
In the presence of a projection bias parametrized by α, a majority of loss averse voters living for n periods,
i) Sets the policy at period 1 as if the loss aversion parameter were $\frac{\lambda(1+\alpha)}{n}$, and plans to keep that policy unchanged in all subsequent periods;
ii) The same majority at period 2 eventually changes the former plan, setting a new policy and re-planning to keep this new policy unchanged in all later periods; the perceived loss aversion parameter is $\frac{\lambda(1+\alpha)}{n-1}$.

[15] Observe that, despite voters look forward in anticipating the effects of their current policy choices on future utility, still their reference point is backward-looking (the current status quo, and the one-period lagged status quo).

iii) This process of plan revisions may continue, and eventually it stops after a finite number of periods.

For n going to infinity loss aversion becomes irrelevant regardless of the value of α. Projection bias and loss aversion may explain why often policy reforms are timid at the beginning, while in later periods they are made progressively more radical. The reason is that only later people realize that adaptation is not as costly as previously thought. This model shows that majorities with a longer residual life are less biased by the status quo.

5 An example: Fiscal Policy

This section applies the framework described above to a basic Meltzer and Richard model with public good provision.[16] The policy consists in the provision of a non-excludable public good financed by a proportional income tax. Agents enjoy utility from consumption of a private good (c_i) and the public good (g) that we measure here in per capita terms. Instead of a public good, we could have a lump sum redistribution; the results are identical (see the Appendix).

Let the utility function be quasi-linear in c_i, and concave and increasing in g:

$$u(c_i, g) = c_i + H(g) \tag{6}$$

($H' > 0$, $H'' < 0$). Individuals are heterogeneous in income: let y_i be the income of individual i, and denote by $\bar{y}$ the average income. Denote with m the individual with the median income. The government budget is balanced and the prices of c and g are normalized to 1. Indirect utility of voter i is then:

$$V(y_i, g) = y_i + H(g) - \frac{y_i}{\bar{y}}\, g$$

Her most preferred level of g is:

$$g_i = H'^{-1}\left(\frac{y_i}{\bar{y}}\right) \tag{7}$$

Policy preference functions are single peaked and the bliss points negatively depend on individual incomes: richer individuals want a smaller government because the private cost of one unit of public good $\left(\frac{y_i}{\bar{y}}\right)$ is higher for them. The equilibrium is the median voter's most preferred policy (g_m). The normative implication is that the majority rule, or Downsian electoral competition, implements the social optimum only if the median voter's income equals the average income. If instead the income distribution is skewed toward the right (i.e., $y_m < \bar{y}$), the voting outcome is overspending and overtaxation.

[16] The model of this section is a stylized version of Meltzer and Richard (1981) as presented by Persson and Tabellini (2000, pp. 48-50).

5.1 Loss aversion

Let g^S be the status quo amount of public good. Lower public good provision or additional taxes are both a loss, while more public good or tax reductions are a gain. Under loss aversion indirect utility is:

$$V(g, y_i \mid g^S) = \begin{cases} V(y_i) - \lambda \frac{y_i}{\bar{y}}(g - g^S) & \text{if} \quad g \geq g^S \\ V(y_i, g) - \lambda \left[H(g^S) - H(g)\right] & \text{if} \quad g < g^S \end{cases}$$

The bliss point, i.e., the most preferred amount of g is:[17]

$$g_i = \begin{cases} H'^{-1}\left(\frac{y_i(1+\lambda)}{\bar{y}}\right) & \text{if} \quad y_i < \check{y} \\ g^S & \text{if} \quad \check{y} \leq y_i \leq \hat{y} \\ H'^{-1}\left(\frac{y_i}{\bar{y}(1+\lambda)}\right) & \text{if} \quad y_i > \hat{y} \end{cases} \tag{8}$$

Suppose that median income declines by a small amount compared to the mean, i.e., inequality increases, at least according to this measure. In the standard model that would always imply a change in policy: higher taxes and more public good. In the model with loss aversion, instead, an increase in income inequality may lead to no changes in taxation as long as the change in inequality does not push the parameter values outside the range in which the status quo prevails. This result helps in rationalizing for instance why a large increase in income inequality in the US and in other countries has not been accompanied by an immediate increase in redistributive policies.

In addition, with loss aversion, the marginal cost of more public good is higher and the marginal benefit of less public good is lower. Therefore, compared to the standard Meltzer and Richard model, the rich increase their demand for public good and the poor reduce theirs.[18] The level of disagreement about the size of government is lower in a loss averse society. This result may help rationalize why the poor would not impose an expropriatory level of taxation and the rich might accept a certain moderate level of taxes. In other words the *moderation effect* help making sense of non extreme forms of taxation in democracies.

[17] Where $\check{y} \equiv \frac{1}{(1+\lambda)} H'(g^S)\bar{y}$, and $\hat{y} \equiv (1+\lambda)\, H'(g^S)\bar{y}$. If $y_i < \check{y}$ then $H'^{-1}\left(\frac{y_i(1+\lambda)}{\bar{y}}\right) > g^S$ and if $y_i > \hat{y}$ then $H'^{-1}\left(\frac{y_i(1+\lambda)}{\bar{y}}\right) < g^S$ (cf. Proposition 1). Finally observe that both $\check{y}$ and $\hat{y}$ negatively depend on the status quo, g^S (cf. proof of Proposition 3).

[18] An alternative and not mutually exclusive argument for why the poor may not want to aggressively expropriate the rich is the *Prospect for Upward Mobility* (POUM) hypothesis by Bénabou and Ok (2001).

5.2 *Old* and *Young* Majorities

As pointed out by the general model, when the benefits of a policy change can be enjoyed for several periods, the voters take into account the multi-period effects of loss aversion. This implies that, other things being equal, younger majorities are more prone to change the status quo.

Suppose the population is split in two generations, the young and the old. In order to focus on the specific effects of loss aversion, let us assume that the two generations are the same in all respects except residual life: the old live only the next n periods; the young live the next nl periods ($l > 1$). Loss aversion and projection bias parameters are the same for both young and old. By Proposition 5, the old make their political choices *as if* their loss aversion were $\frac{\lambda(1+\alpha)}{n}$, and the young as if loss aversion were $\frac{\lambda(1+\alpha)}{nl}$. This implies that there are less young voters entrenched in the status quo, compared to old voters. It may happen that the majority of young voters want a change in policy, but the majority of old voters do not. The reason does not rely on differences in material interests. It is instead a psychological reason: the old do not want to bear the psychologically costly commitment to a change today, because their future horizon in which to enjoy the benefits of that commitment is shorter. The policy outcome depends on the population shares: older societies, where the share of young people is low, are more likely to remain with the status quo.

We illustrate this point with a parametric example. Assume the two generations are the same in all respects (i.e., income distribution, utility functions, loss aversion). Income is uniformly distributed in $\left[\frac{1}{2}, \frac{3}{2}\right]$. Thus $y_m = \bar{y} = 1$ in both groups. Let the utility from the public good be $H(g) = \ln(g)$. The socially efficient level of public good is $g^\circ = H'^{-1}(1) = 1$. Assume that the status quo is $g^S = \frac{3}{2}$, a level which is socially too high. It is easy to see that, by Proposition 5, for any $\lambda(1+\alpha) \geq \frac{n}{2}$, the median of the old generation prefers to keep the (inefficient) status quo (cf. the upper graph in Figure 3), whereas the median of the young generation prefers the status quo only if $\lambda(1+\alpha) \geq \frac{nl}{2}$ (cf. the lower graph in Figure 3). Thus, for any $\frac{n}{2} \leq \lambda(1+\alpha) \leq \frac{nl}{2}$, the majority of young voters wants to change g (for less public good) and the majority of old voters does not want to change.

