A committee-based theory of interest rate smoothing

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Abstract

JEL Classification : E58

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1 Introduction

As the literature has noted, it is quite common for central banks to answer gradually to economic shocks. That is, they move their interest rates through small steps, going towards the same direction over a certain period of time . Hence, the rate tends to move in sequences of small steps in the same direction and direction reversals are relatively infrequent. This interest rate "smoothing", as this behaviour is now labelled, leads to strong persistence in interest rates time-series. Among other recent studies, Orphanides and Wieland (1998) showed the degree of resilience to lie in the 0.8 - 0.9 range for the Federal Reserve Board, while Levieuge (2002) exhibits the upper value as a feature for seven central banks (including the Fed).

This behaviour can only strike the academic observers, whose models generally show that policy responses to shocks should be quickly engineered and characterized by somewhat wide fluctuations of the monetary instrument.

This puzzle leaves a room for an explanation : why would central banks like to smooth interest rates ? Most of the contenders in the field have simply accounted for the empirical regularities by postulating a smoothing term in the central bank's loss function, in addition to the (generally recognized) price and output stability objectives. We share Srour 's (2001) appreciation that this convenient way to "reconcile" the theory with facts is not satisfactorily founded. And though several researchers have investigated the issue and devoted some efforts to ground it into solid foundations, we still believe that the puzzle cannot be told as having been satisfactorily resolved.

Detailed descriptions of the attempts to reconcile the theory and practice of monetary policy can be found in Srour (2001) and Sack and Wieland (2000). We just list them here for convenience and to show how our own proposal differs from the existing literature.

A first rationalisation relies on the uncertainties surrounding the policy-maker when he (she) has to take an interest rate decision (whether the decision is to move the rate downward, upward or to keep it constant). Among the numerous uncertainties, one can pick up the potentially conflicting pieces of information about the state of the economy, or about the effects of monetary actions. In such contexts, one can understand the cautious way with which central banks act.

This explanation resounds of Brainard's (1967) type of policy advice to policy-makers confronted with parameters uncertainty. With all their intuitive features, models controlling for uncertainty are nevertheless not, to our knowledge, able to account for the inertia the data shows.

Another attempt to give rational roots to interest rate inertia extends the scope of the central bank's actions to financial markets. If the bank has a view on financial stability, then it could avoid large swings in interest rates because they would have destabilizing repercussions on assets valuations and thus on financial markets.

Though recent behaviour of some central banks on the fall of the 'New Economy' bubble may give some grounds to this rationalization, Cogley (1999) shows that an action deliberately aimed at deflating asset bubbles could do more harm than good.

The third kind of attempt relies on private expectations. It states that, if agents are forward looking, then the central bank may fear to destabilize their expectations and thus would stick to a certain path of interest rate variations unless circumstances are crystal clear enough for agents to revise their expectations without being destabilized.

This explanation, as Srour (2001) puts it kindly, "has so far met with mixed results, and needs further study". We would be even more critical, as this explanation relies on transparency and communication in monetary policy, which is not a common feature in institutions well known for their taste for secrecy (e.g. think of Messrs Greenspan or Duisenberg voluntarily fuzzy speeches). More over, this explanation both needs forward-looking agents, but with a limited set of information and with a reluctance to change their plans, which in the end seems a little bit contradictory.

With all their intrinsic interest, we believe that these (potentially complementary) explanations are unable to explain interest rate smoothing in a satisfactory way. And notably because they all try to justify the reaction of the central bank as rational, i.e. they try to show that their may be "optimal monetary policy inertia", to quote Woodford's (1999) title.

To be clear, we do not pretend that inertia may not be optimal, but we believe that a positive view of monetary policymaking could usefully complement the normative results of the existing literature. The intuition of the paper is that such a positive view has to start from the inside of monetary policy committees.

