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**COMMITTEES AND SUPERMAJORITY VOTING: BALANCING  
COMMITMENT AND FLEXIBILITY**

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# Committees and Supermajority Voting: Balancing Commitment and Flexibility\*

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## Abstract

When optimal policymaking is time-inconsistent (Kydland and Prescott, 1977), but the economy is hit by shocks, there is a trade-off between the need to commit to a policy and the need to retain discretion so as to respond to shocks. Rogoff (1985) shows that a way to strike the right balance between commitment and flexibility in monetary policy is to appoint a conservative central banker. I show that a rationale for using a committee to make decisions through voting is that a commitment device can be created out of it, without totally renouncing flexibility to respond to unexpected contingencies. Appropriate voting procedures and a well chosen supermajority rule can make a randomly sampled committee behave like Rogoff's optimally conservative central banker. Supermajority rules can mitigate time-inconsistency by introducing a status quo bias. The optimal bias will depend on the volatility of the environment and on how heterogeneous preferences are. When voting institutions (i.e. the committee's constitution) are endogenously chosen by simple majority voting, the emerging majority rule is the supermajority yielding the mix of commitment and flexibility preferred by the median voter. A corollary to this is that constitutional reform should require the approval of a supermajority.

*JEL Classification: D71, D72, E58, H11.*

*Keywords: supermajorities, committees, commitment versus flexibility, time-inconsistency, voting, endogenous institutions, endogenous constitutions.*

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# 1 Introduction

Optimal plans in contexts such as those of monetary policy, capital taxation or patent protection are typically time-inconsistent (see Kydland and Prescott, 1977; and Calvo, 1978). The lack of commitment to a policy makes a rational public expect only those policies that the government will find optimal given the public’s beliefs. These latter self-enforcing policies are time-consistent, but they will typically imply a suboptimal performance. An example is when a government promises low future inflation. Agents know, however, that a government that desires to raise economic activity beyond its natural rate will find it optimal to cause surprise inflation to attain its ends. Hence, agents expect inflation as high as that which the government will not want to exceed. The consequences are high average inflation and no governmental ability to permanently alter the activity level.

Kydland and Prescott focussed on the adverse consequences of the lack of commitment, and advocated strongly for “rules rather than discretion”. Subsequent work on monetary policy, however, emphasized the valuable stabilization properties of discretionary policy (see for instance Thompson, 1981; Taylor, 1981; and Rogoff, 1985). Optimal monetary policy is dynamically inconsistent, but the presence of shocks (realized after private agents form expectations and take action) makes discretion valuable. It is discretion that allows the flexibility needed to conduct stabilization. The reason is that in real life shocks may be too hard to describe and verify, so state-contingent policy rules cannot be written and enforced. In such context, Rogoff showed that dynamic inconsistency in monetary policy can be mitigated by appointing a “conservative” central banker. This is someone who cares relatively little about unemployment vis a vis inflation. When choosing how conservative the central banker should be, a trade-off emerges: more conservativeness will imply a lower average inflation—which is good—but also a lower flexibility to respond to exogenous shocks that affect employment—which is bad. Rogoff (1985) showed that the optimal degree of commitment to a policy prescription is only partial. The optimal central banker is one that yields an ideal mix of commitment and flexibility.

Appointing an optimally conservative central banker requires observing accurately the “conservativeness” of candidates before appointment takes place (trial and error is not an option given the stability of the job). This may not be easy to do, however. An individual’s *actual* inflationary bias comes not only from intrinsic personal preferences, which after all may be learned from professional and political affiliations. That bias stems also from strong political pressures originating in other branches of government, political parties, and private interests. And it is very difficult to assess beforehand how strong-minded a central banker will be when facing such pressures.<sup>1</sup> However, even when these individual ‘types’ are hard to

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<sup>1</sup> An intrinsically conservative person may end up behaving quite non-conservatively if he lacks the personal

observe, we might have a pretty good idea of what society's distribution of types looks like. It turns out this is all we need to get an optimally conservative central banker, provided we can sample a monetary policy committee from the population, and design the rules under which it will function. I show that a randomly sampled committee, under appropriate voting procedures and a well chosen majority rule, will behave like Rogoff's optimally conservative central banker.<sup>2</sup>

I consider monetary policy being set by a committee where members with different preferences vote on deviations from an inflation target after observing shocks. Monetary policy boards are in place for instance in the European Central Bank and in the Bank of England. I begin by showing that when the committee chooses inflation by simple majority, monetary policy is exactly as if the the person with median preferences were setting it. The problem is, this median type within the committee will then be subject to the same dynamic inconsistency problem that he would face when setting policy alone. He would like the committee to behave more conservatively than it actually does. When the median member can choose the majority rule to allow for policy revisions, he chooses a supermajority requirement. There is a supermajority rule that makes the committee behave in a way that optimally trades off commitment and flexibility from his point of view. Institutional design, however, may not be under the care of the median voter or any other individual designer. I show that if society is to choose the voting rules that should govern inflation policy by simple majority voting, then the supermajority rule that emerges is the one the median person prefers. Thus, the endogenous constitution makes the monetary policy committee equivalent to the median person's optimal central banker.<sup>3</sup> These results require no further assumptions beyond those already present in the classic treatments of dynamic inconsistency in monetary policy. The optimal supermajority turns out to depend on the volatility of the environment, on the welfare costs of the credibility loss imposed by more flexibility, and on the degree of heterogeneity of preferences.

The reason why introducing supermajority requirements helps mitigate the inflationary bias while retaining some flexibility is very simple. First, a target inflation level is established as the status quo decision. After the shock is observed, a single deviation from the target is selected through simple majority voting. Then this deviation is implemented if and only if

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honesty and stamina required to resist pressure from union leaders, for example.

<sup>2</sup>Perfect approximation when sampling from a distribution with full support requires of course an infinite-size committee. In reality committees will be relatively small, generating some sampling error which I abstract from. This does not invalidate the points made. Also the sampling may be made from a subset of citizens (economists, say). The arguments apply all the same taking this subset as "society".

<sup>3</sup>This result is in line with that of simple majority not being "self-stable" in Barbera and Jackson (2002). It shows yet another way in which Rogoff's result may reflect underlying institutional arrangements (he proposed an interpretation of it as reflecting targetting rules).

it defeats the status quo by the required supermajority. Deviations can only be successful if they are acceptable to the person that becomes decisive under the supermajority—who is effectively given a veto power over proposed deviations. As that person is more conservative than the median one, the latter (and all less conservative types) must reduce the inflation deviations they would like to pass. Therefore, implemented inflation deviations as a function of the shock are smaller than those the median type would like *ex post*, but they are typically non zero.<sup>4</sup> Note this mechanism requires no structure whatsoever—only voting is needed, given a constitution that sets voting procedures.

Reputation concerns have been shown to alleviate dynamic inconsistency (see for instance Barro and Gordon, 1983a). Two papers (Lohmann, 1992; and Walsh, 1995) have suggested solutions that rely on facing the central bank with some incentive scheme. They show that the trade-off between commitment and flexibility can be either relaxed (Lohmann, 1992) or eliminated (Walsh, 1995). Supermajorities only make all the points in the trade-off available for society. What is interesting is that the results presented here depend only on institutional design. No reputation concerns or incentive schemes are considered, so my results can be seen as complementary to those just mentioned.<sup>5</sup> Indeed, those contributions notwithstanding, the profession continues to investigate institutional ways of dealing with dynamic inconsistency (see for instance Atkeson and Kehoe, 2001; and Stokey, 2002).

The paper is developed using a model of monetary policy, which is possibly the most widely known framework to study dynamic inconsistency. The insights, however, are more general, and extend to problems of taxation and patent protection.<sup>6</sup> One interesting aspect of the model used here is that it allows to isolate certain pitfalls in the design of voting procedures involving supermajority rules. Depending on how the conflict of interests within the committee changes with different levels of the shock, we may need to make sure that the order in which voting proceeds is the appropriate one (see Section 6). Seemingly natural procedures involving supermajority rules may fail to balance commitment and flexibility.

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<sup>4</sup>Supermajority rules introduce a status quo bias. This bias is regarded in a bad light in the literature on Reform (see for instance Alesina and Drazen, 1991; and Fernandez and Rodrik, 1991), but it can be beneficial in contexts where dynamic inconsistency is a problem, as it poses a friction against too much policy reoptimization.