How will society eventually choose? Let a be the share of old voters in the society, and $(1-a)$ the share of young voters ($0 \leq a \leq 1$). The old voters who do not want to reduce g are the ones whose income is lower than $\hat{y}^{\text{old}} = \frac{2}{3}\left(1 + \frac{\lambda(1+\alpha)}{n}\right)$. The young voters who do not want to reduce g are the ones whose income is lower than $\hat{y}^{\text{young}} = \frac{2}{3}\left(1 + \frac{\lambda(1+\alpha)}{nl}\right)$. Since in both groups income distribution is uniform in $\left[\frac{1}{2}, \frac{3}{2}\right]$, there are $a\left[\frac{2}{3}(1 + \frac{\lambda(1+\alpha)}{n}) - \frac{1}{2}\right]$ old voters, and $(1-a)\left[\frac{2}{3}(1 + \frac{\lambda(1+\alpha)}{nl}) - \frac{1}{2}\right]$ young voters who prefer the status quo to any $g < g^S$. If these two masses

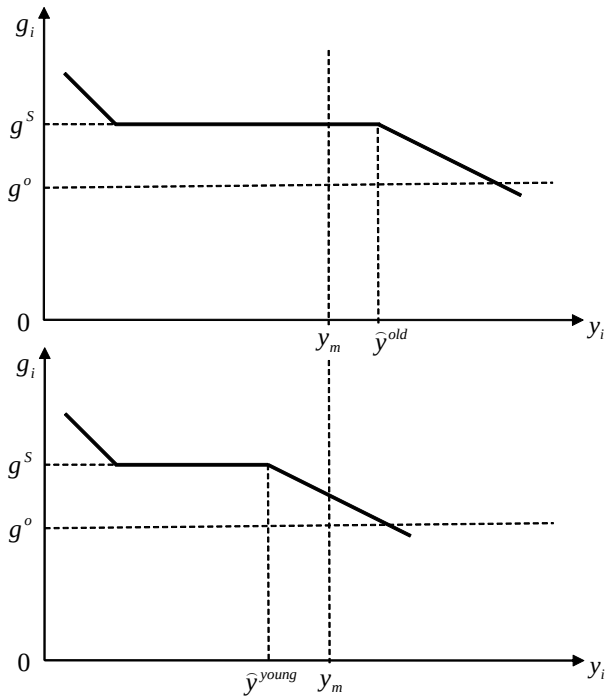


Figure 3: The majority of young voters want to change. The majority of old voters do not.

of voters are not smaller than a half of the population, the status quo survives: $a\left[\frac{2}{3}(1+\frac{\lambda(1+\alpha)}{n})-\frac{1}{2}\right]+(1-a)\left[\frac{2}{3}(1+\frac{\lambda(1+\alpha)}{nl})-\frac{1}{2}\right] \geq \frac{1}{2}$. Solving this inequality yields the condition for the status quo:

$$a \geq \frac{nl-2\lambda(1+\alpha)}{2\lambda(1+\alpha)(l-1)} \tag{9}$$

This inequality tells us that older societies (higher a) are more likely to remain stuck with the status quo, whereas societies where young generations live longer than older generations (higher l) are more likely to abandon it. If both young and old live longer (high n), the status quo is less likely. Of course stronger loss aversion (higher λ) and larger projection bias (higher α) make reforms less likely.[19] The idea that older societies are more static and less prone to reforms seems realistic enough.

Finally, we can document a sort of paradox: suppose that $\lambda(1+\alpha)=\frac{9}{10}$, $n=1$, and $l=2$. In this case, $\frac{n}{2} \leq \lambda(1+\alpha) \leq \frac{nl}{2} \rightarrow \frac{1}{2} \leq \lambda(1+\alpha) \leq 1$: the majority of young voters would like to change the status quo, and the majority of old voters

[19]Indeed, (9) is more likely to be satisfied when a is large and/or the RHS is low. As for the latter, observe that it decreases in l (since $\lambda(1+\alpha)>\frac{n}{2}$) and in $\lambda(1+\alpha)$, and it increases in n.

would like to retain it. By (9), if $a \geq \frac{1}{9}$ the society remains with the status quo. Despite the fact that old voters are only one ninth of the population, the entire society sticks to the status quo. Because of loss aversion and shorter residual life, policy preferences in the old generation are much less dispersed around the status quo. The share of people who want the status quo is much higher in the older group. In other words, loss aversion raises the political cohesion among old voters, raising their chance to play a pivotal role.

The result that older societies are more conservative when it comes to redistribution is strongly supported by the vast empirical evidence on both US and European countries, as summarized by Alesina and Giuliano (2011). The evidence shows that age of the respondent is inversely correlated to preferences for redistribution holding constant the level of income of the respondent and a host of other individual characteristics. Thus age in itself, controlling for "everything" else (so to speak), is a strong determinant of tastes for redistribution as implied by our model.

6 Risk and Loss Aversion

In this section we explore how loss averse voters make their choices when there is uncertainty about the outcome resulting from a policy. We return to the static case, and we address three questions: first how the behavior of loss averse voters is different from risk averse voters? Second, suppose a policy change is opposed to a safe status quo. When does the majority choose the reform? Third, how does risk affect the level of policy chosen?

We use the model of individual decision by Köszegi and Rabin (2006, 2007) by amending it in two directions in order to make it suitable for studying the *collective* policy choice. First, unlike Köszegi and Rabin, our voters not only choose whether to pass a "risky" reform or not. They also choose the size of the reform. In other words, voters not only choose whether insure themselves or not, but they also choose the level of risk in case they do not insure. Second, voters are different in types, so they have different evaluations of the risk embodied in any reform.

Consider a policy with uncertainty about its benefits.[20] For any level of the policy, the benefits depend on a random variable θ, the state of the world. If the state is *good* (i.e., $\theta = \theta^g > 0$) then the benefits are high. If the state is *bad* (i.e., $\theta = \theta^b > 0$) benefits are low. The distribution of θ is common knowledge. The state is good with probability q, and bad with probability $(1 - q)$. For simplicity, voters' benefit functions are the same for all types: $B(t_i, p, \theta) = B(p, \theta)$.[21] Also we assume

[20] This is a simplifying assumption. Not much hinges on it: one could also consider uncertainty regarding costs, or both costs and benefits; the model would be only slightly different.

[21] We make this assumption because, for simplicity, we want to abstract away from any source of heterogeneity other than t_i. In a more realistic world, uncertainty can be different across voters.

$B(p, \theta^g) = B(p + \theta^g)$, and $B(p, \theta^b) = B(p - \theta^b)$.

6.1 Risk averse voters with no loss aversion

Individual i's expected utility is

$$E\left[V(t_i, p, \theta)\right] = q\, B(p + \theta^g) + (1 - q)\, B(p - \theta^b) - C(t_i, p) \tag{10}$$

Suppose $E(\theta) = 0$. The concavity of $B(\cdot)$ leads to risk aversion: if the amount of risk is sufficiently large, then all voters would prefer to pay a premium to insure themselves against policy uncertainty. However, this does not necessarily imply that voters prefer a lower p when the policy is risky. Consider the FOC to maximize $E\left[V(t_i, p, \theta)\right]$:

$$E\left[B_p(p, \theta)\right] = C_p(t_i, p)$$

where $E\left[B_p(p, \theta)\right] \equiv q\, B_p(p + \theta^g) + (1 - q)\, B_p(p - \theta^b)$. If B_p is convex, despite risk aversion, voters want a larger policy in the presence of risk. The reason is that a marginal increase of p yields a marginal benefit in the good state that is substantially higher than the marginal benefit in the bad state. This leads to a higher demand for p compared to the case without risk. Vice versa, If B_p is concave, voters want a lower amount of p when there is risk.

Suppose now that risk is over modest stakes (i.e., θ^g and θ^b are sufficiently small), Rabin's calibration theorem implies that $B(\cdot)$ is approximately linear in p (Rabin, 2000). In this case, with $E(\theta) = 0$, voters choose the same level of the policy with or without uncertainty. The Proposition below summarizes these results.

Proposition 6 *If the expected outcome of two plans is the same, then risk averse voters*
i) Always choose the less risky plan in case of large-scale risk;
ii) Are indifferent between the two plans in case of small-scale risk.
iii) All voters demand more (less) policy when the plan is more risky and marginal benefits are convex (concave).
iv) The equilibrium policy is the median's bliss point.