If it had not already been used for a much more debated issue, "Inside the Monetary Policy Committee with a gun and a camera" would have been a good title of the paper we envisage, as it describes quite well the exercise we aim at. In our view, (at least part of) monetary policy inertia is borne in the cenacle of monetary policymakers : as in the real world of central banking, policy decisions are mainly taken by Committees (as is the case for the ECB, or for the Federal Reserve), this means that interest rate decisions are the issue of a vote (be it explicit or not). This implies that several options have been presented to / discussed by the

Committee members.

On the theoretical side, though the literature is mainly based on the assumption of monetary policy being decided (and implemented) by a single policymaker, the composite nature of Monetary Policy Committees and their consequences on the definition of monetary policy have been explored in a few papers, of which : von Hagen and Süppel (1994) and in Farvaque and Lagadec (2001). But these papers are either normative or do not address the smoothing puzzle.

Nevertheless, these papers take for granted the now empirically well documented fact that "central banks are no unified actors", as von Hagen (1999, p.682) puts it, identifying up to three opposite groups inside the Bundesbank Board, each with different monetary policy objectives. Also important for our objective, Chappell and McGregor (2000) estimate individual policy reaction functions for the Federal Open Market Committee of the Federal Reserve. They show that important differences among individuals do exist, which "suggest that the individual composition of the committee should not be ignored" (p.920). Due to the short history of the institution, such evidence is hard to bring together for the ECB. However, it is striking that, in interviews, ECB Board's members acknowledge the existence of the problem, though trying to dismiss its importance. Hence, one is left to infer the existence of expressed divergences through newspapers accounts of ECB meetings, and their recurrent statement about time-consuming consensus building.

Hence, we think that it can not be dismissed slightly that the plural dimension of Monetary Policy Committees may give rise to a kind of bargaining between their members. Depending on the composition of a Committee, we can think of the central bankers as representative of different productive sectors, of different regions - each with a given specialization, case of the Federal Reserve -, or of different nations - with potentially divergent business cycles, as in the European Monetary Union. With agents representing different, and thus potentially divergent interests, Committee meetings have great chance to look like a bargaining place, which is the hypothesis we will follow in the paper.

In his study of the bank of England, Cobham (2003)[1] defines smoothing :

> "refers to the tendency for monetary authorities to adjust official interest rates mainly in sequences of small steps in the same direction : that is, they adjust gradually, and with relatively few reversals of direction."

[1] Cobham D., 2003, "Why does the Monetary Policy Committee smooth interest rates ?", Oxford Economic Papers, vol. 55, n°3, 467-493

He then proposes to measure smoothing as the ratio of continuations to reversals, stepping being measured by the average size of interest rate changes

For the Fed, Sack and Wieland (2000) indicate that "from 1984 through 1998, changes in the funds rate are frequently followed by further changes of the same sign. Indeed, in this sample 85 percent of funds rate changes represent "continuations" in the direction of policy. Furthermore, such continuations often occur in fairly rapid succession, with an average of 34 days separating changes when there is a continuation compared to an average of 97 days for a reversal, suggesting that these changes constitute steps within a single policy movement. The magnitude of these steps is modest, typically a quarter of a percentage point, as only 13 percent of funds rate changes in this sample have been by half a percentage point or larger. Similar patterns are observed in official interest rates in many other countries."

Hence, official interest rates tend to move in sequences of small steps in the same direction and direction reversals are relatively infrequent. This interest rate "smoothing", as this behaviour is now labelled, leads to strong persistence in interest rates time-series.

For us, these features imply : i) a status quo bias ; ii) inertia ; iii) an average change inferior to the optimal change and iv) a high ratio of continuations to direction changes.

Differently said, these mean :

$$E\left(\Delta i\right)^{effective} < E\left(\Delta i\right)^{optimal}$$
$$V\left(\Delta i\right)^{effective} < V\left(\Delta i\right)^{optimal}$$

2 A simple closed economy macro model

2.1 The economy

Demand :

$$y_{i,t}^{d} = -\alpha\left(\Delta i_t - \pi_{i,t}\right) + \gamma_{i,t} + \varepsilon_t$$

γ and ε designing, respectively, the local and the federal demand shock.

