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Too Little, Too Late? Monetary Policymaking Inertia and Psychology: A Behavioral Model

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Too Little, Too Late? Monetary Policymaking Inertia and Psychology: A Behavioral Model

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Abstract

Can the inertia in the monetary policymaking be attributed to psychological drivers? Our model shows two results. First, our baseline model with individual loss aversion explains inertia in a monetary policy committee (MPC) where holds a *de jure* majority rule. Second, our second model shows that introducing a specification of loss aversion for all members in a MPC leads to inertial decisions when status-quo inflation is below the inflation target. Conversely when status-quo inflation is above the target rate, inertial policy does not occur until the level of inflation discounts the loss aversion mechanism. In the framework of a hawk-dove dimension we conclude that loss aversion favors inertial monetary policy.

JEL CLASSIFICATION: D7,E5
KEYWORDS: MONETARY POLICY, BEHAVIORAL ECONOMICS

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1 Introduction

Can the delay in the US monetary policy liftoff be attributed to psychological drivers? In the United States the Great Recession started in December 2007 and ended in June 2009. Yet, only in December 2015 the Board of Governors of the Federal Reserve System (FED) began the process of monetary policy normalization. The episode has been considered as a case of missing liftoff (Orphanides, 2015). In general how to explain inertia in monetary policymaking? On this respect, is the exploration of the monetary decision making a useful tool? Monetary institutions have evolved dramatically over the past 35 years, mainly driven by the recommendations of economic theory and the efforts of policymakers to improve central banking institutions. One major evolution in the governance of central banking that was not advised by research is the widespread establishment of Monetary Policy Committees (MPC henceforth), a process which started in the late 1990s. Research on the subject started to emerge after contributions by Blinder and Morgan(2005) and Blinder(2009) calling for additional work to be done. The issue of MPC is related to various dimensions of monetary policymaking: differences between individual and committee decisions; strategic interactions among members; their potential differences in preferences, private information, goals; potential problems of free riding, and so on.

One aspect that so far was never integrated in MPC decisions is the behavioral economics part: among others, an interesting mechanism that has emerged from this literature is loss aversion, in the form expressed by Ksozegi and Rabin (2006). Their interpretation of loss aversion rests on the fact that utility gains are counted with respect to the status quo, with any (positive or negative) deviation from it being weighted as an additional loss. We propose this loss aversion mechanism be applied to each member of a MPC: each individual member values gains and losses with respect to a status-quo policy that the Central Bank (CB) has previously implemented. Indeed, any deviation from the status quo is an additional loss for the individual Central Banker, weighted according to his/her taste for a conservative stance. The model shows how different preferences over inflation among MPC members lead to inertial monetary policy decisions, when they are coupled with loss aversion with respect to inflation targets. In the model it is assumed MPC fully controls inflation in the short-medium term and the two variables considered are the preference for conservativeness - that reflects for the relative taste for inflation stabilization over low unemployment - and the inflation rate chosen by the MPC. Further the model represents the monetary policy stance differently from the mainstream setup in which a loss function of the single central banker is minimized with respect to the maximum social welfare attainable - see among others Gali (2008) and Rotemberg and Woodford (1998). In our framework the MPC members have different preferences over relative inflation and unemployment defined by the parameter of conservativeness, endogenizing the fact they are choosing on behalf of the citizens, but with their own preferences over inflation.

Our model builds on the work of Alesina and Passarelli (2015) that applies loss aversion to political decisions. The main setup for gains and losses caused by monetary policy is taken from the seminal contribution made by Barro and Gordon (1983), who showed the time inconsistency of a government, using inflation surprise to boost the economy in a rational expectations equilibrium. A key determinant of the equilibrium depends on the way and on the velocity with which the inflation target is updated. Our novel main results are in line with the literature on the need for a conservative monetary policy (Rogoff 1985): a MPC with individual loss aversion[1] leads to inertial movements in all the relative orderings of status-quo inflation and targeted inflation. Specifically, there are two results to underline.

First, our baseline model with individual loss aversion explains inertia in a monetary policy committee (MPC) where holds a *de jure* majority rule (empirical evidence by Riboni and Ruge-Murcia (2010)).

Second, our second model shows that introducing a specification of loss aversion for all members in a MPC leads to inertial decisions when status-quo inflation is below the inflation target. Conversely when status-quo inflation is above the target rate, inertial policy does not occur until the level of inflation discounts the loss aversion mechanism.