How to interpret these results? Suppose the status quo is an available risk-free option. Voters regard it as a form of insurance against risk: if they do not change in the policy they will not have to bear any risk. If risk is modest, voters that maximize expected utility endorse a "risky" reform whenever the expected outcome is better than the status quo. If risk is large, they require the expected benefits of the risky reform to be sufficiently larger than the benefits of the risk-free status quo. But what happens when the status quo is not a risk-free option? This is the case when the environment becomes risky, even if the policy is unchanged (e.g., during

an economic crisis). Proposition 6-iii says that in this case all voters want to change the current policy in the same direction (say, either more or less policy, if $B_p(\cdot)$ is either convex or concave, respectively). Observe that, despite voters still differ in their bliss points, *all* their bliss points move in the same direction. In a sense, all them agree on making the same kind of change (i.e., either more p, or less p).

6.2 Loss averse voters

Let us assume that the benefits from the reference point (p^S) are evaluated with certainty. If voters choose a risky reform, p, then the benefits will be either $B(p+\theta^g)$, or $B(p-\theta^b)$. Figure 4 shows the reform's benefit function in the good state, $B(p+\theta^g)$, and in the bad state, $B(p-\theta^b)$. Consider $p^S-\theta^g$, and $p^S+\theta^b$. The former (latter) is the level of risky reform that ensures the status quo benefits in the good (bad) state. The idea is that in the good (bad) state one needs a smaller (bigger) amount of p to ensure the current level of benefits.[22]

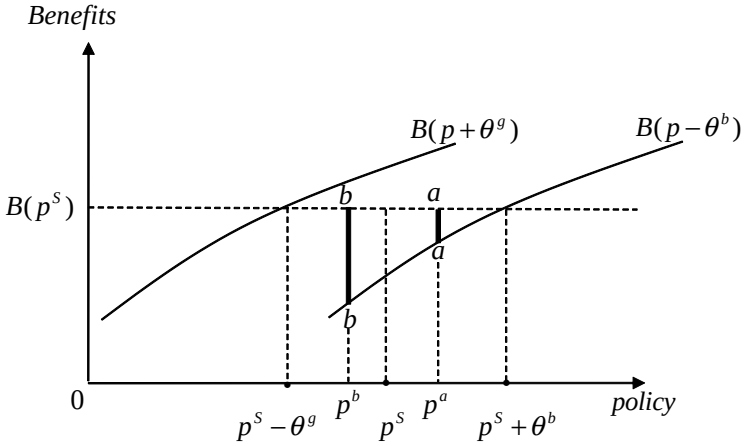


Figure 4: Benefit functions in different states of the world

How would voters choose p? If they choose p within the interval $\left(p^S, p^S+\theta^b\right)$ they feel two behavioral losses: the first one is the *usual* loss due to the fact that

[22] We are implicitly assuming that θ and p are substitute. For instance, if efficiency in government spending is larger (i.e., higher θ) we need less taxes (lower p) to provide the same level of public goods.

One might imagine that θ and p are complementary. Say, longer life expectancy (a positive shock) implies more taxes to keep the same level of health care or retirement benefits. In this case, one may still be using the same model. Formally, the only change that is needed to be done is in the "sign" of θ. In case of complementarity, a "positive" shock means that we are in the "bad" state, θ^b; and vice versa.

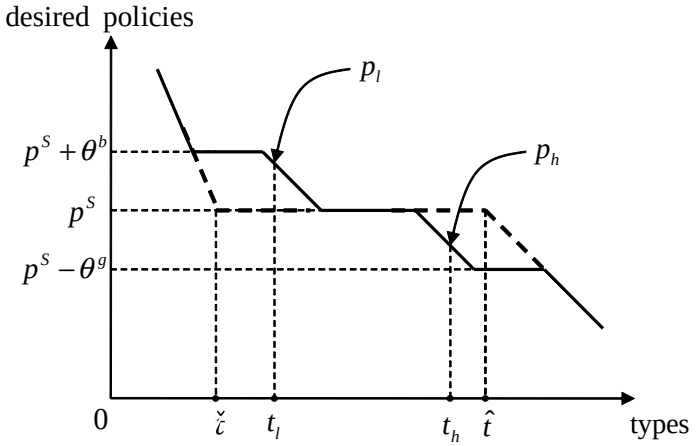


Figure 5: Under loss aversion fewer voters want the status quo

costs are higher than the status quo; the second one is the expected loss of benefits that would occur in the bad state. Take for instance the policy p^a in Figure 4. The first loss is $\lambda\left[C(t_i,p^a)-C(t_i,p^S)\right]$; a way to contain it is sticking with the status quo. The second loss amounts to $\lambda\left[B(p^S)-B(p^a-\theta^b)\right]$, and it occurs with probability $(1-q)$. This second loss is the segment aa in Figure 4, and it occurs only because the reform is uncertain. A way to contain this second loss is demanding a higher p. Thus, within the interval $\left(p^S,p^S+\theta^b\right)$, voters have to solve a trade-off: on the one hand, they would like to stick with the status quo; on the other hand, they would like to demand more p. Of course this trade-off is different across voters. We will see that some of them end up choosing more p than the status quo.

If p is chosen within the interval $\left(p^S-\theta^g,p^S\right]$, voters expect a loss of benefits, but *only* in the bad state. No other feelings of loss occur because costs are lower than the status quo. Take policy p^b in Figure 4. The expected loss is "only" $\lambda(1-q)\left[B(p^S)-B(p^b-\theta^b)\right]$, (cf. segment bb in Figure 4). If the state is good, benefits are larger than the status quo, despite the fact that the policy is lower. The chance that benefits may be larger than the status quo reduces the expected feeling of loss if $p<p^S$, leading some voters to prefer a lower policy than p^S.

Bliss points of loss averse voters when there is no risk are shown by the solid line in Figure 5. The dotted line shows voters' desired policy with risk. Take type t_l in Figure 5: with no risk, she wants the status quo; with risk, she wants a policy $p_l>p^S$. The reason is that, in the presence of risk, demanding a higher policy is a way of reducing the feeling of loss of benefits in the unlucky state. Take now type t_h: if there is no uncertainty she desires p^S; if there is risk she wants a policy that is lower than the status quo: $p_h<p^S$. The reason is that with p_h the loss of benefits occurs only in the bad state. This smaller *expected* loss of benefits leads this voter

to demand for less policy. The Appendix proves that, under uncertainty, those who want less (more) policy instead of p^S are the types sufficiently close to $\hat{t}$ ($\check{t}$). These results are summarized by Proposition 7.

Proposition 7 (Uncertainty: smaller status quo bias)
Suppose the reference point is the status quo policy. If $E(B_p(p^S, \theta)) = B_p(p^S)$*, the status quo bias is smaller when there is uncertainty. Specifically,*
i) The mass of intermediate types who want to keep the status quo policy is smaller;
ii) Some high types want a lower policy;
iii) Some low types want a higher policy.
iv) The equilibrium policy is the median's bliss point.

Thus, loss averse voters are more prone to change when there is risk.[23] But this does not imply that they like risk. On the contrary, loss aversion predicts strong distaste for any order of risk, in particular first-order risk aversion in p^S (Rabin, 2000).[24]

Proposition 8 (Uncertainty: first-order risk aversion) *If the expected outcome of two plans is the same, loss averse voters always turn down the riskier plan. Moreover, compared to risk averse voters, loss averse voters always demand a higher risk premium to pass any plan.*

What is the difference between loss aversion and risk aversion? First, if p^S is an available risk-free option, loss aversion predicts a stronger bias towards the status quo than simple risk aversion. Thus there might be risky reforms that are passed under risk aversion, and are not passed under loss aversion. It cannot be the opposite. Second, and perhaps most surprising, voters' bliss points do not move in the same direction: some voters want more policy, some others want less. Roughly speaking, voters' policy preferences about reforms are "mixed up" by risk. This might help explain why people's disagreement about "the right thing to do" increases during turbulent periods. This result is alien to the model with simple risk aversion. Third, in a risky environment when also p^S entails risk, loss averse voters become less attached to the status quo. This lower attachment is due to the fact that their willingness to change increases for many, although in opposite directions.