<sup>5</sup>Note that introducing explicit incentives is not a trivial operation when the underlying policy model is not precisely micro-founded. The question of how to combine money utility and the (presumably only policy-related) loss function does not have a natural answer without a full fledged model. Moreover, explicit incentives are not without problems. Lohmann's mechanism relies on a conflictive relationship between the central bank and the executive. Walsh's paper makes the remuneration of the central banker contingent on inflation. In real life both approaches may create adverse selection effects. Therefore, a combination of explicit incentives and institutional arrangements may have to be sought.

<sup>6</sup>Simple models showing the role of supermajority rules in these other contexts are available from the author upon request.

An implication of my results is that a person setting policy on his own may want to surround himself with other individuals to form a committee. Also, he may make someone more conservative than himself the decisive or pivotal person in the voting game. This provides a theory of how committees and supermajority voting rules may spring to life. The question of what are the possible advantages of collective decisionmaking in assemblies or committees is a very old one in Economics and Politics. While folk knowledge abounds in tales of committee inefficiency, collective decisionmaking through committees where members vote on issues is pervasive in society. Legislatures, supreme courts, juries, and monetary policy boards can be seen as important instances where decisionmaking is not trusted to an individual, but rather to a group. Surprisingly, we do not have many rationales for this prevalence, apart from the famous Condorcet Jury Theorem (dating back to 1785): by engaging many people that vote on issues, committees aggregate information that is both dispersed and useful. This allows for better decisions.<sup>7</sup> In this paper I show that a committee may arise to embody a partial commitment device so that policymaking becomes credible, without fully renouncing flexibility to respond to unexpected contingencies. A committee comprising several heterogeneous members can attain this by exploiting its internal conflict of interests, something which a single person could never do.

The institution of supermajority voting rules seems to have received very little (and only recent) attention. Gradstein (1999) offers a model in which society can commit to a supermajority rule in order to credibly promise low future taxation. However, there is no value for ex post flexibility in his model. And institutions (as opposed to just policy announcements) are needed precisely when, (i) there is a shock that will affect the relative convenience of different policies, and (ii) no enforceable plans contingent on the shock can be written, say, because the shock is unverifiable. In the absence of such shock, society needs not concern itself with issues of institutional design. Having the ability to commit by writing promises into a constitution, society can commit to the optimal ex ante policy rather than to a decision rule. Two recent papers—by Messner and Polborn (2002) and Azariadis and Galasso (2002)—analyze veto powers and supermajorities in the context of intergenerational conflict. Aghion, Alesina and Trebbi (2002) provide a model where supermajorities in Congress trade-off “insulation” of the executive and legislative control.

The plan for the paper is as follows. The next section presents the canonical model of dynamic inconsistency in monetary policy, and shows the existence of an optimally conservative central banker (as in Rogoff, 1985). Section 3 describes the dynamic inconsistency

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<sup>7</sup>See, for instance, Grofman, Owen and Feld (1983), Young (1988), and Austen-Smith and Banks (1996). Blinder (1998) makes a point that can be rationalized along these lines when saying committees in central banks will tend to avoid “very bad mistakes”. A different use for central bank boards is studied by Waller (2000), who shows they can insulate monetary policy from changing political influences.

problem when a committee is in charge of setting policy. Section 4 shows our main results, identifying the optimal supermajority rule to be used to make the committee replicate the behavior of the optimally conservative central banker. Comparative statics results are also presented there. Section 5 shows how if society chooses the constitution of the central bank by simple majority voting, the emerging one will be that which is preferred by the median voter. Section 6 explains how seemingly natural voting procedures may make supermajority rules fail to balance commitment and flexibility. Section 7 concludes.

## 2 The Basic Dynamic Inconsistency Model

An individual policymaker is characterized by a parameter  $w \in [0, \infty)$  determining how much he cares about inflation relative to unemployment. The loss function for a person of type  $w$  is,

$$L(w) = w\pi^2 + (y - k\bar{y})^2, \quad k > 1, \quad (1)$$

where  $\pi$  is the inflation rate, and  $\bar{y}$  is the natural activity level in the economy.<sup>8</sup> The assumption  $k > 1$  implies that the target activity level is higher than the natural level. This captures distortions in the labor market that lower the natural employment level. The higher  $w$  is, the higher is the person's concern for inflation deviations from a target level of zero, relative to his concerns for unemployment. All the results extend to considering a target inflation level different from zero. The Phillips curve linking inflation to activity level is,

$$y = \bar{y} + \beta(\pi - \pi^* + u), \quad \beta > 0, \quad (2)$$

where  $\pi^*$  denotes the inflation expected by the public. Inflation expectations affect output because they have affected the determination of nominal aspects in the contracts throughout the economy.  $u$  denotes a white noise exogenous supply shock that is unknown to agents at the time of forming inflation expectations. The variance of  $u$  is denoted  $\sigma^2$  and  $Eu = 0$ , where  $E$  denotes the expectations operator. Given this source of uncertainty, the measure of economic-and policymaking-performance is given by the expectation of (1) across realizations of  $u$ , where  $y$  is given by (2).

Suppose a person of type  $w$  is in charge of setting policy. We assume that the policymaker has the ability to choose inflation levels after observing the shock. Then, given  $\pi^*$  and  $u$ , the policymaker chooses  $\pi$  to minimize his loss function subject to (2). Thus, the inflation

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<sup>8</sup>The quadratic formulation is used, for instance, by Barro and Gordon (1983b), Rogoff (1985), Lohmann (1992) and Walsh (1995).

level chosen is,

$$\pi(u, w, \pi^*) = \frac{\beta}{w + \beta^2} [(k - 1)\bar{y} + \beta(\pi^* - u)]. \quad (3)$$

To see the nature of the dynamic inconsistency in policymaking, suppose agents expect low inflation and the shock was neutral (say,  $\pi^* = 0$  and  $u = 0$ ). Then the previous equation says that the policymaker will want to create positive inflation to reduce unemployment ( $\pi$  will be set at  $\frac{\beta}{w + \beta^2}(k - 1)\bar{y}$ ). In a rational expectations equilibrium, however, the inflation expected by agents ( $\pi^*$ ) equals the mathematical expectation of inflation  $E\pi(u, w, \pi^*) = \frac{\beta}{w + \beta^2} [(k - 1)\bar{y} + \beta\pi^*]$ , so the time-consistent expected inflation when a type  $w$  sets policy is,

$$\pi^*(w) = \frac{\beta}{w}(k - 1)\bar{y}. \quad (4)$$

Given this expectation from agents, the actual ex post inflation under a type  $w$  policymaker will be (plugging (4) into (3)),

$$\pi(u, w) = \frac{\beta}{w}(k - 1)\bar{y} - \frac{\beta^2}{w + \beta^2}u. \quad (5)$$

This is the familiar result that a policymaker will respond to the shock inflating more when a deeper recession strikes. The extent of the response, however, will depend on how conservative the policymaker is. A more conservative policymaker (one with a higher  $w$ ) cares relatively more about keeping inflation near zero than about reducing deviations from the target activity level. Thus, he will respond relatively less to the shock  $u$  (note that the slope  $\frac{\beta^2}{w + \beta^2}$  is decreasing in  $w$ . In the limit, an infinitely conservative person does not react to shocks at all). The good thing of a more conservative policymaker is that the average inflation  $\frac{\beta}{w}(k - 1)\bar{y}$  in a rational expectations equilibrium is lower (an infinitely conservative person yields zero inflation).

### *The optimal central banker*

A consequence of dynamic inconsistency is that any policymaker with a finite type obtains an equilibrium average inflation level that is positive and thus too high by his own standards. This is a consequence of keeping flexibility to respond to shocks when it is not possible to commit to a shock-contingent policy rule.<sup>9</sup>

Think of a policymaker with some positive finite type, and label this type  $w'$ . I show now that—starting from a situation of total discretion—this policymaker is ready to trade some flexibility for a diminished average inflation. A policymaker of type  $w'$  would like to leave

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<sup>9</sup>If this were possible, a policymaker of type  $w$  would like to commit to a reaction rule that has the slope of  $\pi(u, w)$  but yields zero inflation in average.

his post to a person with a higher type—ie. a more conservative person—although not to a person with an arbitrarily high type.

