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A Deliberative Independent Central Bank

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Editorial

The paper develops a communication game that is applied to the question of central bank policy and independence. The game is about the preferred degree of conservatism of monetary policy and the game setting consists of a principal (politics), an agent (central bank) and an observer (financial market participants). The extent of the welfare losses depends on the degree of knowledge, the endogenized signaling of financial market participants and the probability whether the degree of conservatism in monetary policy is adequate to nature. Consequently, a mechanism to minimize welfare losses of the principal has to be implemented. It is shown how the introduction of an institutional control mechanism with a countervailing goal function will improve the utilities for the principal.

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A deliberative independent central bank

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The extensive annex can be found http://www.ati.ac.at/~neutropt/team/jericha/jsAnnex.pdf

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Abstract

The game is about the preferred degree of conservatism of monetary policy and the game setting consists of a principal (politics), an agent (central bank) and an observer (financial market participants). The extent of the welfare losses depends on the degree of knowledge, the endogenized signaling of financial market participants and the probability whether the degree of conservatism in monetary policy is adequate to nature. Consequently, a mechanism to minimize welfare losses of the principal has to be implemented. It is shown how the introduction of an institutional control mechanism with a countervailing goal function will improve the utilities for the principal.

The democratic deficit problem of independent central banks: a deliberative solution

"In theory, the democratic method is persuasion through public discussion carried on not only in legislative halls but in the press, private conversations and public assemblies"

John Dewey 1939

Delegation is a key to overcome problems of collective action and delegating competencies to independent institutions is a way to reduce political transaction costs. However, delegation entails side effects that are known as agency losses in economic theory. There is always some conflict between the interests of the principal, who delegates authority, and those of the agent[1]. Agents pursue their own interests subject to the constraints imposed by their relationship to the principal. Thus, the principal experiences some reduction in welfare that results from the fact that agents do not necessarily pursue her preferences. The agent acquires information that is either not available to the principal or too costly to obtain or the agent has incentives to use this information strategically or simply to keep it hidden (McCubbins, Schwartz 1984). As a result of this incentive incompatibility the principal cannot observe whether the action that the agent takes is in her best interest. All these problems are well documented in economic and political science literature.

In the field of monetary policy debate the following commitment problem receives a lot of attention: discretionary monetary policymaking would not ensure time-consistent policies; Politics has an incentive to exploit the short-run tradeoff between employment and inflation and to pursue short-run employment objectives, even though the outcome in the long run will be poor (Kydland/Prescott 1977, Barro/Gordon 1983a, 1983b, Alesina/Summers 1993).

The principal-agent literature stresses a number of elements that are necessary to guarantee that the agent acts in the interest of the principal: There is a large repertoire of mechanisms by which agency problems can be overcome, ranging from contract design, screening and selection mechanisms to monitoring and reporting requirements and institutional checks. In reality, however, central banks do not operate in such an idealized setting, but rather in an environment of uncertainty and incomplete contracts.

Thus, the issue of a democratic deficit of independent central banks has become an object of intense debate (Blinder, 1996; Stiglitz, 1998; Berman/McNamara 1999; Majone, 2001, Scherz 2001). The democratic legitimacy of independent central banks is built on procedures (law, statutes, transparency, accountability) and on the basis of results (price stability, financial stability, minimization of output volatility). In an article on *Central Banking in a Democracy* (1996) Alan Blinder listed a number of conditions to be fulfilled when transferring powers from elected representatives of the people to non-elected experts. These democratic standards are: As central bank leaders are politically appointed, the ultimate responsibility for monetary decisions has to lie with politics (overriding clause), their basic goals needs a statutory basis, and they have to be accountable.

However, this may be a rather fragile conceptual basis for the democratic legitimacy of independent central banks without optimal contracts. Thus, we concentrate on two further issues that will induce a problem of democratic legitimacy that has not been considered sufficiently so far:

1) Monetary policy is pursued in a field of different audiences. Strategic interaction literature places the focus on the strategic interplay of monetary policy and wage bargainers and challenges the assumption of a simple correlation between central bank independence and superior inflation performance (Soskice/Iversen 2000, Mooslechner/Schürz 2002, Franzese/Mooslechner/Schürz 2004). But there are a number of other audiences with whom the central bank interacts, such as financial markets, media, politics, general public and whose decisions influence whether the central bank reaches its goal (Lohmann 1998).

From a democratic point of view it may be particularly problematic that the agent´s decision only partially determines the outcome. In this case, the principal is unable to infer the appropriateness of the agent´s action even from observed results.

2) The rationale for central bank independence is the inflationary bias.[2] Following the proposal of Rogoff (1985) a government will delegate the conduct of monetary policy to conservative central bankers who put more weight on controlling inflation relative to output and this will increase the welfare of the policy maker. However, recently literature began to distinguish between central bank independence and conservatism (Lippi 1999). While independence refers to the relationship between the principal and the agent conservatism is related to the policy target.

From a democratic policy point of view it will be problematic that we do not know the exact degree of conservatism required for an optimal monetary policy.

[1] We will refer to the principal as *she* and to the agent as *he*.

[2] Rarely the possibility of a deflationary bias - a too high inflation aversion - of a central bank has even been mentioned in the literature (for an exception see Fischer 1995, Blinder 1998).

Both questions relate to institutional interactions among different players and to the issue of uncertainty. We adapt a simple communication game from the World Bank context (Luppia, McCubbins 1998) for central bank specifics. The Luppia and McCubbins communication game had two players, a speaker and a principal, we extend it to a three-player and finally a four-player context.

Stages of the central bank conservativeness game

We begin by defining the players and the objective function. The players are the independent central bank (agent 2), the principal (politics) and observers (agent 1).[3] The classical loss function of a central bank can be written in the standard formulation:

$$\Lambda = E\,[\alpha(\pi - \pi^*)^2 + (1-\alpha)(\gamma - \gamma^*)^2] \tag{1}$$

where α is the aversion to inflation variability of the central bank. There is little empirical evidence regarding the inflation aversion parameter α.

Assumption 1

In our game α can be any point in the interval $[0,1]$.

The optimal value of α is empirically unknown. π is the actual inflation rate, π^* the desired inflation rate, γ is actual output and γ^* potential output.

Assumption 2

All players of the game aim at maximizing their utilities.

