Introducing Instruments of Central Bank Accountability in a Monetary Union

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Abstract

This paper analyses the possibility of introducing instruments of central bank accountability in a monetary union. In our model, monetary policy is influenced by the governments of the member states depending on the degree of autonomy of the central bank. Instruments of accountability are introduced which generate different expected losses for a government. The amount of the expected loss will determine the approval of a government to the implementation of a certain mechanism. We show that the agreement between the governments will only be unanimous for the definition of the inflation target of the central bank.

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1 Introduction

It is common uderstanding among economists that an independent central bank is one way to achieve a low and stable inflation rate. Politics have also acknowledged that view as an increasing number of independent central banks shows. Investigations concerning the independence of the European Central Bank (ECB) often come to the conclusion that the ECB is one of the most autonomous central banks in the world, e.g. de Haan and Eijffinger (2000). At the same time, accountability of the ECB is evaluated as not that far-reaching. Therefore, it is often demanded that its accountability should be enhanced. But for more accountability, mechanisms to hold the central bank responsible for monetary policy are needed. These mechanisms easily collide with the independence of the central bank. If they are not properly designed the restriction of central bank independence could be the result.

For the ECB, independence is enshrined in the Treaty and is therefore regarded as well protected, because all member states of the European Union have to agree upon a change. But as the draft treaty of the European Convention shows, the position of the ECB is not inviolable. The question we investigate is if it is possible that the governments of countries forming a monetary union are able to agree on the introduction of different accountability mechanism.

Considerations about the independence of a central bank are mostly found in the literature concerning the inflation bias of monetary policy. To reduce this bias, four solutions are proposed, which grant different forms of independence to a central bank: monetary policy rules, appointment of a conservative central banker, reputation building or a contract with the central bank (Briault, Haldane, and King 1997, p. 300). In this paper we will use a central bank with different degrees of independence and a conservative central banker as modelling framework. In the status quo, there is no accountability mechanism in place.

For the ECB as an supranational institution, an additional aspect is to consider. The governments of the member states of the monetary union are able to introduce accountability mechanism via a change of the Treaty. To evaluate the effects of such mechanism, each government will consider the impact on its loss function. The ECB conducts monetary policy for the whole euro area, whereas the governments of the member states are concerned with economic circumstances in their own "region". If governments form the institution that keeps the central bank accountable, approval for the introduction of different measures of accountability will depend on their effects on the economy in this country. Even if another

institution on the European level and not the governments control the central bank, it is plausible to assume that members of this institution will explicitly or implicitly have national interests in mind. But the literature mostly analyses the relationship between a central bank and a government where both institutions are concerned about the same economic area. One exception is e.g. Dixit and Jensen (2003) analysing an incentive contract for a central bank in a monetary union. Another one is Dixit (2000) investigating the sustainability of commitment to a monetary rule as well as Bottazzi and Manasse (2002) examining the distribution of seignorage in a monetary union. Castren (1999) analyses whether a country would join a monetary union, because it would gain from such an arrangement. In this paper, we assume that monetary policy is already delegated to a central bank for the whole currency area and whether additional accountability mechanisms can be introduced after granting independence to the central bank.

The main aspects of the paper can be summarised as follows: Firstly, we look at independence and accountability jointly in one model. Secondly, we analyse independence and accountability of a central bank which conducts monetary policy for a monetary union. Thirdly, we investigate whether governments with different national interests could agree on the introduction of measures to hold the central bank accountable. We do not examine the effect on central bank behaviour the use of such an mechanism would have or the difficulties of an institutional implementation in the euro area. Also, we do not weigh the pros and cons of different mechanisms.

The plan of the paper is as follows: In the next section, explain more closely the assumed relationship between accountability and independence. In section three the basic model is introduced and marks the *status quo* where a central bank conducts monetary policy for a monetary union. Then the effects of four mechanisms of accountability related to different aspect of independence are analysed and the resulting inflation rates and expected losses for a representative government are determined. These expected losses form the basis for a comparison with the *status quo* in section five. In this way, the costs for the governments and the likelihood of approval of a government to a certain accountability mechanism can be derived. The final section concludes.

2 The Interdependence between Independence and Accountability

A central bank is independent if the bank can conduct monetary policy free of constraints and influence from government, parliament or different interest groups. As a rule, central bank independence is divided into personnel, financial and political independence (see e.g. de Haan and Eijffinger 2000). Personnel independence describes the influence of the government on the selection, (re-) appointment and replacement of central bankers as well as the terms of office. A financially independent central bank cannot be forced to finance the budget deficit of the government directly or indirectly. Political independence is divided into goal and operational independence. With goal independence the central bank is able to determine the objectives of monetary policy like the target inflation rate as well as the order of different objectives like inflation and unemployment. Operational independence puts the central bank in the position to choose and use the instruments to reach the objectives in its own way.