Several authors have argued that periods of crisis generate impetus for large reforms, such as fiscal crises, hyperinflation, major recessions, banking crises (see Alesina and Passalacqua (2015) for a survey). It is quite reasonable to assume that

[23] $E(B_p(p^S, \theta)) = B_p(p^S)$ in Proposition 7 represents a sufficient condition. The Appendix shows that the Proposition above holds whenever $E(B_p(p^S, \theta))$ is not too different from $B_p(p^S)$.

[24] Expected utility functions are not differentiable in p^S. This implies first-order risk aversion (cf. Appendix for details).

uncertainty is also higher in crises periods, although the severity of the crisis itself and the amount of uncertainty are two separate variables. To be sure, other models are consistent with the "crisis leading to reform" idea. However the argument that large reforms are less likely to occur when there is no uncertainty about a reasonably acceptable and certain status quo, even when the latter may be far from first best seems intuitively reasonable. More empirical research on this point is needed.

So far we have assumed that the benefits from p^S are known and evaluated with certainty. This assumption is appropriate when the status quo represents an available risk-free option, or when voters simply do not expect risk, as in the case the environment has become uncertain, but voters did not have enough time to internalize it. If instead they expect the risk in p^S, the introduction of a stochastic references point á la Köszegi and Rabin (2006, 2007) seems more appropriate.[25] What happens in this case? The Appendix shows that when risk is anticipated more voters want the status quo, compared to the case of deterministic reference point. The reason is that when also the outcome of p^S is uncertain, voters face background risk in their reference point. This risk enters their indirect utility and it is correlated to the risk of any other level of p they might choose. Because of this correlation, there is no chance to diversify risk by choosing a different p. On the contrary, choosing a different level of p increases the amount of risk that they have to face. This raises their incentive to choose the status quo, explaining why the status quo bias is larger when the reference point is stochastic.[26]

7 Conclusions

In this paper we have explored how loss aversion with the status quo as reference point, affects the political equilibrium in a voting model. A society needs to choose the level of a certain policy which has benefits and costs. Individuals differ in their evaluation of these benefits and costs and everybody suffers from loss aversion. Without loss aversion, the equilibrium policy would be the one most preferred by the median voter, but the initial status quo would be irrelevant. With loss aversion,

[25] Köszegi and Rabin's idea that reference points are agents' probabilistic beliefs about outcomes inspires our idea that if the voters expect the status quo not to be risk-free, then the reference policy must be stochastic. In our model the reference point is fixed. This is the limiting case of Köszegi and Rabin's "....UPE/PPE behavior when the decision maker ... has fixed expectations formed independently of the relevant choice set" (Köszegi and Rabin, 2007, p. 1052).

Unlike Köszegi and Rabin we do not study endogenous reference points, although they would represent a nice extension of our approach.

[26] The idea that, compared to a deterministic reference point, with a stochastic reference point voters are less willing to change is related to Köszegi and Rabin (2007, Proposition 2) and to Barberis, Huang and Thaler's (2006) idea that loss averse decision makers are only second-order risk averse when they face uncorrelated background risk.

instead, the results are different. First, we show a status quo bias, that is for any initial status quo a positive mass of voters would prefer the latter, whereas their preferences would be possibly different with a different status quo, or under rationality. Thus, small shocks to preferences (or to the environment) do not lead to changes of policies; the shocks have to be sufficiently large to overcome the status quo bias. In other words societies become very averse to change even when reforms would be collectively welfare improving. Second, we show a path dependence: the voting equilibrium depends on the initial status quo. Societies with a certain attitude in past policies (say, large government size, strong regulation, etc..) continue to display the same policy attitude even when they make changes. Third, loss aversion implies a moderating effect: the most extreme types – who would want to move the status quo – have more moderate ideal policies than without loss aversion. Fourth, in a dynamic setting, the effect of loss aversion diminishes with the length of the planning horizon of voters. Younger societies are more prone to change; however, loss aversion also favors the political cohesion of older generations, increasing their chance to affect the social choice. This sheds a novel light on the intergenerational conflict about policy reforms.

As a policy example we use the Meltzer and Richard (1981) model with a public good (in the text) or with lump sum redistributions (in the Appendix). We derive several empirically plausible implications; one is that even relatively large increases in income inequality, which in the model without loss aversion would lead to more taxes and more public goods (or transfers), may not lead to a change in the status quo. A related point is that even with very large increases in inequality the level of redistribution with loss aversion would be lower than without it. We also show that older societies are more *conservative* in the sense they are more subject to the effect of loss aversion which lead to a stronger status quo bias. Finally, we investigate the interaction of loss aversion and risk aversion in a stochastic environment in which the results of policies are not known with certainty. Risk enhances willingness to change in the society, but also disagreement about what kind of change.

Our analysis has been 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 fascinating subjects are left for future research.

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8 Appendix

8.1 Proofs

Proof. Proposition 1 Recall that $\check{t}$ is implicitly determined by $B_p(t, p^S) - (1 + \lambda)C_p(t, p^S) = 0$, and $\hat{t}$ is implicitly determined by $(1 + \lambda)B_p(t, p^S) - C_p(t, p^S) = 0$. Thus, for any "intermediate" type $t_i \in \left[\check{t}, \hat{t}\right]$, the optimality condition is

$$\begin{array}{ll} B_p(t_i, p) - (1 + \lambda)C_p(t_i, p) \leq 0 & \text{if} \quad p \geq p^S \\ (1 + \lambda)B_p(t_i, p) - C_p(t_i, p) \geq 0 & \text{if} \quad p < p^S \end{array}$$

thus the bliss point is $p_i = p^S$.
For any "high" type, $t_i > \hat{t}$,

$$\begin{array}{l} B_p(t_i, p^S) - (1 + \lambda)C_p(t_i, p^S) < 0 \\ (1 + \lambda)B_p(t_i, p^S) - C_p(t_i, p^S) < 0 \end{array}$$

Thus the bliss point is lower than the status quo, $p_i < p^S$.
iii) For any "low" type, $t_i < \check{t}$,

$$\begin{array}{l} B_p(t_i, p^S) - (1 + \lambda)C_p(t_i, p^S) > 0 \\ (1 + \lambda)B_p(t_i, p^S) - C_p(t_i, p^S) > 0 \end{array}$$

Thus the bliss point is larger than the status quo, $p_i > p^S$.
Implicit differentiating (4) w.r.t. t_i, and using A1-A3 yield

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

Therefore bliss points are unique and (weakly) monotone in types. The policy outcome is the median's bliss point. **QED** ■

Proof. Proposition 2 Both $\check{t}$ and $\hat{t}$ negatively depend on p^S: by the definition of $\check{t}$ and $\hat{t}$ in the text, if follows that:

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

By (4), if p^S is sufficiently low, then $t_m < \check{t}$. In this case the policy outcome p_m solves $B_p(t_m, p) - (1 + \lambda)C_p(t_m, p) = 0$. If p^S is sufficiently high, then $t_m > \hat{t}$. In this case p_m solves $(1 + \lambda)B_p(t_m, p) - C_p(t_m, p) = 0$. By A1-A2, $B_p(t_m, p)$ is decreasing in

p and $C_p(t_m, p)$ is increasing. Thus the policy outcome is lower in the former case. **QED** ■

Proof. Proposition 3 By (4), it follows that without loss aversion (i.e., $\lambda = 0$) the bliss points of all types equal the bliss points in the rational model. Implicit differentiating (4) yields,

$$\begin{array}{ll} \frac{\partial p^i}{\partial \lambda} < 0 & \text{if} \quad t_i < \check{t} \\ \frac{\partial p^i}{\partial \lambda} > 0 & \text{if} \quad t_i > \hat{t} \end{array}$$

With loss aversion, the bliss points of low types are smaller, and decreasing in the loss aversion coefficient. The bliss points of high types are larger, and increasing in the loss aversion coefficient. Moreover,

$$\frac{\partial \check{t}}{\partial \lambda} < 0 \quad \frac{\partial \hat{t}}{\partial \lambda} > 0$$