Assumption 3

In stage 1 nature takes on a state which is characterized by two parameters: n_b and n_k are elements of the sets $n_b \in \{\alpha\uparrow, \alpha\downarrow\}$, where $\alpha\uparrow$ stands for a high value of the α-parameter and $\alpha\downarrow$ for small α, and $n_k \in \{agents\ know, agents\ are\ uncertain\}$. $\alpha\downarrow$ can be understood as an indicator for an inflation-prone monetary policy and $\alpha\uparrow$ would mean a conservative inflation-averse monetary policy. We assume that the agents in our game can have different preferences on the value of the α-parameter. Nature takes on $n_b = \alpha\uparrow$ with probability *b* and attributes the agents with knowledge with probability

[3] In the following we use the term financial market agents and observers interchangeably comprising e.g. central bank watchers, bond traders and rating agencies.

k; nature takes on $n_b = \alpha\downarrow$ with probability (1-*b)* and attributes the agents with no knowledge with probability (1-*k)*.

Assumption 4

In stage 2, observers communicate their preferences on the value of the α-parameter. This communication can be done directly by signaling to the principal or the independent central bank or indirectly by commenting in the media.

We have to identify observers with credible threats, otherwise their signaling would not matter for the central banks. The audience central bankers consider as most relevant are financial market agents. As the former Vice-chairman of the Fed Alan Blinder stated "the currently prevailing view of financial markets among central *bankers is one of deep respect*" (Blinder 1998, p.62). Financial market agents provide an *instant evaluation of central bank performance* and revise information faster than central banks. Financial market agents have been gaining in importance in the transmission of monetary policy signals and the advice of financial market agents is considered as important for monetary policymakers.

Financial market agents form expectations on the future course of monetary policy and try to predict future policy changes by analyzing the variables they believe the central bank is following. They have the ability to *punish* the central bank in a number of ways. They may criticize it in the media (e.g. the popular issue whether t*he central bank is behind the curve*) and when the views of monetary policy decision-makers and central bank watchers diverge, the latters′ judgments may induce trading portfolio strategies that run counter to monetary policy intentions. What is even more important, is that financial market agents will have interests related to financial stability in general and their firms' trading and positioning strategies in particular that build the basis for preferences on the value of the α-parameter

According to a prominent policy view, financial markets agents would control monetary policy by punishing wrong policy strategies and rewarding right strategies, thus, ensuring in the end an optimal monetary policy outcome that favors also the principal. Thus, no democratic deficit would result. Incentive compatibility of the central bank concerning the aim of price stability would be ensured by credible threats of financial market agents.

Assumption 5

When financial market observers have knowledge about n_b they will communicate $\alpha\uparrow$ with probability c_1 and $\alpha\downarrow$ with probability c_2. The variables c_1 and c_2 are endogenous. If their preferred decision $\alpha\uparrow$ will be taken by agent 2 at any case they will support it by choosing $(c_1,c_2) = (1,0)$. On the other hand, when the outcome of the game is $\alpha\downarrow$ with certainty, we assume that they communicate the true state of nature to the principal by choosing $(c_1,c_2) = (1,1)$.

Assumption 6

In stage 3, the principal signals her desired course of action, $\alpha\uparrow$ or $\alpha\downarrow$, to the central bank. The principal has neither knowledge about n_b nor about n_k but she knows from general experience the probabilities b, k, c_1 and c_2 and the individual payoffs of agent 2 and herself.

In stage 4, eventually, the central bank takes the decision $\alpha\uparrow$ or $\alpha\downarrow$. The game ends with the agents and the principal receiving their payoffs. The utility financial market agents draw from the game depends on the decision of the central bank. They gain when the central bank opts for $\alpha\uparrow$ and loose in the case of a decision of $\alpha\downarrow$. Therefore, the probabilities c_1 and c_2 which describe the signaling to the principal will depend on the probabilities for the state of nature and on the payoffs for the principal and the central bank.

General discussion of the central bank conservativeness game

The payoffs for the principal, denoted by Ui and $\underline{Ui}$, and for the central bank, Zi and $\underline{Zi}$, are shown in Fig. 1. There exist two information sets for the principal: $h_\uparrow$, when agent 1 signals $\alpha\uparrow$ and $h_\downarrow$, when agent 1 signals $\alpha\downarrow$. The information sets for the central bank are labeled $\mathrm{h_i},\ \mathrm{i} = 1,\ldots,8,\mathrm{A},\ldots\mathrm{D}$. Information set 1, e.g., describes the situation for the central bank when $n_b = \alpha\uparrow$ and $n_k = agents\ know$, then financial market agents communicate $\alpha\uparrow$ and the principal signals $\alpha\uparrow$. Node 1 corresponds to the information set h_1 and the probability that this node occurs is given by

$$P_1 = kbc_1 p(\alpha\uparrow | \alpha\uparrow) \tag{2a}$$

with $p(\alpha\uparrow | \alpha\uparrow)$ being the probability that the principal signals $\alpha\uparrow$ when financial market agents communicate $\alpha\uparrow$. The expected utility for the central bank then is