Accountability of the central bank demands that the bank is responsible for the process and the results of monetary policy, able to explain its actions, and includes mechanisms to sanction the behaviour of the central bank. As well as independence the definition of accountability contains different elements (de Haan and Eijffinger 2000, p. 397 or Eijffinger and de Haan 2000, p. 47-50). The first element of accountability concerns the decision about the definition and order of monetary policy objectives, the second element is transparency with respect to results and process of monetary policy, and the third element is final responsibility for monetary policy. Instruments in this respect are several forms of overriding the decisions of the central bank, the right to re-appoint or dismiss central bankers, and even the possibility to change the legal basis of the central bank.

As we can see, accountability affects the same areas as independence but the relationship between them is complex because more accountability does not necessarily mean less independence (Issing, Gaspar, Angeloni, and Tristani 2001, p. 139). For instance, if the central bank is not responsible for the definition of the monetary objectives it is not contestable in this respect and can reject the influence of interest groups. At the same time, the central bank cannot behave strategically with respect to the definition and this enhances accountability. Here, more accountability leads to less independence with respect to goal independence, but to more independence with respect to the influence of interest

groups. Furthermore, it is not meaningful to hold a fully dependent central bank responsible, because the bank has no opportunity to decide independently. Due to this close relationship, independence and accountability should be investigated within one model. This is in contrast to the literature where independence and accountability are often analysed separately. One exception is e.g. Briault *et al.* (1997).

The evaluation of the possibility to introduce accountability instruments in a monetary union, a theoretical model is employed. Independence is modelled as the degree the central bank can pursue the minimisation of its own loss function or whether the bank had also to consider the objectives of the governments. The modelling of accountability is done more differentiated to allow for different mechanisms.

One possibility to model accountability is to equate accountability with cooperation (Demertzis, Hallet, and Viegi 1998). Another closely related work is the analysis of Castellani (2002) investigating accountability in a similar framework but restricted to the element of *ex post* political intervention. If the central bank would expect to be held accountable in this way, it would take the preferences of the governments into account. In the approach used here, the central bank is already concerned with governments' interests depending on the degree of autonomy. Furthermore, we try to assess whether governments in a monetary union can agree on the introduction of accountability mechanisms, but do not analyse the effects on central bank behaviour of using the mechanism.

A second difference to the existing literature is the investigation of different accountability mechanisms and not only the *ex post*-change of central bank decisions. These accountability aspect correspond closely to related aspects of independence. These are

- goal independence and the accountability for the definition of the target system,
- personnel independence and the replacement of the central banker,
- operational independence and the change of central bank decisions repeatedly,
- operational independence and the change of central bank decisions for one time.

3 The Basic Model

The analysis of independence and accountability is based on the model of Eijffinger and Hoeberichts (2002) for accountability combined with Eijffinger and de Haan (2000, S. 40ff.) for modelling independence of a central bank. These models are broadened by taking into account that monetary policy is carried out in a monetary union and for different mechanisms of accountability. The benchmark resembles the framework for monetary policy-making in the euro area with the ECB as the single central bank conducting monetary policy.

The order of events without any accountability mechanism is as follows

- the degree of independence is granted to the central bank by the governments and exogenous to the model,
- rational inflation expectations are formed,
- the supply shock is realised,
- the central bank – or governments in case of a completely dependent central bank – determine the optimal inflation rate given the supply shock.

If an accountability mechanism is introduced, the decision to do so is made after the degree of independence is determined but before the inflation expectations are formed and monetary policy is conducted. To assess the advantage of a mechanisms, the governments would rely on the expected loss generated in presence of the mechanism.

The economies of the member states of the monetary union form the economy of the currency area. The aggregated supply function of the currency area is given by

$$x = x^N + \pi - \pi^e + \epsilon.$$

Normal capacity utilisation, x^N, is normalised to one, ϵ denotes the supply shock of the monetary union as a whole with zero mean and variance σ_ϵ^2, π denotes the inflation rate of the union, and π^e expected inflation. Without loss of generality, the gap between actual, π, and expected inflation, π^e, translates one to one into the gap between actual, x, and normal capacity utilisation.

Differences between country variables and their aggregate counterparts occur because of country-specific shocks hitting the economies and the respective transmission mechanism are dissimilar. Country-level variables and aggregated variables

differ by chance and we assume that:

$$\pi_i = \pi - v_i \quad \text{and} \quad x_i = x - u_i.$$

The expected values of both idiosyncratic shocks, v_i and u_i, are zero and the variances are given by $\sigma^2_{v_i}$ and $\sigma^2_{u_i}$, respectively with i denoting the respective country.

Even if monetary policy is conducted for the whole currency area, the governments of the countries forming the union take into account only their own economic situation. Therefore, we assume the following quadratic loss function with respect to monetary policy for every government

$$L^G_i = \frac{h}{2}(\pi_i - \pi^*_i)^2 + \frac{1}{2}(x_i - x^*_i)^2, \quad \forall i.$$

Each government attaches the same relative weight, $h/2$, to the gap between actual and target inflation rate, π^*_i. Another source of loss for a government is the gap between actual, x_i, and target value of capacity utilisation, x^*_i. The latter is a multiple λ_i of the normal capacity utilisation, $x^*_i = \lambda_i x^N_i = \lambda_i$. As a rule, the capacity utilisation target will be higher than the normal rate, $\lambda_i > 1$ (Briault, Haldane, and King 1997, p. 303). For further simplification, all governments express the same inflation target, $\pi^*_i = \pi^*, \forall i$.