To see this, note that the expected value of the loss function of a type  $w'$  when a type  $w$  is in charge of setting policy is,

$$EL[w, w'] = w' E\pi(u, w)^2 + E\{(1 - k)\bar{y} + \beta[\pi(u, w) - \pi^*(w) + u]\}^2.$$

Using (5) and (4), and after tedious algebra one gets,

$$EL[w, w'] = [(1 - k)\bar{y}]^2 + w' \left[ \frac{\beta(k - 1)\bar{y}}{w} \right]^2 + (\beta^2 w' + w^2) \left( \frac{\beta}{w + \beta^2} \right)^2 \sigma^2.$$

We can now derive the equivalent to Rogoff's (1985) theorem on the optimal conservativeness of the central banker.

**Proposition 1** (Rogoff, 1985) *A person of type  $w'$  would like to have a person of type  $w^\circ \in (w', \infty)$  in charge of setting policy.*

Proof. Included in the Appendix for completeness.

It is very hard to get a closed form solution for  $w^\circ$ . The first order condition in the problem of a person of type  $w'$  trying to choose the optimal type  $w$  of a central banker yields a quartic equation in  $w$ . As Rogoff (1985) stated, it can be proved  $w^\circ$  is the unique root of that equation which is both positive and real. This is demonstrated in the proof contained in the appendix, and it is also shown that the loss function is convex around the minimum  $w^\circ$ . This means that a type  $w'$  has preferences in the type space  $w$  for central bankers that are both single peaked and convex around that peak.<sup>10</sup> We will rely heavily on these two features in Section 5. The fundamental aspect for now is that  $w^\circ$  is unique, positive, finite, and larger than  $w'$ . Note that Rogoff's exercise assumes the existence of a population of possible central bankers with smoothly varying preferences over inflation and unemployment (or, at least, the existence of the optimal type). We maintain that assumption, specified formally in the next section. Waller (1992) shows how different attitudes towards monetary policy can emerge even when people have the same intrinsic preferences. All that is required is that they conduct their transactions in markets with varying vulnerability to shocks.

I state now a useful lemma.

**Lemma 1** *There exists a continuously differentiable, monotonically increasing function  $w^\circ(w')$  (mapping  $(0, \infty)$  into itself).*

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<sup>10</sup>Slightly abusing language, I will talk about "single peakedness" even though we are dealing with functions that have a minimum rather than a maximum.

Proof: See Appendix.

This lemma states a very intuitive result the reader probably had in mind already. The proposition due to Rogoff holds for any type  $w' \in (0, \infty)$ . Hence, how conservative the optimal central banker is for a type  $w'$ , will depend on how conservative the type  $w'$  is himself. More precisely, there is a function  $w^\circ(w')$  relating each type  $w'$  to his most preferred central banker's type. The more conservative  $w'$  is, the more conservative his ideal central banker  $w^\circ(w')$  will be.

### 3 Dynamic inconsistency in a monetary policy committee

Suppose policymakers are drawn from a distribution function  $F(w)$  with associated density  $f(w)$  and support in  $[0, \infty)$ . This distribution also describes the composition of the (for simplicity, very large) monetary policy committee. The median policymaker has type  $w^m$  satisfying  $F(w^m) = \frac{1}{2}$ . The point of this section is showing that, in a monetary policy committee choosing inflation through simple majority voting, the median type will be decisive. Thus, he will be subject to the same intertemporal inconsistency he would face when setting policy on his own.

#### *Committee members' preferences after a shock*

Suppose a level  $u$  of the shock has just been realized. Also assume some level of inflation expectations  $\pi^* \geq 0$  by the public. A policymaker of type  $w$  then would like to implement an inflation level  $\pi(u, w, \pi^*)$  as defined by (3). Because the optimization of each type is well defined, preferences over the possible inflation levels given  $u$  and  $\pi^*$  are single peaked, with the peak for each type  $w$  lying precisely at  $\pi(u, w, \pi^*)$ .

How do preferences on inflation differ across types  $w$ , given  $u$  and  $\pi^*$ ? The following figure shows plots of the function  $\pi(u, w, \pi^*)$ , each plotted for a different value of  $w$  ( $\pi^*$  is the only element held totally fixed when generating this figure).

A simple way of seeing how the distribution  $F(w)$  induces a distribution  $G(\pi | \pi^*, u)$  in the space of most preferred inflation levels is as follows.<sup>11</sup> Choose, say, a shock of zero, and some level  $\pi^*$ . From (3) we see that a type approaching infinity will want inflation approaching zero. This is because when  $w$  goes to  $\infty$ , the person tends to care about inflation exclusively, so the function  $\pi(u, w, \pi^*)$  tends to the horizontal axis in Figure 1 (this axis would be the rule one commits to when promising unconditional zero inflation). Now move upwards along

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<sup>11</sup>Where  $G(\pi | \pi^*, u)$  indicates the fraction of people that, given  $\pi^*$  and  $u$ , have a most preferred level of inflation deviation which in absolute value is lower or equal to  $\pi$ .

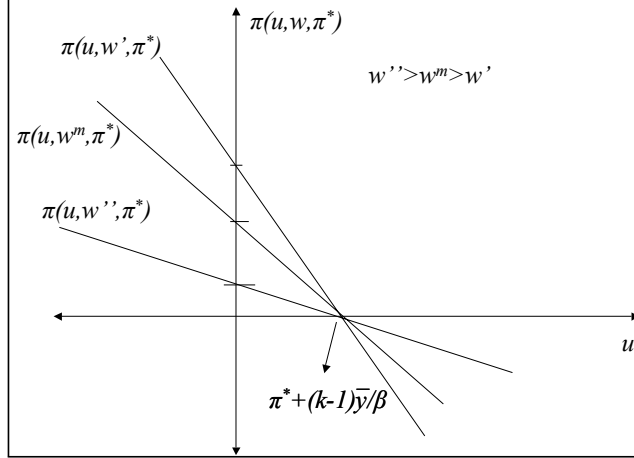


Figure 1:

the vertical axis. As we do that, we move along intersections between the vertical axis and a continuum of functions  $\pi(u, w, \pi^*)$  for varying levels of  $w$ . These intersections are the most preferred levels of inflation corresponding to less and less conservative types. A type such as  $w^m$  will want an inflation level such as  $\pi(0, w^m, \pi^*)$  in the figure, while types lower than  $w^m$  will want even higher inflation levels. The distribution function  $F(\cdot)$  tells us how dense are these intersections as we move along the  $\pi$  axis. This yields a density  $g(\pi \mid \pi^*, u)$  over most preferred inflation levels across types  $w$ , as shown in the following pictures.

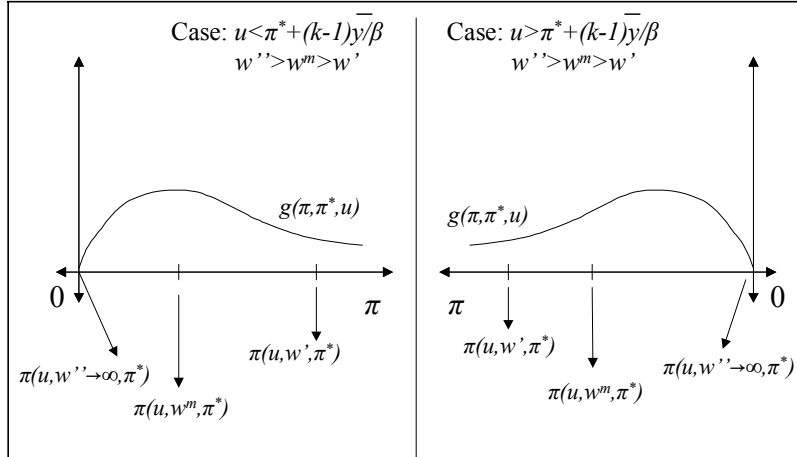


Figure 2:

Note that for a shock level equal to  $\pi^* + \frac{(k-1)\bar{y}}{\beta}$ , all types prefer an inflation level of zero (see equation (3)). Hence, the distribution of most preferred inflation levels across types is actually degenerate in this case. For shocks lower than  $\pi^* + \frac{(k-1)\bar{y}}{\beta}$ , the function  $\pi(u, w, \pi^*)$  is

monotonically decreasing in  $w$ —the more conservative people are, the less inflation they want away from zero (see Left Figure above). For shocks higher than  $\pi^* + \frac{(k-1)\bar{y}}{\beta}$ , the function  $\pi(u, w, \pi^*)$  is monotonically increasing in  $w$ —the more conservative people are, the smaller the deviations from zero they prefer (this implying now lower preferred levels of *deflation*—see Figure to the right above). Summarizing, for any shock level different from  $\pi^* + \frac{(k-1)\bar{y}}{\beta}$  and some inflationary expectation by the public, we have a distribution of most preferred inflation levels. Also, more conservative people always prefer lower deviations from zero inflation.