Loss aversion was applied in many contexts, but never in a context of professional appointees deciding through an intellectual process, such as when deciding which monetary policy to implement. As humans inside a committee, individual CBs may decide according to this natural paradigm. At the same time in the literature on monetary policy, the likely role of psychological bias has been recently put forward by Orphanides (2015). The paper is organized as follows: after a literature review presented in Section 2, Section 3 discusses the baseline model with loss aversion, Section 4 discusses a second version of the model and Section 5 concludes.

[1]See Santoro et al.(2014) for another application of loss aversion to monetary policy

2 Monetary Policymaking Inertia and the Committees

The analysis of the inertia in the monetary policymaking gradually emerged in the literature focused on the monetary policy committees.

Monetary policy committees (MPCs) are extremely relevant nowadays. Indeed monetary policy is delegated to independent committees in the vast majority of countries: Fry et al (2000), Pollard (2004) and Lybek and Morris (2004) document that a striking majority of states now use committees instead of single central bankers. Two remaining instances of a one-man Central Bank are New Zealand and Israel. The shift from one-man CB to MPCs started mainly in the second half of the 1990s: the UK and Japan were the first countries to implement the change, and the others followed.

Dal Bo (2006) shows that an appropriate voting procedure and a supermajority required to take decisions lead the committee to behave as the conservative central banker defined by Rogoff (1985). In this sense, a supermajority introduces a status-quo bias inside MPCs and mitigates time-inconsistency issues, at the cost of limited flexibility to shocks. Riboni and Ruge-Murcia (2010) is a mixed theoretical-empirical paper that wants to test what voting protocol is most prevalent, given the following taxonomy: Consensus model (supermajority); Agenda setting model (chairman controls the agenda); Dictator model (big chairman power); Simple majority model (median member). While the simple majority model and the dictator model are observationally equivalent to a one-man CB, the consensus model and the agenda-setting model are different and create something like a persistent status-quo policy. In the first two settings the committee adjusts interest rates to the value preferred by the key member, regardless of the initial status quo, while in the latter two regimes there is a gridlock interval -inaction region - where the committee keeps the interest rate unchanged: this delivers results of endogenous autocorrelation and regime switches in interest rates.

The result of the comparison between the four predicted interest rates and the actual ones says that MPC decisions are better described by the consensus setting, confirming two empirical data, i.e. the high autocorrelation of interest rates and the distribution of actual interest rate changes with a mode of zero.

Riboni (2010) goes along to think about a committee as a technology for commitment on a similar theme of Dal Bo (2006). The theoretical paper presents a voting game with endogenous default policy - status-quo policy - in which a MPC's vote defines current policy in every period, given assumed ex-ante preferred policies. A chairman presents proposals on which a vote is cast on whether accept the new proposal or maintain the status-quo, deciding by a majority vote. The basic intuition is that a deviation from the status-quo might change the majority setting in which the agenda setter is decisive. In this context if we start from a policy preferred by the agenda-setter and also the ex-ante optimal policy for the entire economy -Ramsey policy - the incentive to change drops because the agenda-setter anticipates that future policy could be supported by majority different from that of the agenda-setter itself.

3 Monetary policy with loss aversion

3.1 A simple model of choice

This model builds on a work of Alesina and Passarelli (2015) that apply loss aversion to political decisions. Consider a monetary policy committee (MPC from now on) with a continuum of voters, heterogeneous in the parameter t, which is *degree of conservativeness*. High values of t means that the individual banker prefers low inflation, while low values of t means that he prefers high inflation. We define this parameter as a single measure to define a banker in a *hawk-dove dimension*: an hawk has high t, while a dove has low t. We are going to consider the parameter as a relative preference for low inflation over low unemployment, as Ejffinger et al (2015).
Let *F(t)* be the distribution of t, which is common knowledge. The MPC has to choose a unidimensional policy $\pi \in \Re^+$. For simplicity we are assuming that it is unfeasible for the MPC to choose a negative degree of inflation; moreover, we are assuming that the MPC implements its decision efficiently in the short run.