Contrary to a government, the central bank decides about monetary policy by taking into account the economic situation of the whole currency area. Therefore, we assume that the loss function of the central bank has the same form as that of a government, but contains aggregated variables rather than country variables:

$$L^{CB} = \frac{f}{2}(\pi - \pi^*)^2 + \frac{1}{2}(x - x^*)^2.$$

The inflation target of the central bank is the same as that of every government, $\pi^*_i = \pi^*, \forall i$. This assumption will be relaxed in subsection 4.3. We assume that the central bank is more inflation averse than a government and, therefore, attaches a higher relative weight to the inflation gap, $f > h$ (Rogoff 1985).

If the governments can influence the monetary policy of the central bank, the objective function of the central bank will not only contain their own loss function but also the aggregated loss function of the governments. The influence of a government on central bank policy will depend on its political weight b_i, $\sum_i b_i = 1$ (Dixit 2000, p. 761/2). The parameter γ represents the degree of independence, where $\gamma = 1$ represents a completely dependent and $\gamma = 0$ a com-

pletely independent central bank.[1] Furthermore, we start with a general form of the objective function and assume different capacity utilisation targets for the governments, λ_i, as well as for the central bank, Λ. The objective function of the ECB is contained as a special case, $x^* = \Lambda x^N = 1$, where the bank does not try to achieve a capacity utilisation target above normal. Summarising this, the final objective function of the central bank, depending on the degree of independence and expressing country-specific variables as function of aggregate variables, can be written as:

$$\begin{aligned} Z &= \gamma \sum_i b_i L_i^G + (1-\gamma) L^{CB} \\ &= \gamma \sum_i b_i \left[\frac{h}{2} \left(\pi_i - \pi_i^*\right)^2 + \frac{1}{2} \left(x_i - \lambda_i\right)^2 \right] + (1-\gamma) \left[\frac{f}{2} (\pi - \pi^*)^2 + \frac{1}{2} (x - \Lambda)^2 \right] \\ &= \gamma \sum_i b_i \left[\frac{h}{2} (\pi - v_i - \pi^*)^2 + \frac{1}{2} (x - u_i - \lambda_i)^2 \right] \\ &\quad + (1-\gamma) \left[\frac{f}{2} (\pi - \pi^*)^2 + \frac{1}{2} (x - \Lambda)^2 \right]. \end{aligned}$$

For a completely independent central bank, this function reduces to the loss function of the central bank and for an completely dependent central bank, the aggregated loss function of the governments remains. Minimisation of the monetary policy objective function with respect to the aggregated inflation rate and assuming rational expectations results in an optimal inflation rate of

$$\pi^{**} = \pi^* - \frac{1 - \gamma\lambda}{\eta} + \frac{(1-\gamma)\Lambda}{\eta} + \frac{\gamma(h\delta + \mu) - \epsilon}{1 + \eta},$$

and rational inflation expectations are given by

$$\pi^e = \pi^* - \frac{1 - \gamma\lambda}{\eta} + \frac{(1-\gamma)\Lambda}{\eta},$$

$$\delta := \sum_i b_i v_i, \ \mu := \sum_i b_i u_i, \ \lambda := \sum_i b_i \lambda_i, \ \eta := \gamma h + (1-\gamma) f.$$

Inflation expectations equal the optimal inflation rate if no shock occurs. In case of a not completely independent central bank, the inflation bias does not only arise because of an output goal above normal for the whole currency area, but

[1] Another possibility to incorporate independence is to consider the relative weight of the inflation gap (Eijffinger and de Haan 1996, p. 20). But by modelling independence by weighing the two loss functions we can also allow for different inflation targets of the central bank and governments.

also for the above normal output goals of the governments. The optimal inflation rate as well as inflation expectations are influenced by the weighted average of the preferences of the governments and the central bank, f and h, where the weight is given by the degree of independence granted to the central bank. If the central bank is completely independent, $\gamma = 0$, inflation and inflation expectations reduce to

$$\begin{aligned} \pi^{**} &= \pi^* - \frac{1-\Lambda}{f} - \frac{\epsilon}{1+f}, \\ \pi^e &= \pi^* - \frac{1-\Lambda}{f}. \end{aligned}$$

If the central bank targets normal capacity utilisation, inflation expectations equal the target inflation rate. Because of the higher priority fighting inflation of the central bank, the inflation bias gets a lower weight $1/f$ compared to $1/\eta$. For an completely dependent central bank, $\gamma = 1$, the two equations are given by

$$\begin{aligned} \pi^{**} &= \pi^* - \frac{1-\lambda}{h} + \frac{h\delta + \mu - \epsilon}{1+h}, \\ \pi^e &= \pi^* - \frac{1-\lambda}{h}. \end{aligned}$$

As a standard result in the literature this reproduces the outcome that inflation expectations and inflation are higher for a dependent central bank as long as the aggregated output objective of the governments is higher than that of the central bank.