Therefore, the higher λ, the more people prefer the status quo. **QED** ■

Proof. Proposition 4
i) The proof of this part is trivial, thus we omit it.
ii) Consider the case in which the shock θ is positive and it is sufficiently high: $\theta > \hat{t}^1 - t_m^1 \geq 0$. Thus $t_m^2 > \hat{t}^1$: the median at time 2 is beyond the "inertia" range, thus the majority votes for the policy preferred by the new median. This policy is lower than the status quo, $p_m^2 < p^{S1}$. Consider any type $t_j > t_m^2$. At the time vote occurs her reference point is the status quo at time 1, p^{S1}. Thus, j's most preferred policy is lower that the policy that is voted by the majority: $p_j^2 = p_j(p^{S1}) < p_m^2$. Thus only the simple majority cast votes in favor of the new policy. Immediately after the new policy has been set up, the latter becomes the new status quo: $p^{S2} = p_m^2 > p^{S1}$. A new inertia range is defined. Specifically, the upper bound is $\hat{t}^2 > \hat{t}^1$, where $(1+\lambda)B_p(\hat{t}^2, p^{S2}) - C_p(\hat{t}^2, p^{S2}) = 0$. If $t_j \leq \hat{t}^2$, then her most preferred policy becomes the new status quo. Suppose at time 3 voting occurs. Voter j's bliss point is $p_j^3 = p_j(p^{S2}) = p^{S2}$. Suppose a policy $p^3 < p^{S2}$ is posed against the status quo. All voters whose type is lower than the median's will vote against. They represent a half of population. In addition, another positive mass of voters, namely all j-types $t_j \in \left(t_m^2, \hat{t}^2\right]$, will also vote against. Thus p^{S2} wins against any lower alternative with more than the simple majority of votes.
Following the same argument it easy to prove that p^{S2} also beats any *higher* alternative with more than the simple majority in favor. **QED** ■

Proof. Proposition 5 For expositional convenience we split the proof in two parts. We start by assuming that there is no projection bias; then, in the second part, we consider it.

First part. Assume there is no projection bias ($\alpha = 0$), so that at any period k perceived utility equals actual utility: $\tilde{V}(t_i, p^k \mid p^{k-2}, p^{k-1}) = V(t_i, p^k \mid p^{k-1})$. Let us prove for $k > 1$, the majority has no incentive to change the policy set at period 1. We proceed backwards: in period n, each individual i chooses her policy in order to maximize her residual lifetime utility, $V(t_i, p^n \mid p^{n-1})$:

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

This maximization yields the individual bliss points in period n:

$$p_i^n \;\; \text{solves} \;\; \begin{cases} B_p(t_i, p^n) - (1+\lambda) C_p(t_i, p^n) = 0 & \text{s.t.} \quad p^n > p^{n-1} \\ p^n = p^{n-1} & \text{otherwise} \\ (1+\lambda) B_p(t_i, p^n) - C_p(t_i, p^n) = 0 & \text{s.t.} \quad p^n < p^{n-1} \end{cases} \tag{11}$$

For each i, p_i^n is unique and it is weakly decreasing in t_i. Thus the equilibrium policy is the median's bliss point, p_m^n (which solves (11) above for $i = m$). This equilibrium solution is a function of the state variable, p^{n-1}. Let $p_m^n = G(p^{n-1})$ denote this function.
At time $n-1$, any individual chooses p_i^{n-1} taking into account the consequences of her choice on the future equilibrium outcome:

$$p_i^{n-1} \in \arg\max_{p^{n-1}} \left\{ V(t_i, p^{n-1} \mid p^{n-2}) + V(t_i, G(p^{n-1}) \mid p^{n-1}) \right\} \tag{12}$$

For expositional convenience, let us consider the median voter. Below, we show that the median voter's bliss point is the equilibrium policy. We now prove that the median has no incentive to choose $p^{n-1} \neq G(p^{n-1})$; i.e., in period $n-1$ she does not want to choose a policy that is different from the policy that she will choose in period n in equilibrium.

Suppose, by contradiction that she does. Say that she maximizes lifetime utility, s.t. $p^{n-1} < G(p^{n-1})$. Assume also that $p^{n-1} > p^{n-2}$. In this case, after some algebraic manipulation, we can re-write the objective function in (12) as:

$$\begin{aligned} &B(t_m, p^{n-1}) - C(t_m, p^{n-1}) + B(t_m, G(p^{n-1})) - C(t_m, G(p^{n-1})) \\ &- \lambda \left[C(t_m, G(p^{n-1})) - C(t_m, p^{n-2})\right] \end{aligned}$$

Recall that $p^{n-1} > p^{n-2}$. Thus maximizing this function w.r.t. p^{n-1} yields an interior solution which solves:

$$\frac{\partial B(t_m, p^{n-1})}{\partial p^{n-1}} - \frac{\partial C(t_m, p^{n-1})}{\partial p^{n-1}} + \frac{\partial B(t_m, p_m^n)}{\partial p_m^n} \frac{\partial p_m^n}{\partial p^{n-1}} - (1+\lambda) \frac{\partial C(t_m, p_m^n)}{\partial p_m^n} \frac{\partial p_m^n}{\partial p^{n-1}} = 0$$

Since $p^{n-1} < p_m^n = G(p^{n-1})$, by implicit differentiating (11), $G'(p^{n-1}) = \frac{\partial p_m^n}{\partial p^{n-1}} = 0$. Thus, if $p^{n-2} < p^{n-1} < p_m^n$, the last two terms of the above equations are zero, then the equation which pins down the median's most preferred policy in period $n-1$ is

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

Observe that in this case the policy is chosen rationally, i.e., the policy is the same as the one in the case with no loss aversion. But this is a contradiction, because if the median chooses the policy rationally in period $n-1$, then she will have no chance to increase her utility in period n other than keeping that policy unchanged. Thus, the policy that she chooses at $n-1$ must be the same policy that she will choose at period n. But this contradicts the assumption that $p^{n-1} < p_m^n$.

Applying the same rationale, it can be proved that a contradiction arises also in the other three cases: 1. $p^{n-2} > p^{n-1} < p_m^n$; 2. $p^{n-2} < p^{n-1} > p_m^n$; 3. $p^{n-2} > p^{n-1} > p_m^n$. This proves that $p^{n-1} = p_m^n$: in period $n-1$ the median sets the policy at a level that she is not willing to change in period n.

In period $n-2$, by applying the same argument as above, it follows that $p^{n-2} = p_m^{n-1}$: the median at period $n-2$ sets a policy that she will not be willing to change at period $n-1$. But the latter is the same policy that she will choose at period n; then $p^{n-2} = p_m^{n-1} = p_m^n$. Applying this same argument recursively, we end up with $p^1 = p_m^2 = \cdots = p_m^n$: the first period policy is set at a level that the median will not be willing to change in any subsequent period.

We can see now how the median sets p^1. Recall that the median's choice at period 2 – and in all subsequent periods – depends on p_1; thus $p_m^n = \cdots = p_m^2 = G(p^1)$. Moreover, since $p_m^2 = \cdots = p_m^n$, experienced utility in any period from 2 till n is constant and equal to $V(t_m, G(p^1) \mid p^1)$. Lifetime utility at period 1 is then $V(t_m, p^1 \mid p^0) + (n-1)V(t_m, G(p^1) \mid G(p^1)$, and p^1 is set to maximize it. After some algebraic manipulation, we can rewrite lifetime utility as:

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

Maximizing this function w.r.t. p^1, and using the result above yield the following optimal choice path:

$$p_m^1 \;\text{ solves } \begin{cases} B_p(t_m, p^1) - (1 + \frac{\lambda}{n})C_p(t_m, p^1) = 0 & \text{s.t.} \quad p^1 > p^0 \\ p^1 = p^0 & \text{otherwise} \\ (1 + \frac{\lambda}{n})B_p(t_m, p^1) - C_p(t_m, p^1) = 0 & \text{s.t.} \quad p^1 < p^0 \end{cases} \tag{13}$$

$$\text{and } \; p_m^2 = ... = p_m^n = p_m^1 \tag{14}$$

This proves that the median sets the policy at the first period *as if* her loss aversion were $\frac{\lambda}{n}$, and she is not willing to change it in all subsequent periods.