Any policy entails benefits and costs, which can be different across individual members. Let $V(t_i, \pi)$ be the indirect utility function of individual member i :

$$V(t_i, \pi) = B(t_i, \pi) - C(t_i, \pi)$$

where $B(t_i, \pi)$ and $C(t_i, \pi)$ are indirect benefit and cost function for individual member i, respectively. In order to ensure the existence of a unique majority voting equilibrium, we also assume that, for any π and any t_i :

(i) Benefits are increasing and concave in the policy:

$$\frac{\partial B(t_i, \pi)}{\partial \pi} > 0,\ \frac{\partial^2 B(t_i, \pi)}{\partial \pi^2} < 0$$

(ii) Costs are increasing and convex in the policy:

$$\frac{\partial C(t_i,\pi)}{\partial \pi} > 0,\ \frac{\partial^2 C(t_i,\pi)}{\partial \pi^2} \geq 0$$

(iii) Types are indexed such that higher types bear higher marginal costs and/or enjoy lower marginal benefits from the policy:

$$\frac{\partial B_\pi(t_i,\pi)}{\partial \pi} \leq 0,\ \frac{\partial C_\pi(t_i,\pi)}{\partial \pi} \geq 0$$

(iv) The equilibrium is interior:

$$\frac{\partial B(t_i,0)}{\partial \pi} > \frac{\partial C(t_i,0)}{\partial \pi}$$

Thus, for all types, $V(t_i,\pi)$ is concave in π and, for any t_i, there is a unique policy which maximizes indirect utility $V(t_i,\pi)$, call it π_i, which solves[2] :

$$B_\pi(t_i,\pi) = C_\pi(t_i,\pi)$$

By *iii*, we have that:

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

This implies that higher types vote for lower inflation. Then, under majority rule, the policy outcome is the median type's bliss point (π_m).

3.2 Rationale for the MPC setting

The outlined model is rather new for monetary policy literature: first of all, the classic assumption for monetary policy is that an individual, the Central Banker, minimizes a loss function depending on the deviation of inflation and output from specific targets (inflation target and potential output, respectively); second, the central banker is assumed to be *more conservative* than the society.[3]

Here the perspective is rather different. According to major changes in Central Banks from late 1990's, Monetary Policy Committees (MPCs) are the new normal in formulating and managing monetary policy.
The underlined assumptions,as of now, are :

[2]By *i* and *ii* the SOC are satisfied.

[3]See for example Rogoff (1985); moreover see Alesina and Grilli (1991) for an application of the principle to the ECB.

F.1) Each member of the MPC (also called *voter*) decides about monetary policy weighting Benefits and Costs for the whole society, but with his subjective preferences.

F.2) The members of the MPC decides monetary policy choosing an inflation rate: the model does not focus on which instruments are used to actually get to the result, but take as granted that the MPC can implement efficiently in the short run what it decides.

F.3) The model, set in this way, is a static model: the MPC decides the inflation not counting inflation expectations in any way and without any degree of smoothing of policy change.

3.3 Choice with Loss Aversion

With loss aversion, losses loom larger than gains, and both are evaluated relative to the status-quo. Let $\lambda > 0$ be the parameter which captures loss aversion, and let π^s be the status-quo policy. *Increasing* the policy (i.e., $\pi > \pi^s$) entails more benefits and larger costs (for example, less burden of debt for debtors and higher prices, respectively). However, higher costs yield a psychological experience of loss, which amounts to

$$\lambda[C(t_i, \pi) - C(t_i, \pi^s)]$$

Viceversa, *reducing* the policy (i.e., $\pi < \pi^s$) entails lower costs and lower benefits, but also a psychological loss, which amounts to

$$\lambda[B(t_i, \pi^s) - B(t_i, \pi)]$$

. Thus, experienced indirect utility with loss aversion, call it $V(t_i, \pi|\pi^s)$ is given by the material utility of the policy, $V(t_i, \pi)$, minus the psychological loss due to the possible departures from the status quo[4]

$$V(t_i, \pi|\pi^s) = \begin{cases} V(t_i, \pi) - \lambda[C(t_i, \pi) - C(t_i, \pi^s)] \text{ if } \pi \geq \pi^s \\ V(t_i, \pi) - \lambda[B(t_i, \pi^s) - B(t_i, \pi)] \text{ if } \pi < \pi^s \end{cases}$$

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

[4]This formulation is consistent with the more general notion of reference dependent utility given by Koszegi and Rabin (2006), where their "‘gain-loss utility"’ is given, in this case, by $-\lambda[C(t_i, \pi) - C(t_i, \pi^s)]$ if $\pi \geq \pi^s$ and $\lambda[B(t_i, \pi) - B(t_i, \pi^s)]$ if $\pi < \pi^s$.We do not assume any change in the concavity of $V(t_i, \pi|\pi^s)$. Thus, we focus on loss aversion, and we do not consider diminishing sensitivity.