$$Z_1 = P_1(P_{1\uparrow}Z1 + P_{1\downarrow}\underline{Z1}) \tag{2b}$$

and for the principal

$$U_1 = P_1(P_{1\uparrow}U1 + P_{1\downarrow}\underline{U1})\ . \tag{2c}$$

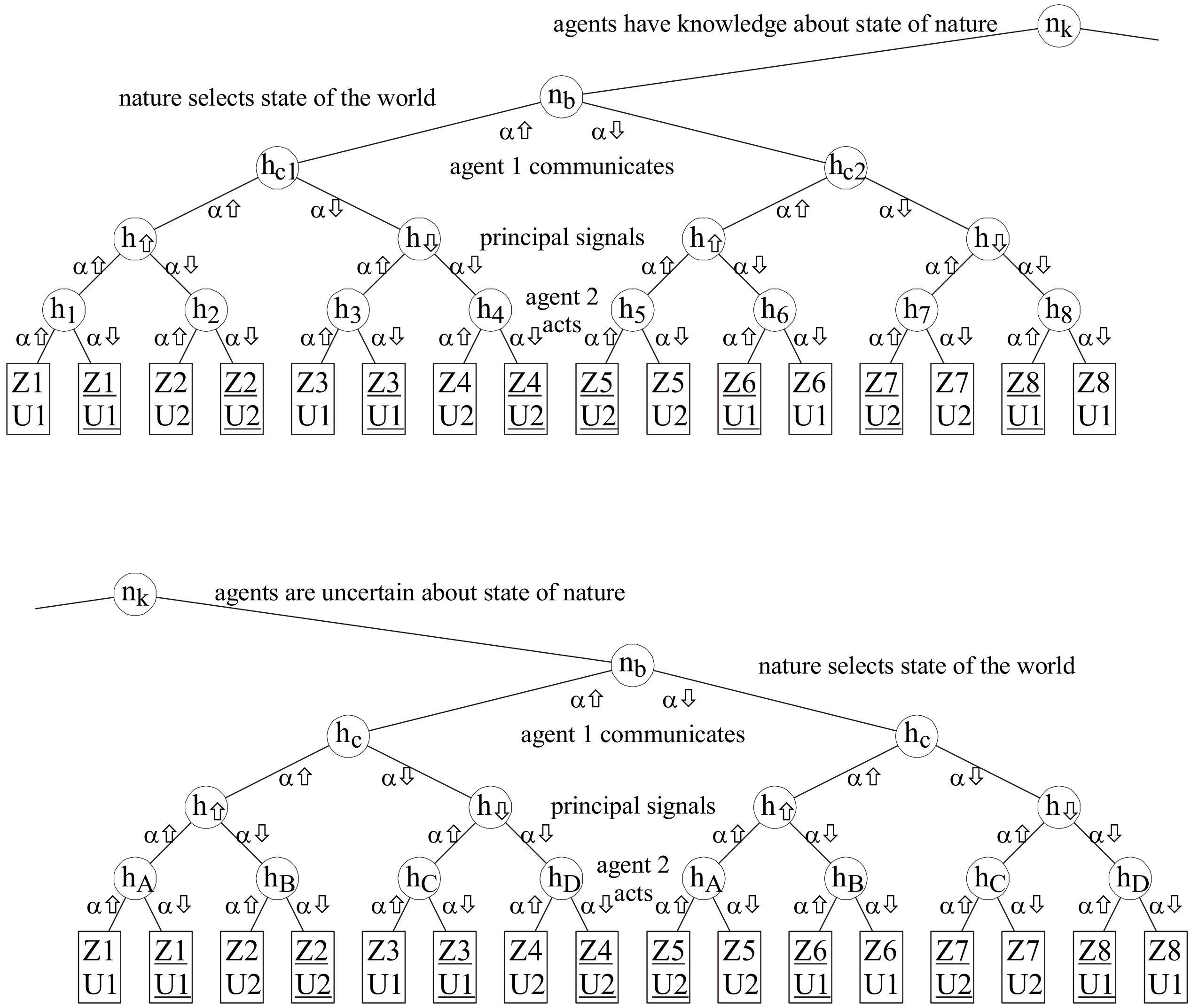

Figure 1. Illustration of the general extensive form representing the delegation game.

Here, $P_{1\uparrow} = p_{a2}(\alpha\uparrow | \alpha\uparrow, \alpha\uparrow, \alpha\uparrow)$ is the conditional probability that the central bank decides $\alpha\uparrow$ at node 1. In general, we will denote the probability that final node *i* is reached by P_i, the probability for a certain signal of the principal by $p(\alpha\updownarrow | \alpha\updownarrow)$ and the probability that agent 2 decides $\alpha\uparrow$ by $P_{\bullet\uparrow}$ throughout the paper. The notation for the nodes 2, 3 and 4 is equivalent to that of node 1. Node 5 presents another case of the game with

$$P_5 = k(1-b)(1-c_2)p(\alpha\uparrow | \alpha\uparrow) = P_1 \frac{(1-b)}{b}\frac{(1-c_2)}{c_1}, \tag{3a}$$

$$Z_5 = P_5(P_{5\uparrow}\underline{Z5} + P_{5\downarrow}Z5) \tag{3b}$$

and

$$U_5 = P_5(P_{5\uparrow}\underline{U2} + P_{5\downarrow}U2) \tag{3c}$$

The nodes 1 to 8 are characterized by the fact that the agents have knowledge about the state of nature. At the nodes A, B, C and D the agents are uncertain about nature. We add the assumption that

Assumption 7

Financial market agents have no intention to reveal their uncertainty. They want to be seen as knowledgeable even when they have no knowledge (e.g. rating agencies have an incentive not to reveal their ignorance). And as they have no contract with the principal, they will not be held responsible for their judgments. Also do they have an interest to opt for $\alpha\uparrow$ despite the state of nature. Financial market agents range from bond traders to stock market participants and the degree of their inflation aversion will be different. However, we may limit our considerations to a single financial market agent as in no case he should be more inflation prone than the government. Financial market agents do not have to win elections. Thus, their likely inflationary bias has to be smaller than the one of the government.

A continuous high degree of inflation aversion of the central bank will help to stabilize the expectations that form the basis for financial market decisions. An environment of price stability enhances the attractiveness of bonds. And a pre-emptive tightening of a central bank in order to avoid a likely bubble could be in the interest of financial market agents (Borio 2002, Schürz 2003). Therefore, the agent in question will signal $\alpha\uparrow$ and $\alpha\downarrow$ with the same probability as he does in the cases where he knows the actual state of nature. This additional rule to the game defines the probabilities for the nodes A to D. e.g. the probability for information set A to occur is given by

$$P_A = (1-k)[bc_1 + (1-b)(1-c_2)]p(\alpha\uparrow|\,\alpha\uparrow) \tag{4a}$$

and the respective utilities are for the central bank

$$Z_A = P_A\{[bZ1 + (1-b)\underline{Z5}]P_{A\uparrow} + [b\underline{Z1} + (1-b)Z5]P_{A\downarrow}\} \tag{4b}$$

and the principal

$$U_A = P_A\{[bU1 + (1-b)\underline{U2}]P_{A\uparrow} + [b\underline{U1} + (1-b)U2]P_{A\downarrow}\}\,. \tag{4c}$$

By maximizing the utilities for each information set we obtain the probabilities which govern the decisions of the three players. The most convenient way to determine these probabilities is to start with agent 2 and to work through the extensive form by backward induction.

By introducing the ratios q_{ij} and q_b

$$q_{ij} \equiv \frac{Zi - \underline{Zi}}{Zj - \underline{Zj}}, \quad q_b \equiv \frac{1-b}{b} \tag{5}$$

we may state the following proposition.

Proposition 1.