*Committee policymaking under simple majority voting*

Policy is chosen after committee members have observed the shock. One procedure through which the committee can choose policy is simple majority voting over all possible pairs of inflation levels. A Condorcet winner is an option that can beat every other option by such pairwise majority voting. There is of course only one such option if any, and there is one whenever preferences over levels  $\pi$  are single peaked. We know already this condition to be satisfied. We also know that, given a distribution of preferred inflation levels across types (such as any of those in the previous Figure), the Condorcet winner is given by the preferred option of the median person.<sup>12</sup> We then conclude that, given inflation expectations  $\pi^*$  and a shock  $u$ , pairwise majority voting will invariably select the inflation level preferred by the median committee member as given by  $\pi(u, w^m, \pi^*)$ . Thus, the rational expected inflation is given by (4):  $\pi^*(w^m) = \frac{\beta}{w^m}(k-1)\bar{y}$ . As a result, actual inflation is  $\pi(u, w^m) = \frac{\beta}{w^m}(k-1)\bar{y} - \frac{\beta^2}{w^m + \beta^2}u$ . The committee behaves exactly as if its median member were in full charge. From the previous section we know that the median person would like the committee to set policy as if a more conservative person than himself were choosing policy. Thus, simple majority voting will not be a system the median policymaker would like to write into the constitution.

## 4 Supermajority voting on inflation

In this section I show how the median person can design the voting procedures and choose a supermajority requirement that will make the committee behave as if a single central banker of type  $w^\circ(w^m)$  were in charge. This gives the median type the mix of commitment and

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<sup>12</sup>From the optimization of any given type  $w$ , we know that the loss function varies monotonically away from the ‘peak’  $\pi(u, w, \pi^*)$ . This implies that if a type  $w$  prefers an inflation level  $\pi$  to another level  $\pi' > \pi$  ( $< \pi$ ), then all types  $w' > w$  ( $< w$ ) also will. Thus, any pairwise comparison induces a splitting of the set of types in two convex sets: one for all those that prefer one inflation level, and another for all those who prefer the other level. The option preferred by the median type leaves exactly 50% of the types at each side, so it beats every other option.

flexibility that is best for him. The argument could be made from the point of view of any type  $w' \neq w^m$ , but there are two good reasons why I focus on the median type in this section. The question to be answered is this: Is there a world and a person who might want to surround himself with other individuals forming a committee and renounce to being decisive? The answer is yes. The median person will want to do this when he can draft the institutions regulating the committee's operation (the committee is a necessary but not sufficient condition for the median person being able to improve on his 'solo' performance). This provides a theory of committees. The second reason is that working out the equilibrium institutions from the point of view of the median person provides the first building block towards a theory of endogenous constitutions in democracies, to be covered in Section 5. There I will show that when society votes on majority rules, the one that will emerge is the supermajority preferred by the median person. We characterize the latter in this section.

Now consider the following procedure to be written into the constitution of the central bank:

1. Previous to the realization of the shock, the target inflation level zero is announced as the status quo policy rule, together with a supermajority requirement  $s > \frac{1}{2}$ .
2. After the shock is observed, a pairwise simple majority vote over all possible inflation pairs is taken to define a reform inflation level  $\pi^r$  that will challenge the zero status quo level.<sup>13</sup>
3. A supermajority vote is taken to decide whether to stick with the zero status quo inflation, or to change to the reform level  $\pi^r$ . The reform level is implemented instead of the status quo if and only if a fraction of the committee not smaller than  $s$  supports the change.

Under this voting procedure, we have,

**Theorem 1** *There exists a supermajority rule  $s^\circ \in (\frac{1}{2}, 1)$  such that the committee implements inflation levels just as if a type  $w^\circ(w^m)$  were setting policy.*

The remainder of this section is devoted to proving this theorem. A brief overview is perhaps convenient. We will work backwards. First, we will study how the supermajority requirement sets a "status quo bias": it constrains the size of deviations from zero inflation that the median type and those less conservative than him might expect to see approved in stage 3 (Lemma 2 below). The more demanding the supermajority requirement, the larger

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<sup>13</sup>Note that—without further structure—simple majority is the only voting rule which can pick out a single option out of many contending ones. The indication that voting involves all possible pairs is clearly utopic, but ensures the emergence of the Condorcet winner. Otherwise, voting sequentially over a single possible succession of pairs gives incentives for members to manipulate their votes (see Black, 1948). An alternative is assuming sincere voting. This step 2 in the voting procedure could be replaced with the median voter behaving as agenda setter and proposing a reform inflation level.

the minimum winning coalition in stage 3 needs to be, implying that the maximum inflation deviation that can beat zero is lower (as the support of more conservative people is required). We then show that in stage 2 there exists a Condorcet winner in the space of the reform inflations that compete to challenge the status quo. The selected reform inflation is precisely the highest deviation from zero inflation that can be expected to gather the minimum winning coalition in stage 3 under the prevailing supermajority rule (Lemma 3). The intuition is as follows: the median voter and those less conservative than him might want wild inflation levels at the prevailing shock. However, they know that if the reform inflation they choose leaves most conservative types worse off than zero inflation, then some of the conservative votes that are needed to overturn the zero inflation might be lost. So they will approve the highest inflation deviation which is *consistent* with beating the status quo in the following voting round. This maximum successful deviation is the one that will be implemented. It is a decreasing function of the type of the decisive person, and therefore of the size of the supermajority required to approve it. Once we know how the supermajority rule affects how conservative the decisive type is, we know what inflation levels will be adopted. Then it is simple to determine who the decisive type should be, given the inflation levels we want to see implemented as a function of the shock (Lemma 4). This determines exactly what supermajority rule must be written in the constitution.

An interpretation is possible in terms of veto power. The proposed voting mechanism gives a veto on inflation deviations to the type that is made decisive under the supermajority rule. Given this, the less conservative members begin by selecting the highest possible deviation that will not be vetoed. This leads to the implementation of inflation deviations that are smaller than those the median member wants. They are also larger than those preferred by the person made decisive under the supermajority. They correspond to what some type in between the previous two would like. Then the supermajority can be adjusted so that the implemented inflation levels are exactly those preferred by the optimal central banker. In what follows we develop these arguments in more detail and provide precise calculations.

#### *Supermajority and status quo bias*

Suppose that, in line with the theorem, policy is being set as if type  $w^\circ(w^m)$  were in charge. (To simplify notation, we will write just  $w^\circ$  when we mean  $w^\circ(w^m)$  for the rest of the section, as no room for ambiguity arises.) Therefore, the rational expectation for inflation is  $\pi^*(w^\circ) = \frac{\beta}{w^\circ}(k-1)\bar{y}$ . Given  $\pi^*(w^\circ)$  and any shock level  $u$ , the type  $w^m$  and all types less conservative than him will want larger deviations from zero inflation than people with types larger than  $w^m$ . We know then that, given the pair  $(u, \pi^*(w^\circ))$  there is a density  $g[\pi(w) \mid u, \pi^*(w^\circ)]$  over most preferred inflation levels across types  $w$ . We know that this

distribution must satisfy  $G[\pi(w^m)] = \frac{1}{2}$ , because the half of committee members who are more conservative than the median type prefer smaller inflation deviations than he does.

Suppose now a supermajority requirement  $s > \frac{1}{2}$  is in place. There is one type in the distribution  $F(w)$  that accumulates to  $s$ ; call it  $w^s$ , which then satisfies  $F(w^s) = s$ .<sup>14</sup> Given the pair  $(u, \pi^*(w^o))$ , we also know that  $F(\cdot)$  induces a density  $g(\pi | u, \pi^*(w^o))$  such that the inflation level  $\pi(u, w^s)$  preferred by type  $w^s$  satisfies  $1 - G[\pi(u, w^s)] = s$  (this is the area below the curve and to the right of  $\pi(u, w^s)$  in the following figure, drawn for the case when  $u < \pi^o + \frac{(k-1)\bar{y}}{\beta}$ ).