1. $B_\pi(t_i, \pi) - (1+\lambda)C_\pi(t_i, \pi) = 0 \text{ if } \pi \geq \pi^s$,

2. $(1+\lambda)B_\pi(t_i, \pi) - C_\pi(t_i, \pi) = 0 \text{ if } \pi < \pi^s$

It is easy to see that voter i sets her desired policy, π_i, according to the following rule:

$$\pi_i \text{ solves} \begin{cases} B_\pi(t_i, \pi) - (1+\lambda)C_\pi(t_i, \pi) = 0 \text{ if } t_i < \check{t} \\ \pi = \pi^s \text{ if } \hat{t} < t_i < \check{t} \\ (1+\lambda)B_\pi(t_i, \pi) - C_\pi(t_i, \pi) = 0 \text{ if } t_i > \hat{t} \end{cases} \tag{2}$$

where $\check{t}$ is implicitly determined by $B_\pi(t_i, \pi^s) - (1+\lambda)C_\pi(t_i, \pi^s) = 0$ and $\hat{t}$ is implicitly determined by $(1+\lambda)B_\pi(t_i, \pi^s) - C_\pi(t_i, \pi^s) = 0$. Observe that $\check{t} < \hat{t}$ and both $\check{t}$ and $\hat{t}$ depend on the status-quo policy.

3.4 Status-quo bias

By (2), a voter'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. The following propositions holds:

Proposition 1 (Status-quo bias) *(i) All intermediate types such that $\hat{t} < t_i < \check{t}$ want to keep the status-quo policy;*

(ii) All high types, with $t_i > \hat{t}$ want to decrease the current amount of π;

(iii) All low types, with $t_i < \check{t}$ want to increase the current amount of π.

Proposition 2 (Equilibrium) *(i) If $t_m \in [\check{t}, \hat{t}]$, then the policy is the status-quo;*

(ii) $t_m < \check{t}$, then the policy outcome is $\pi_m > \pi^s$

(iii) $t_m > \hat{t}$, then the policy outcome is $\pi_m < \pi^s$.

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.

Proposition 3 (Entrenchement) *When a MPC decides to depart from the status-quo, it ends up chooosing a policy that (positively) depends on the status-quo.*

3.5 Policy changes with loss aversion

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. Intuitively, for a small shock θ that affects the distribution of t preferences, the policy does not change. In order to change the status-quo, the shock has to be sufficiently large.

Empirically,the presence of status-quo inflation can help to reconcile with the evidence presented by Riboni and Ruge-Murcia(2010, QJE). Indeed, the consensus model seems to be the *de facto* voting system among five important central banks, causing a certain degree of status-quo bias, that can be reconciled with a way of searching for time consistency of monetary policy. Tough, it is worth noting that the *de jure* voting procedure of 4 over 5 central banks is *simple majority.* That is, 4 over 5 major central banks seem to show a significant amount of stickyness in changing interest rates, not explained by their institutional rules. This data can be reconciled with this model of monetary policy committee with individual loss aversion.

3.6 Rationale for this model of loss aversion in MPC

The outlined model uses a well known psychological mechanism and applies it to MPC voters in an institutional settings.
It is useful to underline that there are no easy made references for a possible application of loss aversion to context in which there are institutional roles (such as a central banker, that is part of a defined bureaucracy with its roles and rules). Further research can fill this gap, but as of now, we dind't find anything on the issue.
A possibly important link to this mechanism comes from the vast literature on the institutional settings of central banks. Indeed, the economics and political economy of central banks taught us that building up independent and conservative central banks is a way to curb inflation and induce much more attention by the public for the decisions of central banks. Loss aversion can be a way to represent this concept: going away in one direction or the opposite from the defined status-quo causes a loss in the single MPC voter, because creates credibility problems that undermines future policies.
Now, it's important to recall the point that in this model, the preferences over inflation and conservativeness of single MPC voters are expressed by the functional forms of $B(t_i, \pi)$ and $C(t_i, \pi)$. Moreover, in this model so

far there is no role for inflation expectations, a key part of any model of monetary policy. We are going to enrich the model in a way to count for them. The underlined assumptions,as of now, are :

F.4) The status-quo inflation coincides with the target rate of inflation defined by the MPC

F.5) The MPC decides only at the start of the period of time, without any role for inflation expectations.