Supply :

$$y_{i,t}^{s} = \beta\left(\pi_{i,t} - \pi_t^e\right) + \eta_{i,t} + \epsilon_t$$

with η and ϵ representing the local and federal supply shock, respectively.

Hence, we get :

$$\pi_{i,t} = \frac{1}{\beta-\alpha}\left(-\alpha\Delta i_t + \beta\pi_t^e + \gamma_{i,t} - \eta_{i,t} + \varepsilon_t - \epsilon_t\right)$$
$$y_{i,t}^s = \frac{\beta}{\beta-\alpha}\left(-\alpha\Delta i_t + \gamma_{i,t} - \eta_{i,t} + \varepsilon_t - \epsilon_t) + \frac{\alpha\beta}{\beta-\alpha}\pi_t^e\right) + \eta_{i,t} + \epsilon_t$$

One has to impose $\alpha < \beta$ to rule out weird behaviour of inflation relatively to its determinants.

Hence, the n local economies we consider differentiate from each other only due to the contemporaneous asymmetric shocks they are confronted with. The shocks are all normally distributed : $j\tilde{\ } N(0;\sigma_j^2)$. We consider the economy to be sufficiently large for asymmetric shocks to offset each other at every period :

$$\sum_{i=1}^{n}\mu_i\gamma_{i,t} = 0 \text{ and } \sum_{i=1}^{n}\mu_i\eta_{i,t} = 0$$

where μ_i is the weight of the i economy, compared to the whole zone.

The federal economy has the same structure as the local ones, hence the aggregation process delivers the following function :

$$\pi_t^f = \frac{1}{\beta-\alpha}\left(-\alpha\Delta i_t + \beta\pi_t^e + \varepsilon_t - \epsilon_t\right)$$

The only (part of the) shocks remaining at the federal level is the common shock.

2.2 The monetary policymakers

We now have to specify the policymakers' loss functions. We suppose monetary policy to be decided by a federal-located college, composed by state representatives (the Governors). We also suppose that, being in charge of the union's monetary policy, these people partly include federal objectives in their functions. Thus, each state representative (Governor) has the following loss function :

$$G_{i,t} = \frac{1}{2}\left(\pi_{i,t} - \pi^*\right)^2 + \frac{\lambda}{2}\left(y_{i,t} - y^*\right)^2$$

We have supposed that the desired inflation and output rates (π^* and y^*) are identical. Hence, even though we do not impose a common pre-specified federal objective, we consider economies with similar preferences structure. As in Drazen (2000), we define y^* as the difference between the desired and the natural output growth rate. In our context, this simply means that each governor / economy may have a different natural output growth rate, though all the governors (members of the board) want to minimize the gap between the actual and their optimal growth rate. To simplify, we assume the same structure for the monetary delegates (identical λ). Finally, the assumption made about similar inflation objectives throughout the union does not seem unrealistic, at least in the European context, where inflation rates convergence is a pre-condition to monetary unification. As such, we can normalize: $\pi^* = y^* = 0$.[2]

The federal loss function is the simple weighted sum of the national loss functions.

In each case, the following have to be computed and compared :

$$V(\Delta i); V(\pi); V(y)$$

2.3 The optimal interest rate

For each local Governor, the preferred policy is obtained minimizing his loss function over i. The optimal interest rate from the point of view of country i's representative reads:

$$\Delta i^*_{i,t} = -\left(\Lambda + \frac{1}{n}\right)(\eta_{i,t} + \varepsilon_t) + \frac{1}{\alpha}(\gamma_{i,t} - \epsilon_t)$$

where : $\quad \Lambda \equiv \frac{\beta\lambda^2(\beta-\alpha)}{\alpha(1+\beta^2\lambda^2)}$

One sees that representative i's favourite interest rate is subject to two types of shocks. Namely, $\eta_{i,t}$ and $\gamma_{i,t}$ are idiosyncratic, whereas ϵ_t and ε_t affect the whole union. It will therefore be more convenient to consider that $\Delta i^*_{i,t}$ is the sum of a country-specific shock, Vi, t, and of a union-wide shock, Ut, such that:

$$\Delta i^*_{i,t} = U_t + V_{i,t} \tag{1}$$

where $U \equiv -\left(\Lambda + \frac{1}{n}\right)\varepsilon_t - \frac{1}{\alpha}\epsilon_t$and $V_t \equiv -\left(\Lambda + \frac{1}{n}\right)\eta_{i,t} + \frac{1}{\alpha}\gamma_{i,t}$..