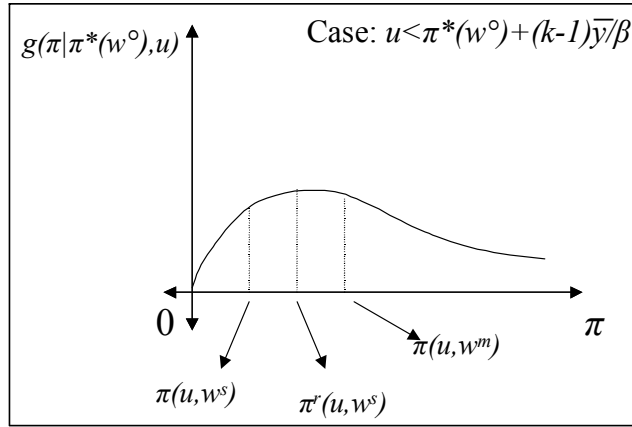


Figure 3:

We now proceed to identify the set of inflation levels that could successfully challenge a zero status quo inflation given that type  $w^s$  is decisive in stage 3. Clearly, in order to defeat zero by supermajority voting, an alternative positive inflation level must gather a fraction  $s$  of votes, coming from the relatively less conservative members. If the inflation level that is opposed to the zero status quo is  $\pi(u, w^s)$ , then the status quo will clearly be overturned. The reason is that at  $\pi(u, w^s)$  the type  $w^s$  is at his bliss point (a minimum in his loss function). Hence, type  $w^s$  and all types less conservative than himself (of measure  $s$ , and who have even higher preferred inflation levels) would always prefer  $\pi(u, w^s)$  to zero. An inflation level slightly above  $\pi(u, w^s)$ —although less satisfactory than  $\pi(u, w^s)$  itself—will still be better than zero in the eyes of type  $w^s$ . An alternative inflation that is much higher than  $\pi(u, w^s)$ , however, might yield type  $w^s$  a higher loss than a zero inflation, so he might decide to stick with the status quo. There is an inflation deviation  $\pi^r(u, w^s)$  that, being larger than  $\pi(u, w^s)$ , leaves type  $w^s$  exactly as well off as zero. This is therefore the highest alternative inflation that will get the vote of type  $w^s$  against the status quo. We now establish,

<sup>14</sup>Note that, given  $F' > 0$ , the more stringent the supermajority requirement (the higher  $s$ ) is, the more conservative is the decisive type  $w^s$ .

**Lemma 2** *Under a supermajority rule  $s$  making type  $w^s$  decisive, and given inflation expectations  $\pi^*(w^\circ)$  and a shock  $u$ , the highest inflation deviation that can defeat the status quo zero inflation is a level  $\pi^r(u, w^s) = \frac{2\beta\{(k-1)\bar{y} + \beta[\pi^*(w^\circ) - u]\}}{w^s + \beta^2}$ , which has absolute value monotonically decreasing in  $w^s$ .*

Proof. See Appendix.

The intuition for this lemma is simple: a type  $w^s$  that is made decisive under supermajority rule  $s$  will only lend his vote to those less conservative than himself in order to deviate from zero inflation if he is at least as well off by doing so. This imposes a bound on how different from zero the alternative inflation can be. The more stringent the supermajority requirement (the higher  $s$ ), the more conservative the decisive type  $w^s$  becomes. Because the more conservative types will like zero inflation comparatively better to any alternative inflation level than less conservative types, a more stringent supermajority implies that the highest possible deviation that can defeat the status quo at any shock level is lower.

*Choosing  $\pi^r$  under simple majority voting*

Given a supermajority requirement  $s$ , in stage 2 everybody knows that  $\pi^r(u, w^s)$  is the inflation level farthest away from zero that can be successfully opposed to the status quo. The person with median type—and all those less conservative than him—will prefer  $\pi^r(u, w^s)$  (already smaller in absolute value than  $\pi(u, w^m)$ ) to any other smaller proposed deviation. Then  $\pi^r(u, w^s)$  beats all smaller deviations. On the other hand they will also prefer it to deviations larger than  $\pi^r(u, w^s)$ . The reason is simple: larger deviations will not defeat the status quo in stage 3, so they are effectively as bad as zero inflation. It follows that  $\pi^r(u, w^s)$  beats all larger deviations too. This implies,

**Lemma 3** *Simple majority voting will select  $\pi^r(u, w^s)$  as the reform inflation to be opposed to the status quo.*

*Determining the optimal supermajority*

From the last two lemmas we know that, under the proposed voting procedure,  $\pi^r(u, w^s)$  will be the implemented level of inflation. So what is required in order to make the committee behave as an individual with type  $w^\circ$  is to find  $s^\circ$  such that the type  $w^{s^\circ}$  made decisive satisfies  $\pi^r(u, w^{s^\circ}) = \pi(u, w^\circ)$ . This is, the designer needs to find a type  $w^{s^\circ}$  who, for every level of the shock, is indifferent between zero inflation and the inflation level that would be implemented by a type  $w^\circ$ .

**Lemma 4** *The type  $w^{s^\circ}$  who is always indifferent between the inflation level  $\pi(u, w^\circ)$  and zero is  $w^{s^\circ} = 2w^\circ + \beta^2$ .*

Proof. See Appendix.

Note that if the designer wants the committee's behavior to replicate that of a central banker of type  $w^\circ$ , then the type that must be made decisive is a type  $w^{s^\circ}$  which is always larger than  $w^\circ$ . The last lemma tells us exactly what  $w^{s^\circ}$  is, as a function of  $w^\circ$ . And knowing  $w^{s^\circ}$  we can now find the required supermajority  $s^\circ$  that makes it decisive, and therefore makes the committee behave like a type  $w^\circ$ ,

$$s^\circ = F(w^{s^\circ}) = F(2w^\circ + \beta^2). \quad (6)$$

This completes the proof of the theorem and characterizes the optimal supermajority rule as a function of the optimal central banker's type. Note that  $s^\circ$  is always a supermajority. Even when the median member wants a committee that behaves as a type that is arbitrarily close to himself, the way to generate such behavior is by making decisive a type that is at a 'significant' distance from himself. When the type of the optimal central banker  $w^\circ$  tends to  $w^m$  (say because the variance of the shock goes to infinity and the median member does not want to lose any flexibility), the limit value of the supermajority is  $F(2w^m + \beta^2)$ , which is strictly above  $\frac{1}{2}$ . Of course in the limit, if the median type wants the committee to behave exactly like himself, he only needs to rely on simple majority voting. But as soon as he wants to depart from that, even if very little, he needs a supermajority requirement which is strictly above simple majority. Going to the other extreme, the supermajority requirement tends to unanimity only when conditions are such that the optimal central banker should be infinitely conservative (for instance when  $\sigma = 0$ ). Unanimity is equivalent to full commitment to a target inflation level.

#### *Comparative statics*

It is interesting to relate the optimal supermajority to characteristics of the underlying policy trade-off.

**Proposition 2** *The optimal supermajority  $s^\circ$  is smaller when the volatility of the environment is larger (i.e. when  $\sigma$ , the dispersion of the shock, is larger).*

Proof. See Appendix.

The proof in the Appendix contains the formalities of the comparative statics exercise involved. The intuition for this result is direct. When the variance of shocks is large, ex post flexibility is very valuable vis a vis credibility. Therefore, anyone prefers an optimal central banker who is less conservative than otherwise. The way of attaining a committee that behaves like an optimal central banker that is less conservative is (see expression (6)) by having a smaller required supermajority to overturn the status quo.

The optimal supermajority can also be shown to depend on the degree of heterogeneity of preferences in society.

**Proposition 3** *The optimal supermajority  $s^\circ$  is smaller when preferences in society are more heterogeneous (as measured by a median preserving spread of the distribution  $F(\cdot)$ ).*

Proof. See Appendix.