By maximizing his utility at each node of his game, agent 2 takes decisions by pure strategies only which follow for nodes i, j, and m as

$$P_{i\uparrow} = \Theta(Zi - \underline{Zi})\ ,\ i = 1\ldots4 \tag{6a}$$

$$P_{j\uparrow} = \Theta(\underline{Zj} - Zj)\ ,\ j = 5\ldots8 \tag{6b}$$

$$P_{m\uparrow} = \vartheta_{ij}\ ,\ m = \text{A, B, C, D} \tag{6c}$$

with (ij)={15, 26, 37, 48} for nodes m = {A, B, C, D}, where $\Theta(x)$ is the *Theta function* which gives 1 for $x > 0$ and 0 for $x < 0$ and ϑ_{ij} is given by

$$\begin{aligned} \vartheta_{ij} \ &= \ \Theta(Zi - \underline{Zi})\Theta(\underline{Zj} - Zj) + \Theta(Zi - \underline{Zi})\Theta(Zj - \underline{Zj})\Theta(q_{ij} - q_b) + \\ &+ \ \Theta(\underline{Zi} - Zi)\Theta(\underline{Zj} - Zj)\Theta(q_b - q_{ij}) \end{aligned}\ . \tag{7}$$

Proof.

The case for nodes 1 to 8 is straight forward. The Θ -function will be either 0 or 1 which corresponds to a pure strategy (either $P_{\bullet\uparrow} = 1$ or $P_{\bullet\downarrow} = 1$). Since agent 2 knows the state of nature he knows at which node the game is currently played and will decide for the higher payoff there which is expressed by eqs. (6a) and (6b). Let us illustrate the case for the nodes m by the example of node A. The utility there is given by eq. (4b) and has to be maximized by the agent. The essential quantity in this process is

$$\zeta_{15} = b(Z1 - \underline{Z1}) + (1-b)(\underline{Z5} - Z5)\ . \tag{8}$$

In the case of $\zeta_{15} \geq 0$ the agent will decide with $P_{A\uparrow} = 1$, in the case of $\zeta_{15} < 0$ with $P_{A\uparrow} = 0$ ($P_{A\downarrow} = 1$). Since the probabilities b and (1-b) are always greater than or equal 0 the condition $\zeta_{15} \geq 0$ is met by either

$$\Theta(Z1 - \underline{Z1})\Theta(\underline{Z5} - Z5) = 1\ ,$$

i.e. $Z1 > \underline{Z1}$, $\underline{Z5} > Z5$, or

$$\Theta(Z1 - \underline{Z1})\Theta(Z5 - \underline{Z5})\Theta(\frac{Z1 - \underline{Z1}}{Z5 - \underline{Z5}} - \frac{1-b}{b}) = 1$$

i.e. $Z1 > \underline{Z1}$, $Z5 > \underline{Z5}$, $b(Z1 - \underline{Z1}) > (1-b)(Z5 - \underline{Z5})$, or

$$\Theta(\underline{Z1} - Z1)\Theta(\underline{Z5} - Z5)\Theta\left(\frac{1-b}{b} - \frac{Z1 - \underline{Z1}}{Z5 - \underline{Z5}}\right) = 1$$

i.e. $\underline{Z1} > Z1$, $\underline{Z5} > Z5$, $b(\underline{Z1} - Z1) < (1-b)(\underline{Z5} - Z5)$. The total probability $P_{A\uparrow}$ is then written as the sum of these three partial probabilities as given by eq. (6c). These products of Θ -functions will have either a value of 0 or 1 and also the sum of (6c) will be either 0 or 1 corresponding again to a pure strategy which concludes the proof.

Equations 6a - 6c determine the utilities for the principal and agent 2 at each node. For their overall utilities, it is important to find the strategies c_1 and c_2 governing the signaling of agent 1 as well as the probabilities $p(\alpha\uparrow|\alpha\uparrow)$, $p(\alpha\downarrow|\alpha\uparrow)$, $p(\alpha\uparrow|\alpha\downarrow)$ and $p(\alpha\downarrow|\alpha\downarrow)$ which represent the strategies of the principal and direct her signaling.

Proposition 2.

When maximizing her utility at each node of her game, the principal will apply pure strategies only.

Proof.

Node $h_\uparrow$ occurs when agent 1 communicates $\alpha\uparrow$ and the associated utility for the principal to maximize amounts to

$$U_\uparrow = \sum_i U_i|_{\pi_{a1}(\alpha\uparrow)=1} = U_1 + U_2 + U_5 + U_6 + U_A + U_B \tag{9}$$

which will give the strategies $p(\alpha\uparrow|\alpha\uparrow)$ and $p(\alpha\downarrow|\alpha\uparrow)$. Following eqs. (2c), (3c) and (4c) we find

$$U_\uparrow = p(\alpha\uparrow|\alpha\uparrow)\cdot\varphi_{\uparrow\uparrow} + p(\alpha\downarrow|\alpha\uparrow)\cdot\varphi_{\uparrow\downarrow} \tag{10}$$

with

$$\begin{aligned}\varphi_{\uparrow\uparrow} &= U1\,[kbc_1\Theta(Z1-\underline{Z1}) + p_{u\uparrow}b\vartheta_{15}] + \\ &+ \underline{U1}\,[kbc_1\Theta(\underline{Z1}-Z1) + p_{u\uparrow}b(1-\vartheta_{15})] + \\ &+ U2\,[k(1-b)(1-c_2)\Theta(Z5-\underline{Z5}) + p_{u\uparrow}(1-b)(1-\vartheta_{15})] + \\ &+ \underline{U2}\,[k(1-b)(1-c_2)\Theta(\underline{Z5}-Z5) + p_{u\uparrow}(1-b)\vartheta_{15}]\end{aligned} \tag{10a}$$

as example, with $p_{u\uparrow} = (1-k)[bc_1 + (1-b)(1-c_2)]$. Since the coefficients $\varphi_{\uparrow\uparrow}$ and $\varphi_{\uparrow\downarrow}$ are constant for a given game, maximization will yield either $p(\alpha\uparrow|\alpha\uparrow)=1$ when $\varphi_{\uparrow\uparrow}\ge\varphi_{\uparrow\downarrow}$ or $p(\alpha\downarrow|\alpha\uparrow)=1$ when $\varphi_{\uparrow\uparrow}<\varphi_{\uparrow\downarrow}$ which corresponds to pure strategies.