It only remains to prove that the median's bliss point, p_m^1 in (13) is the equilibrium policy in all periods. To see this, consider an individual i with $t_i < t_m$. She would like a policy that is (weakly) higher than the median's policy in any period. At the last period period (n), given p^{n-1}, she can only vote sincerely (cf. the proof of Proposition 1). In period $n-1$, she has no incentive to vote strategically for a policy that is lower than the median's equilibrium, p_m^{n-1}, because if she did the only effect would be passing a p^{n-1} that would bias the median towards a lower policy in period n. Thus, she votes sincerely also in period $n-1$.

Applying this argument recursively, it follows that she always vote sincerely, at least starting from period 2 onwards. Things are similar in period 1: in this period she has no incentive to vote for a policy that is higher than the median's equilibrium, p_m^1, because if she did the only strategic effect would be passing a p^1 that would bias the median towards a lower policy in period 2, and in all subsequent periods. Therefore, the best thing she can do in period 1 is voting for a policy that is lower than (or equal to) p_m^1. Thus, $p_i^1 \leq p_m^1$ for any $t_i > t_m$. Equivalently, $p_i^1 \geq p_m^1$ for any $t_i < t_m$. The equilibrium in the first period is p_m^1 (cf. 13), and it is also the equilibrium in all subsequent periods (cf. 14).

Second part. Assume there is projection bias, $\alpha \in (0,1]$. Let us proceed backward. In period n, any individual i chooses her policy in order to maximize her perceived residual lifetime utility $\tilde{V}(t_i, p^n \mid p^{n-2}, p^{n-1})$, as defined by (5):

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

This maximization yields the individual bliss points. As in the first part of this proof, the equilibrium policy is the one preferred by the median, but it is a function of the state variables p^{n-1} and p^{n-2}: $p_m^n = T(p^{n-1}, p^{n-2})$.
At time $n-1$, each individual chooses her most preferred policy, p_i^{n-1}:

$$p_i^{n-1} \in \arg\max_{p^{n-1}} \left\{ \tilde{V}(t_i, p^{n-1} \mid p^{n-3}, p^{n-2}) + \tilde{V}(t_i, p^n \mid p^{n-2}, p^{n-1}) \right\}$$

Again, one can easily verify that the equilibrium policies of periods $2, \ldots, n$ coincide with the median's plan to keep these policies unchanged: $p_m^n = \cdots = p_m^2 = p^1$.
We can now see how the median sets p^1: lifetime perceived utility at period 1 is $V(t_m, p^1 \mid p^0) + (1-\alpha)V(t_m, p_m^2 \mid p^1)) + \alpha V(t_m, p_m^2 \mid p^0) + (n-2)V(t_m, p_m^2 \mid p^1)$. Recall that the equilibrium policy at time 2 is $p_m^2 = T(p^1, p^0)$. Then we can re-write

perceived utility as $V(t_m, p^1 \mid p^0) + (1-\alpha)V(t_m, T(p^1, p^0) \mid p^1) + \alpha V(t_m, T(p^1, p^0) \mid p^0) + (n-2)V(t_m, T(p^1, p^0) \mid p^1)$. After some algebraic manipulation, we obtain:

$$\begin{cases} nB(t_m, p^1) - nC(t_m, p^1) - \lambda\left[C(t_m, p^1) - C(t_m, p^0)\right] & \text{if} \quad p^1 \geq p^0 \\ -\lambda(1-\alpha)\left[C(t_m, T(p^1, p^0)) - C(t_m, p^1)\right] & \text{and} \quad T(p^1, p^0) \geq p^0 \\ -\lambda\alpha\left[C(t_m, T(p^1, p^0)) - C(t_m, p^0)\right] & \\ \\ nB(t_m, p^1) - nC(t_m, p^1) - \lambda\left[B(t_m, p^1) - B(t_m, p^0)\right] & \text{if} \quad p^1 < p^0 \\ -\lambda(1-\alpha)\left[B(t_m, p^1) - B(t_m, T(p^1, p^0))\right] & \text{and} \quad T(p^1, p^0) < p^0 \\ -\lambda\alpha\left[B(t_m, p^0) - B(t_m, T(p^1, p^0))\right] & \end{cases}$$

Maximizing this function w.r.t. p^1, and using the result above yields the following optimal choice path (observe that $p_m^2 = p^1$ implies that $\frac{\partial T}{\partial p^1}(p^1, p^0) = 1$):

$$p_m^1 \ \text{ solves } \begin{cases} B_p(t_m, p^1) - (1 + \frac{\lambda(1+\alpha)}{n})C_p(t_m, p^1) = 0 & \text{if} \quad p^1 > p^0 \\ p^1 = p^0 & \text{if} \quad p^1 = p^0 \\ (1 + \frac{\lambda(1+\alpha)}{n})B_p(t_m, p^1) - C_p(t_m, p^1) = 0 & \text{if} \quad p^1 < p^0 \end{cases} \tag{15}$$

$$\text{and} \quad p_m^2 = ... = p_m^n = p_m^1 \tag{16}$$

This proves that the median sets the policy at the first period *as if* her perceived loss aversion were $\frac{\lambda(1+\alpha)}{n}$, and she is not willing to change it in any subsequent period. Observe that an increase in the projection bias parameter, α, will increase perceived loss aversion.

By the same argument as in the first part, it follows that the median's plan above is also the plan that the majority chooses at the first period.

Finally, we prove that this plan is time inconsistent: in period 2, after having chosen $p_m^2 = p_m^1$, the median realizes that her true utility is $V(t_m, p_m^2 \mid p_m^1)$ instead of $\tilde{V}(t_m, p_m^2 \mid p_m^1, p^0)$. Suppose that $p_m^1 > p^0$; by (15), true utility in period 2 (and in later periods) is not maximized by $p^2 = p_m^1$. This level is too low, so the median would have rather chosen a level such that $B_p(t_m, p^1) - \left(1 + \frac{\lambda}{n}\right) C_p(t_m, p^1) = 0$. Thus, in period 2 there is scope to increase utility by choosing a different policy. This is the case if there exists a level of $p^2 > p_m^1$ which solves $B_p(t_m, p^2) - \left(1 + \frac{\lambda(1+\alpha)}{n-1}\right) C_p(t_m, p^2) = 0$. In period 2 the median chooses the policy as if her loss aversion parameter is $\frac{\lambda(1+\alpha)}{n-1}$. She is still subject to the projection bias as regards the next period, and her residual life is $n-1$ periods. Moreover in period 2 she will plan to keep the new policy unchanged for all later periods. This latter plan may be time inconsistent as well: for the same reason, the median might be willing to change it in period 3.