The median person's wants the committee to behave as if a type  $w^\circ$  were setting policy. This requires making type  $w^\circ$  decisive. How far the latter is from the median type in the space  $w$  is independent from the distribution  $F(\cdot)$ . But what does depend on this distribution is the fraction of members that are placed between the median and  $w^\circ$ . If the distribution is quite concentrated around the median—i.e. preferences are quite homogeneous—the type  $w^\circ$  will accumulate a large fraction or probability, and the supermajority rule needed to make him decisive will therefore be large. When the distribution is very disperse around the median, the opposite holds.

## 5 Endogenous institutions

In the previous sections I have focused on the case when the median type, or a planner with his views, has the power to design institutions single-handedly. The key institution of choice is the supermajority rule. What supermajority will emerge if it is up to the whole committee (or society, described by the same distribution of types) to decide on it through simple majority?

Note this is similar to asking what would the committee choose when deciding over the type of the central banker. Proposition 1 and Lemma 1 in Section 4 showed that a type  $w'$  will want the committee to behave as a central banker of type  $w^\circ(w') > w'$ . From the proof to Proposition 1 we know that the preferences of any type  $w'$  are single peaked in the space of types  $w$  for possible central bankers. This means that if the committee were to choose the type of the ideal central banker by simple majority voting, the chosen one would be that preferred by the median type  $w^m$ . This median type  $w^m$  desires policy to be set as if a central banker of type  $w^\circ(w^m) > w^m$  were in charge. From Theorem 1 in Section 4 we know the way to implement this would be to choose a supermajority rule  $s^\circ(w^m) = F[w^{s^\circ}(w^m)] = F[2w^\circ(w^m) + \beta^2] > \frac{1}{2}$ . So this suggests that democratic constitutional design would adopt the supermajority  $s^\circ(w^m)$  that yields the median person's right mix of commitment and flexibility.

The last paragraph exposes the intuition for the results of this section. However, the committee is not very likely to engage in debate and voting over what type of central banker

its future policymaking behavior should imitate. Committee members are more likely to debate and vote over different majority rules. Therefore a more careful analysis of the endogenous democratic determination of voting rules requires analyzing preferences in the space of possible majority rules. This consideration is not trivial because not all majority rules translate analogously into policymaking. In particular, I have not said anything about what is the policy performance when a submajority voting rule (i.e.  $s < \frac{1}{2}$ ) is in place. In what follows I develop the argument at a more appropriate level of detail by proving two lemmas that yield the section's theorem.

**Lemma 5** *The supermajority rule  $s^\circ(w^m)$  will beat any higher alternative under simple majority voting.*

Proof. The supermajority rule  $s^\circ(w^m)$  makes decisive (in Stage 3) a type  $w^{s^\circ}(w^m)$ . This causes the reform inflation level chosen in Stage 2 (and then approved in Stage 3) to be what a central banker of type  $w^\circ(w^m)$  would choose. All supermajority rules above  $s^\circ(w^m)$  will make people more conservative than  $w^{s^\circ}(w^m)$  decisive, which implies that the implemented inflation will be that of central bankers more conservative than  $w^\circ(w^m)$ . From the single peakedness of preferences of any type  $w'$  over central banker types  $w$ , it follows that all types  $w' \leq w^m$  will prefer the supermajority rule  $s^\circ(w^m)$  to any higher one. Then the lemma follows. ■

We now study what happens with majority rules lower than  $s^\circ(w^m)$ .

**Lemma 6** *The supermajority rule  $s^\circ(w^m)$  will beat any lower alternative majority rule under simple majority voting.*

Proof. We must consider two cases:

(1)  $s \in (F(2w^m + \beta^2), s^\circ(w^m))$ . Any supermajority in this interval will make decisive types in this interval, and will yield inflation levels as would be chosen by central bankers with types in the interval  $(w^m, w^\circ(w^m))$ . Thus, the single peakedness of preferences in the  $w$  space means that all types  $w' \geq w^m$ , preferring central bankers of type equal or higher than  $w^\circ(w^m)$ , will prefer the supermajority rule  $s^\circ(w^m)$  to any other in the interval  $(F(2w^m + \beta^2), s^\circ(w^m))$ .

(2)  $s \in (0, F(2w^m + \beta^2)]$ . (The meaning of a submajority rule  $s < \frac{1}{2}$  is that in Stage 3 the reform level that emerged in Stage 2 is approved over the status quo inflation if at least  $s\%$  of the voters vote for it.) A person of type  $2w^m + \beta^2$  is always indifferent between sticking with zero inflation and letting the median person set policy. A person of a type lower than that is actually happier letting the median person set policy rather than sticking with zero inflation. That means that any majority rule below  $F(2w^m + \beta^2)$  will guarantee that if in Stage 2 the median person imposes his most preferred inflation level (as the reform

inflation that will challenge the status quo in Stage 3), then that inflation level will indeed be implemented. Hence, any majority rule  $s \in (0, F(2w^m + \beta^2)]$  (including submajority rules  $s \in [0, \frac{1}{2})$ , simple majority  $s = \frac{1}{2}$ , and supermajorities  $s \in (\frac{1}{2}, F(2w^m + \beta^2)]$ ) will impose no constraints on the median person and inflation  $\pi(u, w^m)$  must be expected. Thus, all types  $w' \geq w^m$  (and, actually, even some types below the median) will prefer the supermajority rule  $s^\circ(w^m)$  to any other in the interval  $[0, F(2w^m + \beta^2))$ .

Cases 1 and 2, put together, imply that all types  $w' \geq w^m$  would support the supermajority rule  $s^\circ(w^m)$  against any lower majority rule. ■

The two previous lemmas readily imply,

**Theorem 2** *Simple majority voting over (all possible pairs of) majority rules  $s$  will select the supermajority rule  $s^\circ(w^m)$  preferred by the median person.*

This tells us that the endogenous democratic constitution will be equivalent to that which would be written by a constitutionalist with the preferences of the median person. A constitutionalist, however, is not needed. Supermajority rules can be the outcome of a collective decision under the basic simple majority voting scheme.

## 6 Why supermajority voting will not do without appropriate voting procedures

The voting procedure used in Section 4 forces the committee to select a specific candidate deviation before the supermajority vote is taken to decide on whether to keep the status quo or not. Another natural voting procedure could be as follows.

1. Previous to the realization of the shock, the target inflation level is announced as status quo, together with a supermajority requirement  $s > \frac{1}{2}$ .
2. After the shock is observed, a supermajority vote is taken to decide whether to stick with the zero status quo inflation or not. The status quo is overturned if and only if a measure of at least  $s$  votes this way.
3. If the status quo is overturned, a new inflation level is chosen by pairwise simple majority voting over all possible inflation pairs.

The difference between this procedure and the one in Section 4 is that now people must decide whether to stick with zero inflation before knowing what the selected alternative inflation is. It turns out that this procedure, that seems as natural as the one we used before, can be very problematic.

**Proposition 4** *If  $s > F(2w^m + \beta^2)$ , the implemented inflation is the status quo zero level regardless of the shock. If  $s \leq F(2w^m + \beta^2)$ , the implemented inflation is the one preferred by the median member, regardless of the shock.*

Proof. There exists a type  $w^i \equiv 2w^m + \beta^2$  that is always indifferent between zero inflation and the preferred inflation of the median member  $\pi(u, w^m)$ .<sup>15</sup> It is easy to see that a more conservative type than  $w^i$  would strictly prefer zero inflation, while a less conservative one would prefer the inflation the median member likes best. Given the voting procedure, everybody knows that, if overturned, the status quo will be replaced by the inflation level the median member likes best, as in stage 3 this would be the Condorcet winner. Foreseeing this, anyone more conservative than  $w^i$  would support the status quo in stage 2, while those less conservative than him would vote for overturning it. Thus, if  $s > F(2w^m + \beta^2)$ , the fraction of those voting against the status quo ( $F(2w^m + \beta^2)$ ) is lower than that required for overturning it, and the status quo inflation is implemented regardless of the shock. If the opposite inequality holds, the fraction of the committee voting against the status quo is larger than the required supermajority and overturning takes place. Then the next stage leads to the selection of  $\pi(u, w^m)$  regardless of the shock. ■

This result shows that the use of a supermajority requirement need not provide *per se* varying combinations of commitment and flexibility. Depending on how stringent the supermajority is, it might just yield total commitment or total flexibility. One essential cause for this failure is that the procedure makes the median member decisive whenever the status quo has been overturned. The other essential element is the structure of preferences: if, given some shock level, a type prefers (does not prefer) zero inflation to the most preferred inflation level of another type, he will also prefer it (will also not prefer it) for any other shock level—ignore the shock level that makes everyone want zero inflation. Now suppose that the supermajority is so demanding that it makes decisive a type more conservative than  $w^i$ . Then we know this person will never vote for overturning the status quo, no matter how large the shock is. Sticking with zero inflation may hurt a lot, but for this type giving the median member the chance to ‘overreact’ is even worse. Thus the status quo is maintained even when the gains from some inflation would be enormous. If, on the contrary, the supermajority is not sufficiently large, the decisive type might be less conservative than  $w^i$ . This is a person who will always prefer to overturn the status quo and get the median member setting policy. So the committee behaves exactly as if the median member were in full charge.