This notation does not prevent the two composite shocks from having well-defined expected values and variances. They are indeed both normally distributed with a zero mean and variances: $\sigma^2_U = \left(\Lambda + \frac{1}{n}\right)^2\sigma^2_\varepsilon + \frac{1}{\alpha}\sigma^2_\epsilon$and $\sigma^2_V = \left(\Lambda + \frac{1}{n}\right)^2\sigma^2_\eta + \frac{1}{\alpha}\sigma^2_\gamma$respectively.

The expression of $\Delta i^*_{i,t}$ above defines the interest rate that seems optimal to country i's governor. This is the interest rate that he or she would choose to implement if his or her monetary policy was independent. However, in a monetary union this is not necessary the interest

[2]Note that, as we are interested in computing the variances of our results, this simplification about deterministic components is inocuous in our results, while simplifying the algebra.

rate that will be set. On the contrary a single interest rate must be chosen for the whole zone. Compromises have therefore to be made and their result will depend on the monetary committee's decision mechanism. The next sections precisely investigate the implications of a variety of decision mechanisms.

3 A hegemon

The simplest decision mechanism is to cede to one of the governors the right to set the interest rate for the whole zone. This corresponds to what Eichengreen (1995) refers to as a hegemon. A recent historic example that is particularly relevant for the European Union is the way the European Monetary System used to be managed before the adoption of the euro. In that system of fixed parities, all countries adapted their interest rates to defend the parity of their national currencies with the German mark. The German central bank on the other hand had almost full freedom to set the interest rate that best suited its domestic economy. Although that way of managing the EMS was freely accepted by the other members of the system, it corresponds to a hegemonic decision mechanism where a single country concentrates all the system's decision power. It is a consequence of the well-known $n+1$ phenomenon of all systems of fixed exchange rates (de Grauwe, 1999).

In our framework, a hegemonic decision mechanism allows country i to set its interest rate at the level it prefers, regardless of the situation of its partners. It therefore implements the interest rate that is given by expression of $\Delta i_{i,t}^{*}$ above. As we are interested in the volatility of interest rates, we must focus on the variance of the chosen interest rate. From above, it appears that the variance of the interest rate is simply the sum of the variances of the common shock and of the shock that is specific to the hegemon. It therefore amounts to:

$$Var(\Delta i^{hegemon}) = \sigma_U^2 + \sigma_V^2 = Var(\Delta i^{*})$$

The above expression is not very instructive in itself. However, it provides a benchmark against which the other decision mechanisms may be weighed. Besides, one may also remark that it also corresponds to the variance of the interest rate that a central bank would implement if its monetary policy was independent.

We now turn to more democratic decision mechanisms that share the union's decision power.

4 Majority voting

Let us assume that the monetary committee consists of all the governors with equal decision weight. This hypothesis is consistent with our simplifying assumption that all countries are of equivalent size, and with the decision process adopted in the ECB. Let us assume that they choose the union-wide interest rate by majority voting. Under those circumstances, the median voter theorem applies, since preferences are single peaked in terms of the interest rate. Therefore, the governor whose optimal interest corresponds to the median of the optimal interest rates of all the members of the committee can build a coalition that defeats any interest rate that is not his favourite one. The implemented interest rate is therefore equal to the interest rate that minimises the median governor's loss function, as given by the expression for Δi^* above, which we note Δi^M.