Because a government decides *ex ante*, before actual monetary policy actions are taken, about the approval of the introduction of a mechanism it does not know the realisation of shocks hitting the economy. Therefore, the decision of the government depends on its expected loss. To keep the analysis tractable, we investigate the expected loss of a government for a monetary union consisting of two countries. In the following, country 1 will be regarded as representative. In the basic case, the expected loss of government 1 amounts to

$$\begin{aligned} E[L_1^G] &= E\left[\frac{h}{2}(\pi_1 - \pi^*)^2 + \frac{1}{2}(x_1 - \lambda_1)^2\right] \\ &= \frac{h}{2}E(\pi - v_1 - \pi^*)^2 + \frac{1}{2}E(x - u_1 - \lambda_1)^2 \\ &= \left[\frac{h[(h\gamma b_1 - 1 - \eta)^2 + h\gamma^2 b_1^2]}{(1+\eta)^2}\right]\frac{\sigma_{v_1}^2}{2} + \left[\frac{(\gamma b_1 - 1 - 1\eta)^2 + h\gamma^2 b_1^2}{(1+\eta)^2}\right]\frac{\sigma_{u_1}^2}{2} \\ &+ \left[\frac{(1+h)\gamma^2 b_2^2}{(1+\eta)^2}\right]\frac{\sigma_{u_2}^2 + h^2\sigma_{v_2}^2}{2} + \left[\frac{h+\eta^2}{(1+\eta)^2}\right]\frac{\sigma_\epsilon^2}{2} \\ &+ \frac{1}{2}\left[\frac{h(\gamma\lambda - 1 + (1-\gamma)\Lambda)^2}{\eta^2} + (1-\lambda_1)^2\right], \end{aligned}$$

and depends on the variance of the different shocks hitting its own as well as the other economy in the monetary union, $\sigma^2_{v_i}$ and $\sigma^2_{u_i}$, $i = 1, 2$ and on the variance of the aggregated shock σ^2_ϵ. The higher the variance of the shocks the higher the expected loss, because the central bank does not completely offset the effects of shocks on inflation. The central bank conducts monetary policy for the whole currency area and takes the preferences of every government into account depending on its degree of independence. Therefore, the expected loss of the government 1 also depends on the shocks of the other economy. For a completely independent central bank, $\gamma = 0$, the expected loss of government 1 would only be determined by the variances of its own and the aggregated shock.

The dependence of the expected loss on the variances is true for all analysed mechanisms but the strength of the influence depends on the mechanism used. Furthermore, the inflation bias resulting from capacity utilisation targets of the governments and the central bank increases the expected loss.

For the governments, there is an optimal degree of independence serving their interests best. In contrast to this approach, Eijffinger und Hoeberichts (2002) assume that the central bank chooses the degree of independence for itself. That means it decides how much to incorporate the interests of the government to avoid being overruled. In this paper we assume that independence is exogenous. As the discussion about independence and accountability of the ECB shows, it seems difficult to determine and carry through the optimal degree of independence. This is not least because of the difference between the degree of independence granted by law and the actual degree of independence that depends also on the political and economic circumstances and the personality of the central bankers.

In the following, we will analyse if the introduction of different instruments of accountability lead to different expected losses for a representative government in a monetary union. The approval of the introduction will depend crucially on the expected loss incorporated by every government. If the loss is higher than the *status quo*, it seems unlikely that a country will give approval to this device. To evaluate the mechanisms a comparison of the expected losses of a government is in order.

4 Effects of the Accountability Mechanisms

4.1 Change of Decision-Making

One instrument to hold the central bank accountable is the possibility to change the decisions of the central bank regarding the inflation rate. We distinguish between two opportunities to do so. The first is a one-time change in which the decisions of the central bank are replaced by the joint decision of the governments of the currency area. In this case, inflation expectations cannot adjust to the new situation. The second opportunity is that the governments consistently override the decision of the central bank. In this case, the inflation expectations will adjust to the new situation. This situation for a constant overruling of central bank decisions would be the same as abolishing central bank independence.

The first to accountability mechanisms deal with the change of central bank decisions by the governments. If the governments decide to, they can implement a negotiated inflation rate that minimises the aggregated loss function of governments. The loss of a government is weighted by its political influence b_i. Therefore, this framework resembles a negotiation of the inflation rate between the member countries of the monetary union. This environment is the same as a completely dependent central bank in the basic model. We assume that the political influence of a government is the same for negotiations between the countries and for influencing the central bank. Therefore, the aggregated objective function is given by

$$\begin{aligned} L &= \sum_i b_i L_i^G + C \\ &= \sum_i b_i \left[\frac{h}{2} \left(\pi - v_i - \pi^* \right)^2 + \frac{1}{2} \left(x - u_i - \lambda_i \right)^2 \right] + C, \end{aligned}$$

where C denotes costs for an enforcement of the accountability instrument if the central bank decision is replaced and c^{Mk} denotes the share of a single government with k denoting the mechanism. In Lohmann (1992, p. 277) the political institutions determine the costs level. The costs are the higher the more difficult the accountability mechanism is. One special feature of the EMU is that in the institutions that would control the ECB different national interests meet regardless wether the bank is finally responsible to the European Parliament, the Commission, or the Council of the European Union. Different interests prevail because the members of these institutions come from different countries with different histories of monetary policy-making and because the single monetary

policy of the ECB will, with high probability, transmit differently within the respective economies. Therefore, the members of a monetary union with different interests have to reach an agreement with regard to the central bank. Especially if unanimity is demanded, the costs can be prohibitively high, because no agreement seems possible. Whether this is the case will depend on the expected loss a government incurs through the decision of holding the central bank accountable. The expected loss will also determine the decision about the introduction of an accountability mechanism.