F.6) The psychological loss can be interpreted as a loss that the individual MPC members suffer because he knows the potential costs of being far from the target.Indeed, it can be motivated by problems of efficacy:a credibility problem undermines future capacity to reach the goals of MPC.

4 A concrete application of the model

Let the utility function of the single banker be *quasi-linear* in t_i and concave and increasing in π such that:

$$u(t_i, \pi) = t_i + H(\pi) \text{ where } H' > 0, H'' < 0 \tag{3}$$

Let us denote by $\bar{\mathrm{t}}$ the average conservativeness. Indirect utility of voter i is defined by:

$$V(t_i, \pi) = t_i + H(\pi) - \frac{t_i \pi^2}{2\bar{t}} \tag{4}$$

Note that the Alesina-Passarelli original model have not quadratic cost in indirect utility: we choose to introduce it because it has better adherence to inflation costs.

$$V(t_i, \pi) = t_i + 2\pi^{0.5} - \frac{t_i \pi^2}{2\bar{t}} \tag{5}$$

In this context, the most preferred level of π is:

$$V_\pi(t_i, \pi) = 0$$

gives

$$\pi_i^{**} = (\frac{\bar{t}}{t_i})^{2/3} \tag{6}$$

For a banker with low level of conservativeness (i.e. low t_i), $\frac{\bar{t}}{t_i} > 1$ and $\pi_i > 1$; instead for a banker with high level of conservativeness (i.e. high

t_i), $\frac{\bar{t}}{t_i}$) < 1 and $\pi_i < 1$. Thus, there is a coherence in the choice done by different policymakers.

To be underlined, this specific indirect utility function is a bit problematic for being quasi-linear in t_i: to justify it, we assume that being *hawk* (i.e. having high t) is associated with better future job opportunity in finance.

Let π^s be the status-quo inflation. Under loss aversion, indirect utility is:

$$V(t_i,\pi|\pi^s) = \begin{cases} V(t_i,\pi) - \lambda\frac{t_i}{2\bar{t}}[\pi^2 - (\pi^s)^2] \text{ if } \pi \geq \pi^s \\ V(t_i,\pi) - \lambda[H(t_i,\pi^s) - H(t_i,\pi)] \text{ if } \pi < \pi^s \end{cases} \tag{7}$$

$$V(t_i,\pi|\pi^s) = \begin{cases} V(t_i,\pi) - \lambda\frac{t_i}{2\bar{t}}[\pi^2 - (\pi^s)^2] \text{ if } \pi \geq \pi^s \\ V(t_i,\pi) - \lambda[2(\pi^s)^{0.5} - 2\pi^{0.5}] \text{ if } \pi < \pi^s \end{cases} \tag{8}$$

To find t, let's solve $V_\pi(t_i,\pi) - \frac{\partial}{\partial\pi}[\lambda\frac{t_i}{2\bar{t}}(\pi^2 - (\pi^s)^2] = 0$ to find

$$\check{t} = \frac{\bar{t}}{(1+\lambda)\pi^{3/2}} \tag{9}$$

To find $\hat{\text{t}}$, let's solve $V_\pi(t_i,\pi) - \frac{\partial}{\partial\pi}\lambda[2(\pi^s)^{0.5} - 2\pi^{0.5}] = 0$ to find

$$\hat{t} = \frac{(1+\lambda)\bar{t}}{\pi^{3/2}} \tag{10}$$

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

$$\pi_i \text{ solves} \begin{cases} (\frac{t_i(1+\lambda)}{\bar{t}})^{2/3} \text{ if } t_i < \check{t} \\ \pi = \pi^s \text{ if } \hat{t} < t_i < \check{t} \\ (\frac{t_i}{(1+\lambda)\bar{t}})^{2/3} \text{ if } t_i > \hat{t} \end{cases} \tag{11}$$

5 MPC with target inflation and status-quo inflation

In this part we consider the introduction of inflation expectations in this simple framework. Indeed several model of monetary policy counted for the benefit that a monetary policy expansion can cause in terms of surprise inflation. [5]

The basic idea is that: $B(t_i,\pi,\pi^E)$.For simplicity, we return to linear costs instead of quadratic ones. Our simple setup is:
$B(t_i,\pi,\pi^E) = t_i + H(\pi - \pi^E)$

[5] See for example Barro and Gordon (1983).