The result in this section is entirely driven by the particular structure of preferences imposed. In other set ups the voting procedure presented in this section would work well.

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<sup>15</sup>The reader can check that type  $w^i$  satisfies  $L[u, w^i, 0] = L[u, w^i, \pi(u, w^m)]$  for every  $u$ . Then one can solve for  $w^i$ .

What the proposition above states is that such procedure will not necessarily work—actually, it does not in the set up of this paper. So this result should be seen as a counterexample to any sweeping statements on the power of supermajority rules. The latter will not yield the desired results unless the voting procedures are safe in the context of the specific problem to which they are applied. The general description one could bear in mind is the following. Given any two types  $w^m$  and  $w' > w^m$ , there are three ways in which greater shock levels will affect the conflict of interests between  $w^m$  and  $w'$  relative to that created by sustaining the status quo policy.<sup>16</sup> From the point of view of type  $w'$ , larger (in absolute value) shock levels might make the status quo policy (1) more attractive relative to letting type  $w^m$  set policy, and hence we say the conflict of interests increases with the size of the shock, or (2) less attractive, and we say the conflict of interests decreases with the size of the shock, or (3) equally attractive, in which case we say the conflict of interests is constant in the shock. In the first case, if type  $w'$  is decisive under a supermajority rule and for a zero shock level he prefers zero inflation to  $\pi(u, w^m)$ , then we know that for any larger shock this preference will be maintained. Such supermajority can only result in the permanence of zero inflation regardless of the shock. In the second case, as the conflict of interests washes away relative to the damage done by keeping the status quo, there obviously is some large enough shock such that type  $w'$  prefers to overturn the status quo and give decisiveness back to  $w^m$ . In this second case, supermajority rules will yield a mix of commitment and flexibility even if one uses the voting procedures of this section. The third case is that created by the quadratic loss formulation. Given types  $w' = w^i$  and  $w^m$ , the conflict of interests is constant in the shock, so depending where one sets the supermajority requirement one gets full commitment or full flexibility. The voting procedure identified in Section 4 will work in any of the three situations, while that used in this section will fail in two of them—the first and the last ones.

## 7 Conclusion

I show that a reason to constitute a committee that will make decisions through voting is that this can mitigate dynamic inconsistencies when flexibility is valuable. In such situations, institution building is meaningful if two factors converge: (i) state-contingent policy plans cannot be written and enforced (but institutions or policymaking procedures can); and (ii) unexpected circumstances may arise, so writing down and enforcing a fix policy prescription is not sensible. The first factor makes credibility valuable, and the second makes ex post flexibility important as well. The conflict of interests present within a group of people with heterogeneous preferences yields a partial commitment device that helps dealing with the

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<sup>16</sup>There may also be non-monotonic effects we can safely abstract from here.

credibility issue without fully renouncing flexibility. Clearly this is something no single individual could do. A key institution of choice is the supermajority voting rule that will be used to decide on policy revisions once the prevailing state of nature is known to the decisionmakers. Supermajorities can be adjusted so as to yield a varying mix of commitment and flexibility, provided *appropriate voting procedures* are in place. What supermajority is best depends on the fundamentals of the policymaking problem. Very volatile environments make flexibility very valuable. This calls for low supermajorities, so as to make policy reoptimization easier. Also more heterogeneous societies will tend to have lower supermajority requirements.

This paper offers a rationale for the existence of committees, and for the use of supermajority rules to decide on certain issues. Note that this paper does not argue that supermajorities will always obtain. If the underlying policymaking problem does not involve dynamic inconsistencies, or if flexibility is not valuable *ex post*, then supermajority voting will be unnecessary. In the first case society would choose to stick with simple majority: the median voter does not have any reasons to renounce decisiveness, so simple majority voting over voting rules would allow him to impose the permanence of simple majority. In the second case society can just write the *ex ante* optimal policy in the constitution, and does not even need to set up a decisionmaking body to observe shocks and choose policy. Thus, the view offered here is consistent with the real life observation that the majority rule applying to most decisions is just simple majority, while supermajorities are used for “special” decisions. In our context, special decisions are those involving time inconsistency.

Note that, indirectly, this gives us a rationale for why supermajorities must be applied to another type of special decisions such as constitutional reforms. If some policy revisions require the use of some supermajority  $s$ , then reforming the constitution of the policy committee must require a supermajority of at least  $s$ . Otherwise, the first supermajority requirement would be a hollow one, as coalitions smaller than  $s$  wanting to get a decision approved could reform the constitution to eliminate the requirement.

The model I use to characterize the monetary policy problem, standard as it is in an important literature, has the disadvantage of being *ad hoc*. However, the main insights of the paper extend to other set ups built from comparatively more fundamental principles, which apply to problems of taxation and patent protection. One advantage of using such a simplified setting is that this yields a transparent characterization of the trade-off between commitment and flexibility. Secondly, we obtain a neat conflict of interests after the realization of the shock. This allowed me, in Section 6, to show simply why seemingly natural voting procedures involving supermajorities may fail at mixing commitment and flexibility. When a supermajority must decide whether to stick with the status quo before the alternative policy has been set, the decisive person must essentially choose whether to give decisiveness back

to the median person or not. Under such voting procedures, the structure of preferences in the model makes a supermajority yield either full rigidity or full flexibility, but never the desired mix. This came initially as a surprise. Other models I explored involved a conflict of interests among voters that, for larger shocks, washed away relative to the damage done by sticking with the status quo. In those models supermajorities are always eventually met and therefore policy revision arises, even if the constitutionalist is not careful when designing voting procedures. The model reported in this paper does not have that feature and prompted me to develop safer voting procedures that will perform well regardless of how the conflict of interests among voters changes with shock levels.

No incentive schemes are considered, which as said before can do better than the voting procedures studied here. Certainly a pending issue for future research is to investigate how far appropriate voting procedures can go in helping a committee completely eliminate the commitment versus flexibility trade-off.

## 8 Appendix

**Proof of Proposition 1.** The first order condition when a type  $w'$  wants to choose the central banker's optimal type  $w$  is (after some rearranging),

$$\frac{dE_u L[w, w']}{dw} = -\frac{2w'[\beta(k-1)\bar{y}]^2}{w^3} + \frac{2\sigma^2\beta^4(w-w')}{(w+\beta^2)^3} = 0. \quad (7)$$

Multiplying by  $w^3(w+\beta^2)^3$ , rearranging, and then dividing by  $w^4$ , this equation can be written as,

$$1 - \frac{a}{w} - \frac{b}{w^2} - \frac{c}{w^3} - \frac{d}{w^4} = 0,$$

where  $a$ ,  $b$ ,  $c$  and  $d$  are positive constants. For  $w$  approaching zero, the LHS goes to minus infinity. For  $w$  approaching infinity, the LHS approaches 1 asymptotically. Since the function is continuous, there must be at least one positive  $w$  for which the LHS is exactly zero. But all the terms in  $w$  in the last equation are (strictly) monotonically decreasing functions, implying that there is just one positive real root  $w^\circ$  that satisfies the equation. This means that the loss function is single peaked in  $w^\circ$ . Also note that for  $w = w'$  the LHS in equation (7) is negative, implying the minimum  $w^\circ$  is to the right of  $w'$ . To check  $w^\circ$  is indeed a minimum note that for slightly lower values of  $w$  the LHS in the previous equations is negative, while for slightly larger ones, it is positive. This implies the loss function is indeed convex around  $w^\circ$ . ■