Similarly, at node $h_\downarrow$ the principal will maximize the utility

$$U_\downarrow = \sum_i U_i|_{\pi_{a1}(\alpha\uparrow)=0} = U_3 + U_4 + U_7 + U_8 + U_C + U_D\,. \tag{11}$$

Again, from eqs. (2c), (3c) and (4c), we find

$$U_\downarrow = p(\alpha\uparrow|\alpha\downarrow)\cdot\varphi_{\downarrow\uparrow} + p(\alpha\downarrow|\alpha\downarrow)\cdot\varphi_{\downarrow\downarrow} \tag{12}$$

with $\varphi_{\downarrow\uparrow}$ and $\varphi_{\downarrow\downarrow}$ constant for a given game. Then, maximization will also yield pure strategies $p(\alpha\uparrow|\alpha\downarrow)=1$ ($\varphi_{\downarrow\uparrow}\ge\varphi_{\downarrow\downarrow}$) or $p(\alpha\downarrow|\alpha\uparrow)=1$ ($\varphi_{\downarrow\uparrow}<\varphi_{\downarrow\downarrow}$) for $h_\downarrow$ (end of proof).

We might add that the total expected utility for the principal out of the game follows simply as

$$U = U_{\uparrow} + U_{\downarrow} . \tag{13}$$

The utility for financial market agents is a monotonic increasing function of the probability $P_{\alpha\uparrow}$ for $\alpha\uparrow$ and basis for the signaling of either $\alpha\uparrow$ or $\alpha\downarrow$. Maximizing utility is then equivalent to signal in such a way that $P_{\alpha\uparrow}$ given by

$$P_{\alpha\uparrow} = \sum_{i=1}^{D} P_i P_{i\uparrow} \tag{14}$$

will be as high as possible.

In the proof of proposition 2 we found that the coefficients like $\varphi_{\uparrow\uparrow}$ depended on both c_1 and c_2, eq. (10a). Agent 1 will therefore choose both strategies simultaneously to maximize $P_{\alpha\uparrow}$ for a given game.

Proposition 3.

The probability for $\alpha\uparrow$ in a given game is a linear function of agent 1's strategies c_1 and c_2,

$$P_{\alpha\uparrow} = \gamma_0 + \gamma_1 c_1 + \gamma_2 c_2 . \tag{15}$$

These strategies will in general be mixed strategies.

Proof.

According to eq. (14) $P_{\alpha\uparrow}$ is given by a sum of probabilities which may be seen as a product of the probability P_i that node *i* occurs and the probability $P_{i\uparrow}$ that agent 2 decides $\alpha\uparrow$ at that specific node. From proposition 1 we know that $P_{i\uparrow}$ will be either 0 or 1 owing to agent 2's pure strategies. Examples for P_i are given in eqs. (2a), (3a) and (4a). They consist of products of linear functions in either c_1 or c_2 and the probabilities $p(\alpha \updownarrow | \alpha \updownarrow)$. Since these probabilities represent pure strategies according to proposition 2, P_i will still be a linear function of c_1 and c_2 which remains true for their sum as $P_{\alpha\uparrow}$ (end of proof).

In general, the analysis of a specific game will reveal several conditions for maximum expected utilities depending on the values of *k, b, Zi, Ui* and on the possible values of $P_{i\uparrow}$, $p(\alpha \updownarrow | \alpha \updownarrow)$ and (c_1, c_2). Agent 1 will start to examine the possible outcomes of the game by forward induction and eventually signal with probabilities (c_1, c_2) according to his own interests. At this point the importance for agent 1 to have the first move in the game has to be emphasized.

In the following we will compare three specific cases. Either the central bank is adequately conservative in its monetary policy or it is not conservative enough (inflation-prone) or it is too conservative (deflation-prone). In our game the principal has not necessarily an inflationary bias, we calculate also the cases of optimality and a deflationary bias. Thus, our results do not depend on assumptions concerning the preferences of the principal.

Case 1 "adequate central bank conservativeness" shows the intuitively expected result. The central bank will act specifically according to the value of n_b, and an increase in knowledge will improve the utilities of both, the central bank and the principal. In the case of knowledge of monetary policy about the adequate degree of conservativeness the outcome will only depend on the issue whether the central bank follows nature. However, uncertainty will lead to a deviation from best course of action. Interestingly this happens in both cases, $\alpha\uparrow$ and $\alpha\downarrow$. It will lead to a too restrictive monetary policy in the case of b>1/2 and a too loose monetary policy in the case of b ≤ 1/2. The higher the degree of uncertainty the higher the influence of signaling of financial markets on central bank decisions.

We define case 1 by the relations between payoffs for agent 1 according to

$$\begin{gathered} Z1 = Z3 = Z6 = Z8;\ \underline{Z1} = \underline{Z3} = \underline{Z6} = \underline{Z8}, \\ Z2 = Z4 = Z5 = Z7;\ \underline{Z2} = \underline{Z4} = \underline{Z5} = \underline{Z7}, \\ Z1 > Z2 > \underline{Z2} > \underline{Z1}. \end{gathered} \tag{16}$$

For the principal we assume, as in all following cases, the relations

$$U1 > U2 > \underline{U2} > \underline{U1}. \tag{17}$$

Analysis of case 1 yields three subcases, denoted by 1.1 through 1.3, and depending on the relation of q_{12}, q_{21} and q_b defined by eq.(5). These cases are a direct consequence of agent 2's utility maximization procedure in a certain state of nature with a certain degree of uncertainty and follows from the results of proposition Proposition *1.*, eq.(6c) specifically. From proposition Proposition *2.* we know that the principal will maximize her utility by comparing quantities $\varphi_{\uparrow\uparrow}$, $\varphi_{\uparrow\downarrow}$ and $\varphi_{\downarrow\uparrow}$, $\varphi_{\downarrow\downarrow}$. Depending on their relations we can identify 4 different possible results which we will denote by 1.*i*.1 ($\varphi_{\uparrow\uparrow} \geq \varphi_{\uparrow\downarrow}$) through 1.*i*.4 ($\varphi_{\downarrow\downarrow} > \varphi_{\downarrow\uparrow}$) for each of the subcases $i = 1\ldots3$.

Propositon 4.

The utility for agent 1 gained in case 1 may be summarized by

$$P_{\alpha\uparrow} = kb + (1-k)bc_1 + (1-k)(1-b)(1-c_2)\,, \tag{18}$$

with $(c_1,c_2) = (1,0)$ for cases 1.1 and case 1.2.1, and $(c_1,c_2) = (0,1)$ for cases 1.3 and case 1.2.4.