Unlike in the usual applications of the median voter theorem, here the identity of the median voter changes over time, due to the fact that governor's optimal interest rates are subject to random shocks. A simplification would be to consider that the number of committee members is infinite. The median interest rate would consequently always be equal to the mean. To be sure, this assumption would simplify the analysis but it would mainly substantially affect its results. As long as n is not infinite, the median depends on the realization of individual shocks. We must therefore investigate in details the stochastic properties of Δi^M.

First, the expected value of Δi^M, t is equal to the mean of all $\Delta i^*_{i,t}$'s. As we assume that idiosyncratic shocks cancel out at the federal level, the mean of $\Delta i^*_{i,t}$'s is therefore equal to the common shock, Ut. As we are interested in the volatility of the decided interest rate, we must bear in mind that governors' favourite outcomes are subject to two shocks. The first one, Ut, affects the mean of favourite interest rates. The second one, Vi, t, affects the distribution of governors' favourite policies around that mean. The variance of the chosen value of Δi is therefore the sum of the variance of Ut and of the variance of the median of a sample drawn from the distribution of Vi, t^3. It therefore reads:

$$Var(i^M) = \sigma_U^2 + \frac{\pi}{2n}\sigma_V^2$$

This expression leads to several interesting insights on the way a monetary committee may manage interest rates. At first glance it appears that the variance of the interest rate is a positive function of the

[3] The interested reader can refer to Kenney and Keeping (1962). It must be said that expression of $Var(i^M)$ rests on the expression of the variance of a large sample's median. Although no such expression exists for the variance of the median of a small sample, the estimates provided by Maritz and Jarrett (1978) show that our results can be extended to small samples. They therefore hold for small and large monetary unions.

variance of both shocks. Accordingly, the more volatile the economies of which the union consists, the more volatile is the interest rate, something largely conform to the literature on Optimum Currency Areas.

It furthermore appears that the volatility of the interest rate is a decreasing function of the number of economies that partake in the union. The rationale for this result stems from the fact that the outcome of the decision process is the median of the favourite interest rates of the members of the committee. To be sure, the median can be quite different from the mean. This is precisely why the interest rate is volatile. However, the median governor can by definition never be the extreme governor. Majority voting therefore prevents extreme idiosyncratic shocks from influencing the outcome of the vote.

Furthermore, as the number of countries increases, idiosyncratic shocks tend to be more and more evenly distributed around the mean. The median governor's favourite interest rate is therefore likely to be closer to the mean. This effect explains the negative relationship between the monetary union's size and the volatility of the interest rate.

This rationale is however not applicable to union-wide shocks. The above expression underlines that the variance of the outcome of the vote is greater or equal to the variance of Ut. In a union whose size would be infinite, or that would be perfectly homogeneous, namely if $\sigma_V^2 = 0$, the number of participating countries would not affect chosen policies. In other words, $Var(\Delta i^M)$ would be equal to $Var(\Delta i^*)$.

Another substantial finding stems from the comparison between the policy of a hegemon and the policy chosen by majority voting in the committee. Simple comparison of the two expressions for Δi^* and Δi^M reveals that the latter leads to less volatility in the interest rate. This is a consequence of the fact that majority voting limits the influence of extreme country-specific shocks. On the contrary a hegemon can be hit by an extreme shock.[4] The interest rate set by a hegemon can therefore take extreme values. Overall, the variance of the interest rate set by a hegemon is consequently larger than the variance of the interest rate set by a committee. This comes at a cost for the hegemon, but benefits all its partners.[5]

[4] German reunification is but one example of an extreme shock hitting a hegemon, who sets its monetary policy accordingly.

[5] Here again, the prospect of sharing the Bundesbank's decision power appeared as a key benefit of monetary union to non-German members of the EMS. It allowed Germany to demand compensations during the negotiations that led to the Maastricht treaty.

5 Bargaining with a Chairman

Until now, we have considered a policy committee composed of only type of agent, i.e. national representatives. More realistically, we have to turn now to the case when there is a Chairman to head the meetings of the policy committee.