**Proof of Lemma 1.** Existence and continuous differentiability of the function  $w^\circ(w')$  follows from the conditions for the implicit function theorem being satisfied. The first order

comparative static effect of  $w'$  on  $w^\circ$  is given by  $\frac{dw^\circ}{dw'} = -\frac{\frac{dE_u L[w, w']}{dw dw'}}{\frac{dE_u L[w, w']}{dw dw}} \Big|_{w=w^\circ} > 0$ . The last sign follows from the numerator being negative (as  $\frac{dE_u L[w, w']}{dw dw'} \Big|_{w=w^\circ} = -2\beta^2 \left\{ \frac{[(k-1)\bar{y}]^2}{w^3} + \frac{\sigma^2 \beta^2}{(w+\beta^2)^3} \right\} \Big|_{w=w^\circ} < 0$ ), while the denominator is positive, as it is implied by the convexity of the expected loss function around the minimum  $w^\circ$ . ■

**Proof of Lemma 2.** Given  $(u, \pi^*(w^\circ))$ , the highest inflation that can gather a measure  $s$  of votes against the status quo is that which leaves type  $w^s$  indifferent between the former and the latter. Then,  $\pi^r(u, w^s)$  must satisfy  $L[u, w^s, \pi^r(u, w^s)] = L[u, w^s, 0]$ , which can be written in full as,

$$w^s \pi^{r2} + \{(1-k)\bar{y} + \beta[\pi^r - \pi^* + u]\}^2 = \{(1-k)\bar{y} + \beta[-\pi^* + u]\}^2.$$

After some algebra we can solve for  $\pi^r$ ,

$$\pi^r(u, w^s) = \frac{2\beta\{(k-1)\bar{y} + \beta[\pi^* - u]\}}{w^s + \beta^2},$$

where we see  $\pi^r(u, w^s)$  is monotonically decreasing in  $w^s$ . (This readily implies that  $\pi^r$  is monotonically decreasing in  $s$ —as  $s$  and  $w^s$  are positively related:  $s = F(w^s)$ ). ■

**Proof of Lemma 4.** The type  $w^{s^\circ}$  who is always indifferent between the inflation level  $\pi(u, w^\circ)$  and zero satisfies,

$$L[u, w^{s^\circ}, \pi(w^\circ)] = L[u, w^{s^\circ}, 0],$$

which, obviating the dependence of  $\pi$  on  $u$ , can be written in full as,

$$w^{s^\circ} \pi(w^\circ)^2 + \{(1-k)\bar{y} + \beta[\pi(w^\circ) - \pi^* + u]\}^2 = \{(1-k)\bar{y} + \beta[-\pi^* + u]\}^2.$$

Using (5) and the fact that in a rational expectations equilibrium, if the committee behaves like a type  $w^\circ$  we must have  $\pi^* = \frac{\beta(k-1)\bar{y}}{w^\circ}$ , the above equality becomes,

$$w^{s^\circ} \left\{ \frac{\beta(k-1)\bar{y}}{w^\circ} - \frac{\beta^2 u}{w^\circ + \beta^2} \right\}^2 + \left\{ (1-k)\bar{y} + \frac{w^\circ \beta u}{w^\circ + \beta^2} \right\}^2 = \left\{ (1-k)\bar{y} \frac{w^\circ + \beta^2}{w^\circ} + \beta u \right\}^2,$$

which, after more algebra allows to solve for  $w^{s^\circ}$  yielding the result. ■

**Proof of Proposition 2.** Existence and continuous differentiability of the function  $w^\circ(\sigma)$  follows from the conditions for the implicit function theorem being satisfied. The first order comparative static effect of  $\sigma$  on  $w^\circ$  is given by  $\frac{dw^\circ}{d\sigma} = -\frac{\frac{dE_u L[w, w', \sigma]}{dw d\sigma}}{\frac{dE_u L[w, w', \sigma]}{dw dw}} \Big|_{w=w^\circ} < 0$ . The last sign follows from the numerator being positive (as  $\frac{dE_u L[w, w', \sigma]}{dw d\sigma} \Big|_{w=w^\circ} = \frac{4\sigma\beta^4(w-w')}{(w+\beta^2)^3} \Big|_{w=w^\circ} > 0$ ),

while the denominator is positive, as it is implied by the convexity of the expected loss function around the minimum  $w^\circ$ . ■

**Proof of Proposition 3.** Imagine we apply a median preserving spread to distribution  $F(\cdot)$ , so that we obtain a new—more disperse—distribution  $F^+(\cdot)$ , such that  $F^+(w^m) = \frac{1}{2}$ , and  $F^+(w) < F(w)$  for all  $w > w^m$ . From expression (6) we know that in a society described by  $F(\cdot)$  the supermajority is  $s^\circ = F(w^{s^\circ})$ . Given  $w^{s^\circ} > w^m$ , in a society described by  $F^+(\cdot)$  the supermajority must be  $s^{\circ+} = F^+(w^{s^\circ}) < F(w^{s^\circ}) = s^\circ$ . ■

## References

- Aghion, P., Alesina, A. and F. Trebbi (2002), Endogenous Political Institutions, mimeo Harvard University.
- Alesina, A. and A. Drazen (1991), Why are Stabilizations Delayed?, *American Economic Review* 81(5), 1170-88.
- Atkeson, A. and P. Kehoe (2001), The Advantage of Transparent Instruments of Monetary Policy. Federal Reserve Bank of Minneapolis Staff Report 297.
- Austen-Smith, D. and J. Banks (1996), Information Aggregation, Rationality, and the Condorcet Jury Theorem, *American Political Science Review* 90(1), 34-45.
- Azariadis, C. and V. Galasso (2002), Fiscal Constitutions, *Journal of Economic Theory* 103, 255-81.
- Barbera, S. and M. Jackson (2000), Choosing How to Choose: Self-Stable Majority Rules, mimeo California Institute of Technology.
- Barro, R. and D. Gordon (1983a), Rules, Discretion and Reputation in a Model of Monetary Policy, *Journal of Monetary Economics* 12, 101–121.
- Barro, R. and D. Gordon (1983b), A Positive Theory of Monetary Policy in a Natural Rate Model, *Journal of Political Economy* 91(4), 589-610.
- Black, D. (1948), On the Rationale of Group Decision-making, *Journal of Political Economy* 56(1), 23-34.
- Blinder, A. (1998), Central Banking in Theory and in Practice. MIT Press.
- Calvo, G. (1978), On the Time Consistency of Optimal Policy in a Monetary Economy, *Econometrica* 46(6), 1411-28.

- Fernandez, R. and D. Rodrik (1991), Resistance to Reform: Status Quo Bias in the Presence of Individual Specific Uncertainty, *American Economic Review* 81(5), 1146-55.
- Gradstein, M. (1999), Optimal Taxation and Fiscal Constitution, *Journal of Public Economics* 72, 471-85.
- Grofman, B., Owen, G. and S. Feld (1983), Thirteen Theorems in Search of the Truth, *Theory and Decision* 15, 261-78.
- Kydland, F. and E. Prescott (1977), Rules Rather than Discretion: The Inconsistency of Optimal Plans, *Journal of Political Economy* 85(3), 473-91.
- Lohmann, S. (1992), Optimal Commitment in Monetary Policy: Credibility versus Flexibility, *American Economic Review* 82(1), 273-86.
- Messner, M. and M. Polborn (2002), Voting on Majority Rules, forthcoming *Review of Economic Studies*.
- Rogoff, K. (1985), The Optimal Degree of Commitment to an Intermediate Monetary Target, *Quarterly Journal of Economics* 100(4), 1169-1189.
- Stokey, N. (2002), 'Rules versus Discretion' after Twenty-Five Years, NBER Macro annual.
- Taylor, J. (1981), Stabilization, Accommodation, and Monetary Rules, *American Economic Review Papers and Proceedings* 71(2), 145-149.
- Thompson, E. (1981), Who Should Control the Money Supply?, *American Economic Review Papers and Proceedings* 71(2), 356-361.
- Waller, C. (1992), The Choice of a Conservative Central Banker in a Multisector Economy, *American Economic Review* 82(4), 1006-12.
- Waller, C. (2000), Policy Boards and Policy Smoothing, *Quarterly Journal of Economics* 115(1), 305-39.
- Walsh, C. (1995), Optimal Contracts for Central Bankers, *American Economic Review* 85(1), p. 150-67.
- Young, P. (1988), Condorcet's Theory of Voting, *American Political Science Review* 82(4), 1231-44.