One-time change of decision-making (M1) A one-time change of the central bank decision is assumed to happen *ex post*. Therefore, it is not possible that inflation expectations can adapt to the new situation[2] and expectations do not differ from the basic model (see also Dixit 2000, p. 766):

$$\pi^e = \pi^* - \frac{1-\gamma\lambda}{\eta} + \frac{(1-\gamma)\Lambda}{\eta}.$$

This leads to an inflation rate of

$$\pi^{**} = \pi^* + \frac{\delta h + \mu - \epsilon}{1+h} + \frac{(1-\gamma)\Lambda + \gamma\lambda - 1 - \eta(1-\lambda)}{(1+h)\eta}.$$

The resulting expected loss of government 1 is as follows

$$\begin{aligned} E[L_1^{G,M1}] &= \frac{h + h^2(1-b_1)^2}{1+h}\frac{\sigma_{v_1}^2}{2} + \left[\frac{h+(1-b_1)^2}{1+h}\right]\frac{\sigma_{u_1}^2}{2} \\ &+ \left[\frac{b_2^2}{1+h}\right]\frac{\sigma_{u_2}^2 + h^2\sigma_{v_2}^2}{2} + \left[\frac{h}{1+h}\right]\frac{\sigma_\epsilon^2}{2} \\ &+ \frac{h(\gamma\lambda - 1 + (1-\gamma)\Lambda)^2}{2\eta^2(1+h)} \\ &+ \frac{h(\lambda_1 - 1)(\gamma\lambda - 1 + (1-\gamma)\Lambda)}{\eta(1+h)} \\ &+ \frac{h(1-\lambda_1)^2 + h(\lambda - \lambda_1)^2}{2(1+h)} + c^{M1}. \end{aligned}$$

Differences to the expected loss in the basic case arise because the inflation bias as well as stabilisation contained in the inflation rate differ. The stabilisation of shocks only occur in accordance of the relative inflation weight of the governments. The inflation bias is still influenced by the inflation weight of the central bank because inflation expectations have not changed.

[2]Implicitly that means, that the use of the override mechanism cannot be foreseen. It would be a desirable extension of the model to investigate the effects if the use of the accountability mechanism takes place with a certain probability. For now, we assume that the probability of the use of the overriding mechanism is zero if expectations are formed.

Repeated change of decision-making (M2) In contrast to a one-time decision change, a repeated overriding of central bank decision-making by the governments is assumed to resemble an abolishing of central bank independence. Because this change happens *ex ante*, inflation expectations can adapt to the new situation. In this case, inflation expectations and optimal inflation rate are given by:

$$\begin{aligned}\pi^e &= \pi^* - \frac{1-\lambda}{h},\\ \pi^{**} &= \pi^* - \frac{1-\lambda}{h} + \frac{\delta h + \mu - \epsilon}{1+h}.\end{aligned}$$

The expected loss of government 1 results in

$$\begin{aligned}E[L_1^{G,M2}] &= \left[\frac{h(1+h(1-b_1)^2)}{(1+h)}\right]\frac{\sigma_{v_1}^2}{2} + \left[\frac{h+(1-b_1)^2}{(1+h)}\right]\frac{\sigma_{u_1}^2}{2}\\ &+ \left[\frac{b_2^2}{(1+h)}\right]\frac{\sigma_{u_2}^2 + h^2\sigma_{v_2}^2}{2} + \left[\frac{h}{(1+h)}\right]\frac{\sigma_\epsilon^2}{2} + \frac{1}{2}\left[\frac{(1-\lambda)^2}{h} + (1-\lambda_1)^2\right]\\ &+ c^{M2}.\end{aligned}$$

Again, the difference in the expected loss in case of a repeated decision change occurs because of differences in the resulting inflation bias and stabilisation of the economy. Both are only due to the inflation weight of the governments and the relative inflation weight of the central bank does not play a role anymore.

4.2 Replacement of Central Banker

The replacement of the central banker (M3) is a public process leading to an adaptation of the inflation expectations to the new preferences of the central bank. We exclude that the new central banker is more prone to an influence by the governments so that the independence parameter γ and the political weights b_i do not change. The only parameter that changes is the weight on the inflation gap from f to g in the central bank's loss function indicating the new central banker. Also, we do not investigate the basis for dismissing a central banker or the credibility of this mechanism like in Walsh (2002) but only compare the expected loss of a government by replacing the central banker.