The utility for the principal in the cases 1.*i* is summarized as

$$\begin{aligned} U(i) &= U1[\varphi_{1\uparrow} + \varphi_{2\downarrow} + \varphi_{3\downarrow}(\delta_{i2} + \delta_{i3}) + \varphi_{4\uparrow}(\delta_{i1} + \delta_{i2})] + \\ &+ U2[\varphi_{1\downarrow} + \varphi_{2\uparrow} + \varphi_{3\uparrow}\delta_{i3} + \varphi_{4\downarrow}\delta_{i1}] + \\ &+ \underline{U2}[\varphi_{3\uparrow}(\delta_{i1} + \delta_{i2}) + \varphi_{4\downarrow}(\delta_{i2} + \delta_{i3})] + \\ &+ \underline{U1}[\varphi_{3\downarrow}\delta_{i1} + \varphi_{4\uparrow}\delta_{i3}], \end{aligned} \tag{19}$$

with $\delta_{ij} = 1$ for $i = j$ and $\delta_{ij} = 0$ for $i \neq j$. Subcases 1.*i*.1 are obtained by the special choice $(c_1,c_2) = (1,0)$ and subcases 1.*i*.4 by $(c_1,c_2) = (0,1)$.

Equivalently, the utility for agent 2 is written as

$$\begin{aligned} Z(i) &= Z1[\varphi_{1\uparrow} + \varphi_{2\downarrow} + \varphi_{3\downarrow}(\delta_{i2} + \delta_{i3}) + \varphi_{4\uparrow}(\delta_{i1} + \delta_{i2})] + \\ &+ Z2[\varphi_{1\downarrow} + \varphi_{2\uparrow} + \varphi_{3\uparrow}\delta_{i3} + \varphi_{4\downarrow}\delta_{i1}] + \\ &+ \underline{Z2}[\varphi_{3\uparrow}(\delta_{i1} + \delta_{i2}) + \varphi_{4\downarrow}(\delta_{i2} + \delta_{i3})] + \\ &+ \underline{Z1}[\varphi_{3\downarrow}\delta_{i1} + \varphi_{4\uparrow}\delta_{i3}] \end{aligned} \tag{20}$$

for the cases 1.*i*, making again the special choices $(c_1,c_2) = (1,0)$ for subcases 1.*i*.1 and $(c_1,c_2) = (1,0)$ for subcases 1.*i*.4.

The coefficients φ are given by $\varphi_{1\uparrow} = kbc_1$, $\varphi_{2\uparrow} = k(1-b)(1-c_2)$, $\varphi_{3\uparrow} = (1-b)\varphi_{u\uparrow}$, $\varphi_{4\uparrow} = b\varphi_{u\uparrow}$, $\varphi_{1\downarrow} = kb(1-c_1)$, $\varphi_{2\downarrow} = k(1-b)c_2$, $\varphi_{3\downarrow} = (1-b)\varphi_{u\downarrow}$, $\varphi_{4\downarrow} = b\varphi_{u\downarrow}$ with $\varphi_{u\uparrow} = (1-k)[bc_1 + (1-b)(1-c_2)]$ and $\varphi_{u\downarrow} = (1-k)[b(1-c_1) + (1-b)c_2]$ being the probabilities that the agents have uncertainties at the nodes $h_\uparrow$ and $h_\downarrow$ respectively.

A sketch of the proof is given in the Annex.

Case 2 “inflationary bias” describes the situation when the independent central bank pursues an overly expansionary monetary policy, which implies an unfavorable $\alpha\downarrow$. There are several likely reasons for this: a number of central banks has no explicit commitment, price stability is not a clearly defined concept, central banks might want to please politicians under certain circumstances. Thus, in game 2 we assume that despite the overriding aim of price stability, the central bank may follow the principal.

The worst results for the principal occur at intermediate values of *b*. As a consequence of following the principal's signaling, the central bank will not receive a high utility for most of the cases but will neither face the risk of considerable loss over the whole *b*-range. Financial markets have no influence on central bank decisions in the range of low values of *b*.

Case 2 is defined by

$$\begin{gathered} Z1 = Z3 = \underline{Z5} = \underline{Z7};\ \underline{Z1} = \underline{Z3} = Z5 = Z7, \\ Z2 = Z4 = \underline{Z6} = \underline{Z8};\ \underline{Z2} = \underline{Z4} = Z6 = Z8, \\ \underline{Z2} > Z1 > \underline{Z1} > Z2. \end{gathered} \tag{21}$$

For the principal we assume relations (17) again. Analysis of case 2 yields 4 subcases, denoted by 2.1 ($\varphi_{\downarrow\downarrow} > \varphi_{\downarrow\uparrow}$) through 2.4 ($\varphi_{\uparrow\uparrow} \geq \varphi_{\uparrow\downarrow}$), which result from the principal maximizing her utility.

Proposition 5.

The utility for agent 1 gained in case 2 is summarized by

$$P_{\alpha\uparrow} = bc_1 + (1-b)(1-c_2)\,, \tag{22}$$

with the special choices (c_1,c_2) = (1,0) for case 2.1 yielding $P_{\alpha\uparrow} = 1$, and (c_1,c_2) = (0,1) for case 2.4 from which $P_{\alpha\uparrow} = 0$ follows for that case.

The utility for the principal in case 2 reads as

$$\begin{aligned} U \;=\; & U1\,\{k[bc_1 + (1-b)c_2] + (1-k)bP_{\alpha\uparrow} + (1-k)(1-b)(1-P_{\alpha\uparrow})\} \\ +\; & \underline{U2}\,\{k[b(1-c_1) + (1-b)(1-c_2)] + (1-k)(1-b)P_{\alpha\uparrow} + (1-k)b(1-P_{\alpha\uparrow})\}\,. \end{aligned} \tag{23}$$

The special choices of (c_1,c_2) yield $U = bU1 + (1-b)\underline{U2}$ for case 2.1 and $U = (1-b)\,U1 + b\underline{U2}$ for case 2.4.

Eventually, the utility for agent 2 is

$$Z = P_{\alpha\uparrow}\,Z1 + (1-P_{\alpha\uparrow})\,\underline{Z2} \tag{24}$$

with $Z = Z1$ for case 2.1 and $Z = \underline{Z2}$ for case 2.4.

A sketch of the proof is given in the Annex.

In Case 3 "deflationary bias" the probability *k* does not enter into the result of *Z* and *U*. This means that the degree of knowledge of the central bank and financial market agents about nature has no bearing on their success in the game. As there is no possibility of verification, central bank statements and central bank actions cannot be challenged. Relevant monetary policy issues from the point of view of the principal will not be questioned by financial market agents

An adequate α which would be of interest to the principal will not be secured by the signaling of financial market agents.