This process of plan revisions stops at period h if h is such that $B_p(t_m, p^{h-1}) - \left(1 + \frac{\lambda}{n-(h-1)}\right) C_p(t_m, p^2) > 0$ and $B_p(t_m, p^h) - \left(1 + \frac{\lambda(1+\alpha)}{n-h}\right) C_p(t_m, p^2) < 0$. In words,

the policy chosen in period $h-1$ is ex post suboptimal, but in period h, because of loss aversion and too short residual life, there is no incentive to change it. **QED** ■

Proof. Proposition 6 Recall that $\bar{p} = q(p+\theta^g) + (1-q)(p-\theta^b)$ is the expected outcome of the risky plan, and assume $E(\theta) = 0$.
i) In case of large scale risk, the concavity of $B(\cdot)$ implies that for any i ad any p it holds $E\left[V(t_i, p, \theta)\right] < V(t_i, \bar{p})$: all voters prefer the risk-free plan with the same expected outcome. Moreover, by the concavity of $B(\cdot)$, between two risky plan all voters prefer the less risky one; i.e., the plan which is second-order stochastically dominant.
ii) Small-scale risk implies that $V(t_i, p, \theta)$ is substantially linear in p (cf. Rabin's Calibration theorem), so voters are risk-neutral. Thus irrespective of risk, all voters are indifferent between two policy plans with the same mean, while they always prefer the plan with the highest expected outcome.
iii) The optimality condition which pins down voter i's most preferred policy is: $E\left[B_p(p, \theta)\right] = C_p(t_i, p)$. If $B_p(p, \theta)$ is convex in p then for any p, $E\left[B_p(p, \theta)\right] > B_p(\bar{p})$. This implies that the optimality condition is satisfied for a higher value of p: all voters prefer more p when the policy is risky.
iv) For any probability distribution of θ (i.e., for any q), by implicit differentiating the optimality condition above, it follows that voter i's most preferred policy is decreasing in t_i. Thus the decisive voter is the median. **QED** ■

Proof. Proposition 7
i) Let $\left[\check{t}^u, \hat{t}^u\right]$ be the set of types that want the status quo when there is uncertainty. As above, $\left[\check{t}, \hat{t}\right]$ is the set of types that want the status quo when there is no uncertainty. We have to show that $\check{t} < \check{t}^u$ and $\hat{t}^u < \hat{t}$.
Voter i's experienced indirect utility when there is uncertainty and the reference point is the status quo is the following

$$E\left[V(t_i, p, \theta \mid p^S)\right] = \begin{cases} E\left[V(t_i, p, \theta)\right] - \lambda\left[C(t_i, p) - C(t_i, p^S)\right] & \text{if } p \geq p^S + \theta^b \\ E\left[V(t_i, p, \theta)\right] - \lambda\left[C(t_i, p) - C(t_i, p^S)\right] & \text{if } p^S < p < p^S + \theta^b \\ -\lambda(1-q)\left[B(p^S) - B(p-\theta^b)\right] & \\ E\left[V(t_i, p, \theta)\right] - \lambda(1-q)\left[B(p^S) - B(p-\theta^b)\right] & \text{if } p^S - \theta^g < p \leq p^S \\ E\left[V(t_i, p, \theta)\right] - \lambda\left[B(p^S) - E\left[B(p, \theta)\right]\right] & \text{if } p \leq p^S - \theta^g \end{cases} \tag{17}$$

In this function, $E\left[V(t_i, p, \theta)\right]$ is the expected utility without loss aversion (cf. equation 10). The additional terms weighed by λ capture loss aversion.
As pointed out earlier, $\check{t}$ solves $B_p(p^S) - C_p(t, p^S) - \lambda C_p(t, p^S) = 0$, and $\hat{t}$ solves $B_p(p^S) - C_p(t, p^S) + \lambda B_p(p^S) = 0$. Similarly, $\check{t}^u$ solves $E[B_p(p^S, \theta)] - C_p(t, p^S) - \lambda C_p(t, p^S) + \lambda(1-q)B_p(p^S - \theta^b) = 0$, and $\hat{t}^u$ solves $E[B_p(p^S, \theta)] - C_p(t, p^S) + \lambda(1-q)B_p(p^S - \theta^b) = 0$. Recall that $C_p(t, p^S)$ is increasing in t. Since $E[B_p(p^S, \theta)] =$

$B_p(p^S)$, then $\check{t} < \check{t}^u$ and $\hat{t}^u < \hat{t}$.
Observe that $E(B_p(p^S, \theta)) = B_p(p^S)$ is only a sufficient condition: in fact, we have that $\check{t} < \check{t}^u$ and $\hat{t}^u < \hat{t}$ as long as $E(B_p(p^S, \theta))$ is not too different from $B_p(p^S)$.
ii-iii) Take a type $t_i \in \left(\hat{t}^u, \hat{t}\right)$. Without uncertainty, since $t_i < \hat{t}$ then $(1+\lambda)B_p(t_i, p^S) - C_p(t_i, p^S) > 0$, and $B_p(p^S) - (1+\lambda)C_p(t_i, p^S) < 0$: she prefers the status quo. Under uncertainty, since $t_i > \hat{t}^u$ then $E[B_p(p^S, \theta)] - C_p(t_i, p^S) + \lambda(1-q)B(p^S - \theta^b) < 0$, and $E[B_p(p^S, \theta)] - (1+\lambda)C_p(t_i, p^S) + \lambda(1-q)B(p^S - \theta^b) < 0$. Thus when there is uncertainty this high type t_i wants lower the policy w.r.t. the status quo. Similarly, it is possible to prove that, under uncertainty, all types in $\left(\check{t}, \check{t}^u\right)$ want a policy that is higher than the status quo.
iv) The proof consists in showing that the p^i which maximizes (17) is weakly decreasing in t. This proof parallels the proof of Proposition 6.iv) above. Therefore, we omit it. **QED** ■

Proof. Proposition 8 The first part of the Proposition follows from the concavity of $V(t_i, p, \theta \mid p^S)$, which implies second-order risk aversion. By (17) and (10), $E\left[V(t_i, p, \theta \mid p^S)\right] \leq E\left[V(t_i, p, \theta)\right]$, with strict inequality if $p \neq p^S$. This implies that, compared to risk averse voters, loss averse voters always demand a higher risk premium to pass a plan. **QED** ■

8.2 Loss Aversion with Lump Sum Transfers

As in Meltzer and Richard (1981), the policy consists in a lump-sum transfer financed by a proportional income tax. Individuals are heterogeneous in labor productivity (x_i). The distribution of x_i is common knowledge, and its average is normalized to one: $\bar{x} = 1$. Individuals are risk neutral and draw utility from consumption and disutility from labor. Their utility is:

$$v_i = c_i - U(l_i)$$

where c is consumption, l is labor, and $U(\cdot)$ is an increasing and convex function with $U(0) = 0$. Labor is the only factor of production. The government can levy a linear income tax τ and provide a non-negative lump sum transfer r. The budget constraint of individual i is:

$$c_i = x_i\, l_i(1-\tau) + r$$

The balanced public budget constraint is (the population size is one):

$$\tau\, L = r$$

where L is total labor supply (and income). Individual labor choice is:

$$l_i^* \in \arg\max_{l_i} \quad x_i\, l_i(1-\tau) + r - U(l_i)$$

The individual optimality condition,

$$x_i\,(1-\tau) - U'(l_i) = 0$$

yields individual labor supply:

$$l_i^* = U'^{-1}(x_i(1-\tau))$$

Since $U'^{-1}(\cdot)$ is an increasing function, individual (and total) labor supply increases in productivity and decreases in taxes.

Using the government budget constraint, the individual policy preference function (recall that $\bar{x} = 1$) is:

$$V_i(\tau) = l_i^* x_i(1-\tau) + \tau L^*(\tau) - U(l_i^*)$$

where $L^*(\tau)$ is the equilibrium total labor supply function. Recall that $y_i = l_i^* x_i$ and $\bar{y} = L^*(\tau)$. Then,

$$V_i(\tau) = y_i(1-\tau) + \tau\bar{y} - U\left(\frac{y_i}{x_i}\right)$$

Applying the envelop theorem, and maximizing, yields the optimality condition (Meltzer and Richard, 1981, eq. (13), p. 920), which pins down the individuals' bliss points:

$$\bar{y} + \tau\frac{\partial\bar{y}}{\partial\tau} - y_i \leq 0$$

Bliss points are interior only for individuals whose labor productivity is lower than the average, $x_i < 1 \rightarrow y_i < \bar{y}$. All the other types want zero tax.