The resulting optimal inflation rate and inflation expectations are given by

$$\begin{aligned}\pi^e &= \pi^* - \frac{1-\gamma\lambda}{\gamma h + (1-\gamma)g} + \frac{(1-\gamma)\Lambda}{\gamma h + (1-\gamma)g},\\ \pi^{**} &= \pi^* - \frac{1-\gamma\lambda}{\gamma h + (1-\gamma)g} + \frac{(1-\gamma)\Lambda}{\gamma h + (1-\gamma)g} + \frac{\gamma(h\delta+\mu)-\epsilon}{1+\gamma h + (1-\gamma)g}\end{aligned}$$

and the expected loss of government 1 amounts to

$$\begin{aligned} E[L_1^{G,M3}] &= \left[\frac{h[(\gamma b_1 - 1 - a)^2 + h\gamma^2 b_1^2]}{(1+a)^2}\right]\frac{\sigma_{v_1}^2}{2} + \left[\frac{(\gamma b_1 - 1 - a)^2 + h\gamma^2 b_1^2}{(1+a)^2}\right]\frac{\sigma_{u_1}^2}{2} \\ &\quad + \left[\frac{(1+h)\gamma^2 b_2^2}{(1+a)^2}\right]\frac{\sigma_{u_2}^2 + h^2\sigma_{v_2}^2}{2} + \left[\frac{h+a^2}{(1+a)^2}\right]\frac{\sigma_\epsilon^2}{2} \\ &\quad + \frac{1}{2}\left[\frac{h(\gamma\lambda - 1 + (1-\gamma)\Lambda)^2}{a^2} + (1-\lambda_1)^2\right] + c^{M3}, \\ a &:= \gamma h + (1-\gamma)g. \end{aligned}$$

This result resembles the *status quo* except for another value of the relative weight, which the central bank attaches to the inflation gap in its loss function.

4.3 Determination of Inflation Target

The last examined accountability mechanism is the definition of objectives of monetary policy by different authorities. We constrain the analysis to the inflation target. Up to now, we assumed identical inflation targets for every government and the central bank. Now we ask (1) what target the governments would determine for the central bank, and (2) what target the central bank would choose for itself.

The order of events is as follows. Firstly, the central bank or the governments determine the inflation target for the central bank. Secondly, the central bank chooses the optimal inflation rate given this inflation target. Therefore, we solve for the optimal inflation rate given the inflation target in a first step and minimise the loss function of the governments or the central bank in regards to the target of the central bank constrained by the supply function and the equation for the optimal inflation rate at the second stage.

Starting point is the objective function of monetary policy, but now the inflation target for the government, π_G^*, differs from that of the central bank, π_{CB}^*:

$$\begin{aligned} Z &= \gamma \sum_i b_i \left[\frac{h}{2}(\pi - v_i - \pi_G^*)^2 + \frac{1}{2}(x - u_i - \lambda_i)^2\right] \\ &\quad + (1-\gamma)\left[\frac{f}{2}(\pi - \pi_{CB}^*)^2 + \frac{1}{2}(x - \Lambda)^2\right]. \end{aligned} \tag{1}$$

After adaptation of inflation expectations, the optimal inflation rate and inflation

expectations are given by

$$\begin{aligned}\pi^{e} &= \frac{\gamma h\pi_G^* + (1-\gamma)f\pi_{CB}^*}{\eta} - \frac{1-\gamma\lambda-(1-\gamma)\Lambda}{\eta},\\ \pi^{**} &= \frac{\gamma h\pi_G^* + (1-\gamma)f\pi_{CB}^*}{\eta} - \frac{1-\gamma\lambda-(1-\gamma)\Lambda}{\eta} + \frac{\gamma(\delta h+\mu)-\epsilon}{\eta+1} \qquad (2)\end{aligned}$$

and depend on the weighted average of both inflation targets.

Inflation target determined by governments (M4) To determine the inflation target for the central bank the governments take into account that the central bank will set the optimal inflation rate according to equation (2). Considering this, the governments minimise their aggregated expected loss by choosing the inflation target. The resulting target is given by

$$\pi_{CB}^* = \pi_G^* + \frac{1-\gamma\lambda-(1-\gamma)\Lambda}{(1-\gamma)f}.$$

Inflation and inflation expectations correspond to

$$\begin{aligned}\pi^{e} &= \pi_G^*,\\ \pi^{**} &= \pi_G^* + \frac{\gamma(\delta h+\mu)-\epsilon}{1+\eta}.\end{aligned}$$

If the inflation target of the central bank is set by the governments of the monetary union jointly, the loss of government 1 is given by

$$\begin{aligned}E[L_1^{G,M4}] &= \left[\frac{h((\gamma h b_1-1-\eta)^2+h\gamma^2 b_1^2)}{(1+\eta)^2}\right]\frac{\sigma_{v_1}^2}{2} + \left[\frac{(\gamma b_1-1-\eta)^2+h\gamma^2 b_1^2}{(1+\eta)^2}\right]\frac{\sigma_{u_1}^2}{2}\\ &+ \left[\frac{(1+h)\gamma^2 b_2^2}{(1+\eta)^2}\right]\frac{\sigma_{u_2}^2+h^2\sigma_{v_2}^2}{2} + \left[\frac{h+\eta^2}{(1+\eta)^2}\right]\frac{\sigma_\epsilon^2}{2} + \frac{1}{2}(1-\lambda_1)^2 + c^{M4}.\end{aligned}$$

By determining the inflation target for the central bank the governments can eliminate the inflation bias by removing the term which originates from the difference between normal and target capacity utilisation. If the central bank pursues no separate target Λ, the inflation objective of the central bank had not to offset the inflation bias resulting from that objective. Inflation expectations resemble the target inflation rate of the governments. The remaining expected loss is due to shocks hitting the economy and the capacity utilisation target of government 1.