Case 3 is defined by

$$
\begin{gathered}
Z1 = Z2 = \underline{Z5} = \underline{Z6};\ \underline{Z1} = \underline{Z2} = Z5 = Z6, \\
Z3 = Z4 = \underline{Z7} = \underline{Z8};\ = \underline{Z3}\ \underline{Z4} = Z7 = Z8, \\
Z1 > \underline{Z3} > Z3 > \underline{Z1}.
\end{gathered}
\tag{25}
$$

For the principal we assume relations (17) again. Analysis of case 3 yields utilities with very compact expressions when compared to the previous cases 1 and 2.

Proposition 6.

The utility for agent 1 gained in case 3 is given by

$$P_{\alpha\uparrow} = 1, \tag{26}$$

the utility for the principal is

$$U = b\,U1 + (1-b)\,U2, \tag{27}$$

and the utility for agent 2 follows as

$$Z = Z1. \tag{28}$$

A sketch of the proof is again given in the Annex.

A crucial issue for the democratic legitimacy of an independent central bank is accountability. The actions and words of an independent institution with no explicit commitment must inherently be linked to the possibility that its policy explanations and claims are challenged by the principal under conditions of asymmetric information. Without this theoretical possibility, the agent might have no incentive to reveal his information to the principal. As we showed in cases 1-3 that financial market agents cannot be an adequate substitute for politics the principal would have to rely on the expertise and honesty of the central bank agent.

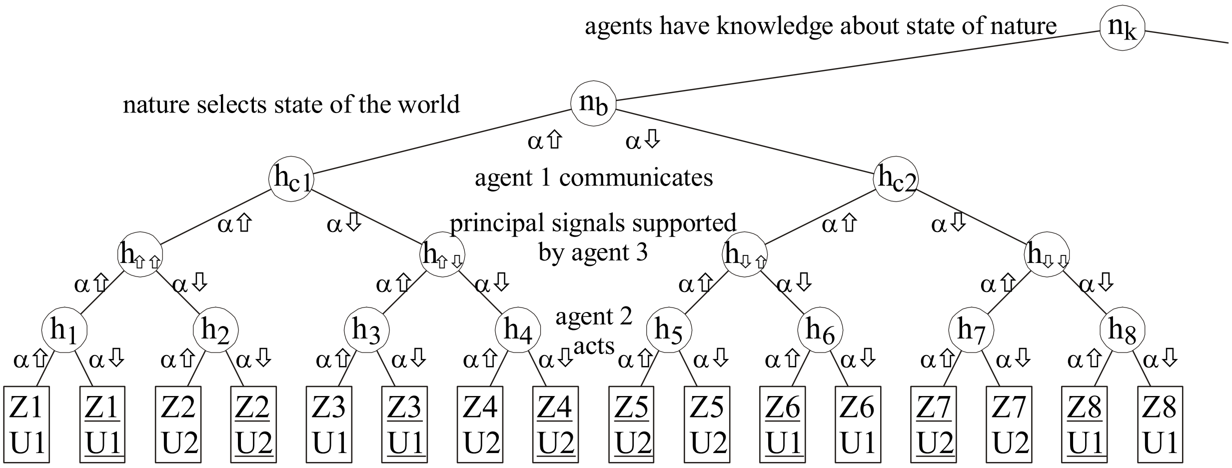

Figure 5. Deliberative form of the central bank conservativeness game "competing agents"

As trust can fail we will examine the case where the statement of financial market observers can be falsified before the central bank takes a decision. Thus, we introduce an agent 3 into the game by connecting him directly to the nodes of the principal. Agent 3 may act as an expert for the principal. In this way, he provides the principal knowledge about the state of nature with the same probability *k* that characterizes the knowledge of agent 1 and agent 2. In the EMU context the rather particular situation arises that the European Parliament monitors the performance of the agent but has no possibilities of sanctioning other than by communicating its opinion to the public. Thus, the European Parliament might signal whether it considers the ECB policy too inflation-prone or not but as its credible threats are rather small the signaling will be of little importance for the agent.

Agent 3 fulfils a deliberative role. The focus is on debate, arguing implies that participants try to challenge the validity claims inherent in all causal or normative statements and seek a justification for principles guiding action. A classical deliberative institution is a court aiming at justice. But deliberative practices are also embedded in the European comitology procedures. Deliberation does not preclude wrong results, ideological bias, self-interest strategies or faulty judgment, either but it increases the knowledge and might help to avoid hidden information (Ferejohn 2000). The introduction of agent 3 serves in particular as a kind of protection against a situation where the central bank opts for a too high α, i.e. is too inflation-averse and creates too high costs for growth and employment. Agent 3 produces the outcome desired by the principal and implies even a welfare improvement compared to the game of adequate α. However, the introduction of experts with an objective function other than the central bank would improve only the outcome for the principal and deteriorate the utilities for the agent.

The relations of payoffs for this case (denoted case 4) are assumed the same as in case 1. In contrast to case 1, they are now imposed by the presence of agent 3. Therefore, we impose a stronger criterion for these relations compared to case 1, namely $Z1 > Z2 >> \underline{Z2} > \underline{Z1}$. The analysis of this case finds two subcases 2.1 characterized by $b > 1/2$ and 2.2 with $b \le 1/2$.

***Proposition* 7.**

The utility for agent 1 gained in case 4 is then

$$P_{\alpha\uparrow} = \begin{cases} bk + (1-k) & , \quad case\,4.1 \\ \quad bk & , \quad case\,4.2 \end{cases}, \tag{29}$$

the utility for the principal yields

$$U = \begin{cases} b\,U1 + (1-b)[U1k + \underline{U2}(1-k)] & , \quad case\,4.1 \\ (1-b)\,U1 + b\,[U1k + \underline{U2}(1-k)] & , \quad case\,4.2 \end{cases}, \tag{30}$$

and the utility for agent 2

$$Z = \begin{cases} b\,Z1 + (1-b)[Z1k + \underline{Z2}(1-k)] & , \quad case\,4.1 \\ (1-b)\,Z1 + b\,[Z1k + \underline{Z2}(1-k)] & , \quad case\,4.2 \end{cases}. \tag{31}$$

A sketch of the proof is again given in the Annex.