5.1 MPC decision under inflation targets and loss aversion

Let the utility function of the single banker be *quasi-linear* in t_i and concave and increasing in π such that:

$$u(t_i, \pi, \pi^E) = t_i + H(\pi - \pi^E) = t_i + 2(\pi - \pi^E)^{0.5} \tag{12}$$

π^E defines the target rate of inflation and it is equal to inflation expectations. It is important to underline that gain from inflation surprise holds only when $\pi > \pi^E$.

$$C(t_i, \pi) = \frac{t_i}{\bar{t}}\pi \tag{13}$$

Let us denote by $\bar{\mathrm{t}}$ the average conservativeness. Indirect utility of voter i without loss aversion is defined by:

$$V^1(t_i, \pi, \pi^E) = \begin{cases} t_i + 2(\pi - \pi^E)^{0.5} - \frac{t_i \pi}{\bar{t}} \text{ if } \pi > \pi^E \\ t_i + 2\pi^{0.5} - \frac{t_i \pi}{\bar{t}} \text{ if } \pi \leq \pi^E \end{cases} \tag{14}$$

In this context, the most preferred level of π is:

$$V^1_\pi(t_i, \pi, \pi^E) = 0 \tag{15}$$

$$\pi^* = \begin{cases} \pi^E + (\frac{\bar{t}}{t_i})^2 \text{ if } \pi > \pi^E \\ (\frac{\bar{t}}{t_i})^2 \text{ if } \pi \leq \pi^E \end{cases} \tag{16}$$

The equilibrium with loss aversion depends also on the relative position of π^E and π^s.
Under loss aversion and $\pi^E > \pi^s$, the model has the same equilibrium as in Part 2, expressed by equations (7)...(11). Under loss aversion and $\pi^E = \pi^s$, the equilibrium is π^s.

Under loss aversion and $\pi^E \leq \pi^s$, the design is:

$$V(t_i, \pi, \pi^E|\pi^s) = \begin{cases} V(t_i, \pi, \pi^E) - \lambda \frac{t_i}{\bar{t}}[\pi - \pi^s] \text{ if } \pi \geq \pi^s \\ V(t_i, \pi, \pi^E) - \lambda[H(t_i, \pi^s) - H(t_i, \pi)] \text{ if } \pi < \pi^s \end{cases} \tag{17}$$

$$V(t_i, \pi, \pi^E|\pi^s) = \begin{cases} V(t_i, \pi, \pi^E) - \lambda \frac{t_i}{\bar{t}}[\pi - \pi^s] \text{ if } \pi \geq \pi^s \\ V(t_i, \pi, \pi^E) - \lambda[2(\pi^s)^{0.5} - 2\pi^{0.5}] \text{ if } \pi < \pi^s \end{cases} \tag{18}$$

The results are: To find t, let's solve $V_\pi(t_i, \pi, \pi^E) - \lambda \frac{\partial}{\partial \pi} \frac{t_i}{t} [\pi - \pi^s] = 0$ to find

$$\check{t} = \frac{\bar{t}}{(1+\lambda)} \frac{1}{(\pi - \pi^E)}^{0.5} \tag{19}$$

To find $\hat{t}$, let's solve $V_\pi(t_i, \pi, \pi^E) - \lambda \frac{\partial}{\partial \pi} [2(\pi^s)^{0.5} - 2\pi^{0.5}] = 0$ to find that $\hat{t}$ does not exist. Voter i sets her desired policy, π_i, according to the following rule:

$$\pi_i^{***} \text{ solves} \begin{cases} \pi^E + (\frac{\bar{t}}{t_i})^2 \frac{1}{(1+\lambda)^2} \text{ if } t_i < \check{t} \\ \pi^E \frac{\lambda^2}{1+\lambda^2} \text{ if } t_i > \check{t} \end{cases} \tag{20}$$

$\frac{\lambda^2}{1+\lambda^2}$ is lower than 1.