Inflations target set by central bank (M5) The central bank minimises its objective function according to the supply function and the optimal inflation

rate (2) with respect to π^*_{CB} and gets

$$\pi^*_{CB} = \pi^*_G - \frac{1-\gamma\lambda-(1-\gamma)\Lambda}{\gamma h}.$$

It comes not as a surprise that the inflation target corresponds to inflation expectations. Inflation and inflation expectations result in:

$$\begin{aligned}
\pi^e &= \pi^*_G - \frac{1-\gamma\lambda-(1-\gamma)\Lambda}{\gamma h}, \\
\pi^{**} &= \pi^*_G - \frac{1-\gamma\lambda-(1-\gamma)\Lambda}{\gamma h} + \frac{\gamma(\delta h+\mu)-\epsilon}{1+\eta}.
\end{aligned}$$

The expected loss of government 1 is given by

$$\begin{aligned}
E[L_1^{G,M5}] &= \left[\frac{h(1+\eta-\gamma h b_1)^2 + h^2\gamma^2 b_1^2}{(1+\eta)^2}\right]\frac{\sigma^2_{v_1}}{2} + \left[\frac{(1+\eta-\gamma b_1)^2 + h\gamma^2 b_1^2}{(1+\eta)^2}\right]\frac{\sigma^2_{u_1}}{2} \\
&+ \left[\frac{(1+h)\gamma^2 b_2^2}{(1+\eta)^2}\right]\frac{\sigma^2_{u_2}+h^2\sigma^2_{v_2}}{2} + \left[\frac{h+\eta^2}{(1+\eta)^2}\right]\frac{\sigma^2_\epsilon}{2} \\
&+ \frac{1}{2}\left[\frac{(\gamma\lambda-1+(1-\gamma)\Lambda)^2}{\gamma^2 h} + (1-\lambda_1)^2\right] + c^{M5}.
\end{aligned}$$

A comparison between the two optimal inflation rates shows that inflation is higher if the central bank determines its inflation target. This matches with the result of Muscatelli (1998, S. 539) where the average inflation bias is higher in the case of a goal independent central bank.

5 Comparison between different accountability mechanisms

Before we compare the different accountability mechanisms let us state shortly the differences between a central bank in a monetary union and a central bank accountable to only one government. The expected loss of a representative government depends on the individual political weight of a country. But the main difference between the set-up with a single government to an approach containing a group of governments is the nature of the costs for holding the central bank accountable. If there is only one country, then only one government decides. If there is a group of governments, then every single government has to approve the accountability instrument. Therefore, it is more difficult to achieve a decision. If all governments can expect to gain, then this approval would be straightforward. But as the following analysis shows this must not be the case.

To assess the change of the expected loss in a monetary union comparable to the euro system, where the central bank is foremost committed to price stability, we assume that the central bank has a capacity utilisation target that equals the normal value of utilisation, $\Lambda = 1$. This is because the ECB is appointed to stabilise prices and has no output objective as an independent goal. The aggregated goal for the capacity utilisation of the governments is still assumed to be $\lambda > 1$.

The government of country 1 will only agree upon the introduction of an accountability mechanism if the costs of the use are not higher than the gain. If there is no expected gain the country will not even approve to the introduction of the mechanism. The change of the expected loss of government 1 caused by the use of an accountability mechanism consists of the expected loss in the basic case less the expected loss arising from the use of the accountability mechanism. For every mechanism, the change of the expected loss arises from four sources, the idiosyncratic shocks of government 1 and 2, the aggregated shock and the inflation bias due to the capacity utilisation target. To get a clear picture of the change, we split the expected loss change up into the different sources and indicate the direction of the change. The respective equations are contained in the appendix. This results in the following assessment of the development of the expected loss:

Mechanism	Idiosyncratic shocks	Idiosyncratic shocks	Aggregated shock	Inflation bias
$\Delta^{Mk}E(L_1^G)$	country 1	country 2		
$= E[L_1^G] - E[L_1^{G,Mk}]$	$\sigma_{u_1}^2 + h^2\sigma_{v_1}^2$	$\sigma_{u_2}^2 + h^2\sigma_{v_2}^2$	σ_ϵ^2	λ, λ_1
$\Delta^{M1}E(L_1^G)$	> 0	< 0	> 0	$\lessgtr 0$
$\Delta^{M2}E(L_1^G)$	> 0	< 0	> 0	< 0
$\Delta^{M3}E(L_1^G)$	> 0	> 0	< 0	> 0
$\Delta^{M4}E(L_1^G)$	0	0	0	> 0
$\Delta^{M5}E(L_1^G)$	0	0	0	< 0

Table 1: Change of the expected loss of government 1 for the five accountability mechanisms with respect to the individual parts of the expected loss.