We model a majority voting inside a policy committee in the following simplified way. First, the Chairman, as the agenda-setter, makes a proposal regarding the level of the interest rate. Then, a simple majority voting among committee members takes place between the choices of this proposed value and the status quo value, i.e., 0. If the proposal is accepted, it will be implemented immediately. Otherwise, the status quo will prevail until the next vote takes place. We can assume single-peaked preference of each player over the policy change. We denote the most preferred level of the policy change by the agenda-setter and the median value of those of the committee members respectively by $.\Delta i^A$ and Δi^M.

Depending on the relationship between the values of $.\Delta i^A$ and Δi^M, we have four distinct cases that yield qualitatively different equilibrium results of this voting game. By representing the proposing action of the agenda-setter with the function $A(\Delta i^A\ ;\ \Delta i^M)$, we can write the values of this function for the four different cases as follows:[6]

1) When $.0 \leq \Delta i^A \leq \Delta i^M \Rightarrow A(\Delta i^A\ ;\ \Delta i^M) = \Delta i^A$

2) When $0 \leq \Delta i^A \leq 2\Delta i^A \leq \Delta i^M \Rightarrow A(\Delta i^A\ ;\ \Delta i^M) = 2\Delta i^A$

3) When $0 \leq \Delta i^A \leq \Delta i^M \leq 2\Delta i^A \Rightarrow A(\Delta i^A\ ;\ \Delta i^M) = \Delta i^A$

4) When $0 \leq \Delta i^M \leq \Delta i^A \Rightarrow A(\Delta i^A\ ;\ \Delta i^M) = 0$

Depending on the situation, all of these proposals will succeed in the majority voting within the committee, that is, they will all become the equilibrium of this game, instead of the status quo (though, in the fourth case, the equilibrium coincides with the status quo ; by default since there is no other choice).

From this simple model, we can draw several insights into the workings of a committee system with an agenda-setter.

Firstly, the median voter is rarely a winner in this type of majority voting. It can prevail only when . $\Delta i^M = \Delta i^A$ or $.\Delta i^M = 0$.

Secondly, the agenda setter's most favorite level of change is not always the outcome either, although the agenda-setter can attain exactly what she wants in the first and third case. Most importantly for our purpose, we can detect a bias toward the status quo in the equilibrium of

[6] To ease the presentation, we only present cases located at the right of the status quo point ($\Delta i = 0$), as the analysis is strictly symmetrical. For a more complete exposition, see for example, Grossman and Helpman (2001).

this game in comparison with the agenda-setters most preferred change, provided that the game is repeated for a number of times.

However, even though we now have an agenda-setter, we do not cover all the situations one could find in monetary policy committees. This leads us to differentiate two cases:

Case 1 *The Chairman is one among the Governors : there is an agenda setter, but its preferred policy is defined as in the hegemon case.*

In this case, $\Delta i^A = \Delta i^{hegemon}$. And, except in the case where shocks hitting the agenda-setter's economy are bigger than those hitting the rest of the economies, then the policy is the one that would be chosen by a hegemon. There is no smoothing.

Case 2 *The Chairman has different preferences from the Governors and is the agenda-setter.*

In this case, the Chairman has the following loss function :

$$P_t = \frac{1}{2}\left(\pi_t^f - \pi^*\right)^2 + \frac{\lambda^f}{2}\left(y_t^f - y^*\right)^2$$

that is, the Chairman considers only federal aggregates. Her favorite policy move is :

$$\Delta i^C = U_t$$

with a variance equal to : $Var(i^C) = \sigma_U^2$.

Then, from what precedes, we write : $\Delta i^A = \Delta i^C$. And then, except in the case where $Corr(U;V) = -1$, we can assume : $Var(\Delta i^C) < Var(\Delta i^*)$. The bargaining-and-voting game would still deliver the solutions described above, but, in this case, one can show that a smoothing effect emerges from the appointment of a Chairman with preferences different from those of the rest of the Committee members.

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