Let us now apply loss aversion. We assume that an individual brackets taxes and transfers separately: i.e., she perceives the monetary amount of taxes that she pays separately with respect to the amount of transfers that she receives. This is consistent with the extensive literature and familiar observation that people treat out-of-pocket expenses (taxes, in this case) differently than opportunity costs (transfers, in this case). Let τ^S be the status quo tax rate. By loss aversion, the indirect utility is computed relative to the status quo, and losses are overweighed. Thus for individuals who enjoy positive net transfers, it becomes:[27]

$$V(\tau, y_i \mid \tau^S) = \begin{cases} \left[y_i(1-\tau) - y_i^S(1-\tau^S)\right](1+\lambda) + \tau\bar{y} - \tau^S\bar{y}^S & \\ -U(\frac{y_i}{x_i}) + U(\frac{y_i^S}{x_i}) & \text{if} \quad \tau \geq \tau^S \\ y_i(1-\tau) - y_i(1-\tau^S) + \left[\tau\bar{y} - \tau^S\bar{y}^S\right](1+\lambda) & \\ -\left[U(\frac{y_i}{x_i}) - U(\frac{y_i^S}{x_i})\right](1+\lambda) & \text{if} \quad \tau < \tau^S \end{cases}$$

[27] Of course we constraint τ and τ^S to be lower than the tax rate that maximizes the Laffer curve.

where y_i^S and $\bar{y}^S$ are the status quo individual and total income, respectively. The first line says that, by loss aversion, the voter overweighs the reduction of personal income (a loss) when she decides for a tax increase. The second line says that she overweighs the loss of transfers, and the increased disutility from labor, if the tax rate decreases. By the envelope theorem, the optimality condition is then

$$\frac{\partial V}{\partial \tau}(\tau, y_i \mid \tau^S) = \begin{cases} \bar{y} + \tau \frac{\partial \bar{y}}{\partial \tau} - y_i(1+\lambda) \gtreqless 0 & \text{if} \quad \tau \geq \tau^S \\ \left[\bar{y} + \tau \frac{\partial \bar{y}}{\partial \tau}\right](1+\lambda) - y_i \gtreqless 0 & \text{if} \quad \tau < \tau^S \end{cases}$$

Starting from this point, all results of the model with public good provisions (in the text) also hold in this model of lump sum redistribution.

8.3 Stochastic reference point

How do voters choose the policy when the environment is uncertain *and* they expect risk? Voters are acclimatized to the stochastic environment, eventually because there is no alternative risk-free policy plan. If the policy is the status quo, they expect to enjoy either $B(p^S + \theta^g)$ or $B(p^S - \theta^b)$. The reference policy is stochastic: $p^S + \theta^g$ with probability q, and $p^S - \theta^b$ with probability $(1-q)$.

Proposition 7 says that risk leads some voters to ask for more policy as a way to mitigate the sense of loss that occurs in the bad state. Risk also implies that some high types ask for less policy because there is the chance of a good state. However, the anticipation of a bad outcome implies that, when the bad outcome occurs, voters feel a lower sense of loss. This leads some low types to demand p^S instead of a higher policy. Vice versa, the anticipation of a good outcome implies that, when the bad outcome occurs, the latter looms larger. This leads some high types to stick with p^S instead of asking for a lower level of p. In sum, when risk is anticipated both these incentives are weaker. Thus, voters are less willing to deviate from the status quo. Hence, we can state the following:

Proposition 9 *When loss averse voters expect risk, the status quo bias is stronger compared to unexpected risk.*

Proof. All agents expect risk. If they choose the reference policy, p^S, the outcome is either $p^S + \theta^g$ with probability q, or $p^S - \theta^b$ with probability $(1-q)$.

Voter i's experienced indirect utility, $E\left[V(t_i,p,\theta \mid p^S)\right]$ in this case is

$$\begin{cases} \begin{array}{c} E\left[V(t_i,p,\theta)\right] \\ -\lambda\left[C(t_i,p)-C(t_i,p^S)\right] \end{array} & \text{if } \; p \geq p^S+\theta^b+\theta^g \\ \\ \begin{array}{c} E\left[V(t_i,p,\theta)\right] \\ -\lambda\left[C(t_i,p)-C(t_i,p^S)\right]-\lambda q(1-q)M \end{array} & \text{if } p^S < p < p^S+\theta^b+\theta^g \\ \\ \begin{array}{c} E\left[V(t_i,p,\theta)\right] \\ -\lambda\left[q^2L+q(1-q)M+(1-q)^2Q\right] \end{array} & \text{if } p^S-\theta^g-\theta^b < p \leq p^S \\ \\ \begin{array}{c} E\left[V(t_i,p,\theta)\right] \\ -\lambda\left[q^2L+q(1-q)M+(1-q)qN+(1-q)^2Q\right] \end{array} & \text{if } p \leq p^S-\theta^g-\theta^b \end{cases} \tag{18}$$

with $L=L(p,\cdot)\equiv B(p^S+\theta^g)-B(p+\theta^g)$; $\;M=M(p,\cdot)\equiv B(p^S+\theta^g)-B(p-\theta^b)$; $N=N(p,\cdot)\equiv B(p^S-\theta^b)-B(p+\theta^g)$; $\;Q=Q(p,\cdot)\equiv B(p^S-\theta^b)-B(p-\theta^b)$.
The rationale of $E\left[V(t_i,p,\theta \mid p^S)\right]$ above is the following:

L is the loss of benefits experienced when the agent expects the good state and the good state actually occurs. This loss occurs with probability q^2, and only when she chooses $p \leq p^S$;

M is the loss of benefits experienced when the agent expects the good state, but the bad state actually occurs, so that benefits are lower than $B(p^S+\theta^g)$. This loss occurs with probability $q(1-q)$, and only when she chooses $p < p^S+\theta^b+\theta^g$;

N is the loss of benefits experienced when the agent expects the bad state, but the good state occurs; however benefits are lower than $B(p^S-\theta^b)$. This loss occurs with probability $q(1-q)$, and only if she chooses $p \leq p^S-\theta^g-\theta^b$;

Q is the loss of benefits experienced when the agent expects the bad state, and the bad state occurs; however benefits are lower than $B(p^S-\theta^b)$. This loss occurs with probability $(1-q)^2$, and only when she chooses $p \leq p^S$.

- when the agent chooses $p > p^S$, the cost is higher than the status quo; the usual experienced loss for higher cost is $C(t_i,p)-C(t_i,p^S)$.

Let $\left[\check{t}^{us},\hat{t}^{us}\right]$ be the set of types that want the status quo when there is uncertainty and the reference policy is stochastic. This interval is different when the reference policy is stochastic. Specifically, in order to prove this Proposition we have to show that $\check{t}^{us} < \check{t}^{u}$ and $\hat{t}^{us} > \hat{t}^{us}$ where $\check{t}^{u}$ and $\hat{t}^{u}$ are defined in the proof of Proposition 7. This implies that more people want to keep the status quo when the reference policy is stochastic.

Consider $\check{t}^{us}$: it solves $E[B_p(p^S,\theta)] - C_p(t,p^S) - \lambda C_p(t,p^S) - \lambda q(1-q)M_p(p^S,\cdot) = 0$. Since $M_p(p^S,\cdot) = -B_p(p^S - \theta^b)$, and since $q(1-q) < (1-q)$, then it is easily proved that $\check{t}^{us} < \check{t}^{u}$. Now consider $\hat{t}^{us}$: it is implicitly defined by $E[B_p(p^S,\theta)] - C_p(t,p^S) - \lambda q^2 L_q(p^S,\cdot) - \lambda q(1-q)M_p(p^S,\cdot) - \lambda(1-q)^2 Q_q(p^S,\cdot) = 0$, with $L_q(p^S,\cdot) = -B_p(p^S + \theta^g)$, and $Q_q(p^S,\cdot) = -B_p(p^S - \theta^b)$. By simple algebraic manipulation, $L_q(p^S,\cdot) - \lambda q(1-q)M_p(p^S,\cdot) - \lambda(1-q)^2 Q_q(p^S,\cdot) > \lambda(1-q)B_p(p^S - \theta^b)$.

Recall by the proof of Proposition 7 that $\hat{t}^{u}$ solves $E[B_p(p^S,\theta)] - C_p(t,p^S) + \lambda(1-q)B_p(p^S - \theta^b) = 0$. Thus, for any t, the LHS of the latter equation is always smaller than the LHS of the equation above which defines $\hat{t}^{us}$. Therefore, $\hat{t}^{us} > \hat{t}^{u}$. **QED** ■