The result is different from the Alesina-Passarelli framework. Indeed, there are two generic cases holding exogenous the target rate of inflation and the status-quo rate of inflation. The first case is when the status-quo rate is below the target rate of inflation: the MPC's choice follow the usual Alesina-Passarelli patterns, thus it is possible that changes in members' preferences do not change the chosen inflation rate, that stays below the target rate.

The second case is when the status-quo rate is above the target rate of inflation: in this case, the usual A-P pattern is not present, since MPC's choices shift smoothly in presence of t's shifts. Starting from above the target rate of inflation, as long as conservativeness grows, inflation shrinks toward the target rate of inflation, that is an equilibrium. Further upward shifts of t move the inflation toward the fixed value of $\pi^E \frac{\lambda^2}{1+\lambda^2}$.

6 Conclusion

Our baseline model shows that individual loss aversion causes inertia in a MPC where holds a *de jure* majority rule.
Our second model shows that by introducing a specification of loss aversion for all members in a monetary policy committee leads to inertial decisions when status-quo inflation is below the inflation target. Conversely when status-quo inflation is above the target rate, inertial policy does not occur until the level of inflation discounts the loss aversion mechanism. In the framework of a hawk-dove dimension we conclude that loss aversion favors inertial monetary policy.
It is useful to compare our contribution with the existing literature, underlining the main differences. First of all our model builds crucially on the

assumption that there are differences in various aspects among the members of a monetary policy committee. Our assumption is consistent with the results of several studies that find evidence of heterogeneity across a number of dimensions in the cases of USAs FOMC, Britains MPC, Swedens Riksbank and the MPCs of East European countries. [6] Specifically heterogeneity emerges on preferences over inflation stabilization relative to output gap stabilization, i.e. the so called hawk-dove dimension. The parameter that we used to denote conservativeness is a synthetic indicator that can be associated with the hawk-dove dimension: a more conservative MPC member is associated with a hawk position, while a less conservative one is associated with a dove position. In this admittedly rough distinction the inner factors behind this choice are left without explanation.

Second, we decided not to insert any external/internal status variables, both to keep the model simple and because there is still no agreement on whether this difference matters for monetary policy decisions and for the heterogeneity of committee members.[7]

Third, we do not consider the potential special role of staff involvement, that can have an impact through the chairman interplays and direction of the MPC's works. However it is useful to point out that so far the contributions on the issue are not definitive and consistent.

Fourth, another issue we do not consider is the group polarization hypothesis inside committees (from psychology, see Sibert (2006)): inside MPCs we assume the presence of common information, frank and open exchange of views and data and the absence of extreme time pressure.

Finally our explanation of the monetary policymaking inertia is different from the existing ones in the literature so far. Dal Bo (2006) focuses on supermajority voting; Riboni and Ruge-Murcia (2010) certify that the results of monetary policymaking seems to follow a consensus model of voting; Riboni (2010) applies the same concept, and caution over future equilibria in which members have different preferences, because this would make a MPC inertial.

Focusing on voting rules and procedures, supermajority voting is a way to obtain time consistency in monetary policy; moreover, time consistency with some flexibility can be achieved by MPCs in case of half-and-half doves and hawks, and in the case of a medium level variance of shocks. Empirically, the consensus model seems to be the de facto voting system in five impor-

[6]For references, among others see Eijffinger et al (2013,2013,2015) and Besley et al (2008).

[7]See for example different opinions among Bhattacharjee and Holly(2006) and Besley et all(2008).

tant central banks, causing a certain degree of status-quo bias, which can be reconciled with a way of searching for time consistency in monetary policy. However it is worth noting that the de jure voting procedure of 4 out of 5 central banks is simple majority. Our model of loss aversion gives a possible explanation: simple majority voting procedures lead to inertial policy through the loss aversion mechanism of individual members, when status-quo inflation is below targeted inflation.
Riboni and Ruge-Murcia (2008) present a framework with MPC members having differing institutional roles, while in our contribution there is no special role for agenda-setters with respect to the voting process; the main similarities are the presence of heterogeneous preferences - although there it is state-dependent - and status-quo policy -although it is obtained via institutional voting rules. Riboni (2010)'s model has several differences. Firstly, the voting process is related to a particular voting technique - with a preferential role for the agenda setter - and he assumes that if the majority does not change, the policy is maintained causing a status quo. Secondly, there is no role for loss aversion: here status-quo policy is determined by MPC voting rules and dynamic thinking over power gains/losses by the agenda setter.

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