Comparison of the utilities for the central bank and the principal revealed by the different cases shows the following results:

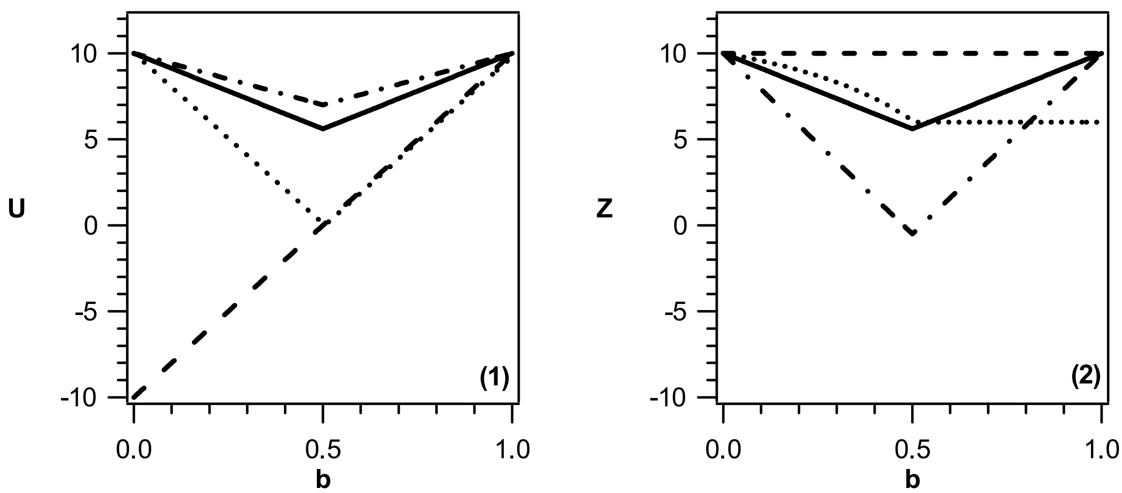

Figure 6. Expected utilities for the principal (1)* and the for the central bank (2)**.

*Comparison of the utilities for the principal as a function of the probability b with the specific values k = 0.7, $U1$ = 10, $U2$ = 6, $\underline{U2}$ = -10, $\underline{U1}$ = -15 for games 1 to 4; game 1: solid line, game 2: dots, game 3: dashes; game 4: dash-dotted line.

**Comparison of the expected utilities for the central bank as a function of *b* with the specific values $k = 0.7$, $Z1 = 10$, $Z2 = 6$, $\underline{Z2} = -10$, $\underline{Z1} = -15$ for games 1 and 3, $\underline{Z2} = 10$, $Z1 = 6$ for game 2, and $Z1 = 10$, $Z2 = 6$, $\underline{Z2} = -60$, $\underline{Z1} = -100$ for game 4.

The utilities for the principal coincide for all cases when the outcome due to the state of nature is certain (b=1), even though we assumed uncertainty (value of $k = 0{,}7$).

In the case of optimal monetary policy under uncertainty the utilities of the principal and the central bank are the same. Both reach their lowest utilities at b= 0,5. The slopes for the subcases differ significantly.

In the case of inflationary bias the utility of the principal decreases as a function of *b* till *b=0,5*. The decreasing utility function towards b= 0,5 expresses the fact of an increasing number of possible initial parameters of each sub-game. The most difficult judgment for the central bank is to be made when there is no clearness what to do from the state of nature. Thus, at $b = 0.5$, the utility functions of the principal in cases *adequate, inflationary bias* and *competing agents* show a discontinuity. For the central bank the situation is the same, only in the case *deflationary bias* there is no discontinuity. A deflationary bias provides the best result from the point of view of the central bank. This reflects the biased preference for $\alpha\uparrow$ of financial market agent 1. For the principal it is the opposite result: a deflationary bias of its agent provides the worst outcome. Her utility function is decreasing over the whole range of *b*.

In the non-standard solution of case 4 the principal reaches the highest utility but the central bank receives the lowest in comparison with all other cases.

Conclusions

The analysis in this paper concentrated on the issue of the adequate degree of conservatism of monetary policy. Our game yields two interesting results. We showed in a game theoretic context agency losses resulting from interaction between the central bank and financial market agents and from the uncertainty concerning the adequate degree of conservativeness. We suggested a specific institutional solution for this incentive problem (for a similar narrative argument see Scherz 2001). The introduction of an external monitor would pose the credible threat of falsification of monetary policy statements to monetary policy makers. The institutional design of this external monitor shall be open to public debate. However, it should comprise in particular up to now from the decision process excluded societal actors. The introduction of an external monitor would act both on the beliefs of the principal and the incentives for monetary policy makers. Rather than aiming for an unbiased source of information, the principal fares better by obtaining biased reports from different agents. Agents positioned against each other with countervailing interests rather than common interests will do a better job for the principal. Thus, a multiple goal function for the monitoring experts similar to the one of the Fed would be of relevance in EMU. By counseling the principal on a continuous basis monitoring experts would increase the knowledge of the principal and help to monitor the performance of the central bank adequately.

The social relationship between economists, economic politicians, politicians and other actors of society can be specified in epistemic terms in terms of the perspectives taken by them. Pragmatism and critical social science argue that it is important to keep reflective practices open to the variety of possible perspectives (Bohman 2001). This practical turn avoids providing the single true approach that can be the basis for monetary policy. Technocratic approaches model the economist as an engineer who searches for truth and an optimal solution to a specific problem. However, this abstract model in a closed setting does not work in a context of social relationships. In particular, it might not be sufficient for the external evaluation of an independent economic policy-maker with enormous resources. From the point of view of monitoring politicians, standards for the rational acceptability of propositions of the independent central bank remain fragile. Also an independent - only truth seeking – economic expert is not at hand. The distinction between economic convictions, temporary paradigms and often diverging economic theories calls for more caution. Thus, the different standpoints cannot be resolved by expert information provided by economic policy advisors to an ignorant monitoring Parliament but have to be dealt with practically in reflective practices. When we give up the concept of truth as a perspective from nowhere, 'we can do no better than move back and forth between different standpoints, playing one off against the other' (McCarthy and Hoy 1994, p. 81).

Our policy conclusions gain normative weight particularly in the European Economic and Monetary Union context because the European Parliament is a particularly weak principal, as she has no instruments for sanctioning the ECB. Financial market are no substitutes for deliberative mechanisms. Only deliberation in monetary policy allows to take on the bureaucratic challenge that an independent central bank represents to democracy.

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