A comparison between the expected losses neglecting the costs of the use can indicate whether an approval of an accountability mechanism by the governments seems probable. Beginning with the two simplest cases, we first concentrate on the definition of the target system of the central bank because these accountability mechanism result in unambiguous changes of the expected gain.

If the governments prescribe the inflation target for the central bank (M4), the expected loss of the representative government is lower compared to the *status quo*. The inflation target will be determined so as to neutralise the inflation bias coming from the capacity utilisation target of the governments weighted with the preferences of the central bank $1/(1-\gamma)f$. This leads to inflation expectations and an optimal inflation rate that are lower as in the *status quo*. Inflation expectations even equal the inflation target of the governments but not that of the central bank. The central bank is urged to target an inflation rate that lies below the target of the governments. Moreover, shock stabilisation is the same as in the original situation. In this case, the only source of a change of the expected loss comes from the different inflation bias arising from the capacity utilisation objectives. Because this bias is lower with the determination of the inflation target, the expected loss is lower too. Therefore, it does not seem implausible to expect that the governments would agree on the change from a goal independent to a goal dependent central bank.

If the central bank selects the inflation target for itself (M5), the expected loss of a government is higher than in the basic case. Again, the degree of output stabilisation does not change and the inflation bias from the different capacity utilisation targets is the only source for a change of the expected loss. But now, the inflation expectations as well as the optimal inflation rate include a bias. The central bank chooses an inflation target that is higher than the inflation target of the governments taking the aggregated capacity utilisation target into account. The target is even higher than the inflation expectations in the basic case because the weighting is done only according to government preferences. Therefore, the expected loss is higher if the central bank determines the inflation target for itself.

Both countries would accept that the inflation target of the central bank would be defined jointly by the governments. But the determination of the inflation target by the central bank would not find the approval of the governments.

As the comparison between the two accountability mechanisms regarding decision overriding shows, there is at least an unambiguous pattern for the different components of the expected loss of a representative government. Whether the abolishment of independence or the one-time overriding of a central bank decision will result in a higher expected loss depends on the variance of the different shocks hitting the economy and the aggregated capacity utilisation targets of the governments. If we compare the single components of the expected loss, we see that a country can expect to gain from the use of the accountability mechanism in terms of the country-specific variances and the aggregated shock variance. But in

terms of the the idiosyncratic shock variances of the other country, the picture is reversed. With respect to the inflation bias component, the expected loss would be higher for the abolishing of independence. The one-time overriding of the central bank decision does not result in an unambiguous change of the expected loss. Lets take a look at each accountability mechanism in turn.

For the abolishing of independence (M2), it is hardly surprising that the inflation expectations are higher than with a partly independent central bank. This also affects the part of the expected loss arising from the inflation bias. Without idiosyncratic and aggregated shocks, the repeated overriding of central bank decisions by the governments is not likely to occur because of the higher expected loss.

The opposing result occurs with respect to the aggregated shock. Because the optimal inflation rate is lower in terms of the aggregated shock with a completely dependent central bank, an aggregated shock is allowed to distort the inflation rate more in case of a dependent bank. This arises from the relatively higher weight the governments allocate to the capacity utilisation target. This leads to a higher capacity utilisation in case of a positive output shock bringing it closer to the higher objective of the government. Therefore, the repeated overriding of central bank decisions would be in the interest of the government.

For the idiosyncratic shocks, the picture is not uniform. The optimal inflation rate admittedly is higher in case of the idiosyncratic shocks of both countries if the mechanism takes place. But whereas this leads to a lower expected loss in terms of own shocks, the opposite arises with regard to the shocks of the other country. The explanation has to take into account that the decisions of the governments are a weighted average of the interest of both countries. If one country can put through its interest in regard of idiosyncratic shock stabilisation this will be at the expense of the shock stabilisation of the other country. The weighting is measured by the political weight of each country. If we assume that both countries are symmetric with respect to the idiosyncratic shocks, $\sigma_{u_1}^2 + h^2\sigma_{v_1}^2 = \sigma_{u_2}^2 + h^2\sigma_{v_2}^2$, we can determine a critical value for the political weight,

$$b_1^* = \frac{\gamma(1+h) + 1 + \eta}{2\gamma(1+h)}.$$

If the political weight of country 1 is higher than this threshold, the weight of the change of the expected loss is higher for the own shocks than for the shocks of country 2. Country 1 would prefer the introduction of the accountability mechanism but not country 2. For a relatively big country, $b_1 > b_1^*$, the accountability

mechanism would *c.p.* result in an expected gain. The reverse is true for a relatively small country, $b_1 < b_1^*$.

For the one-time overriding of central bank decisions (M1), inflation expectation do not differ from the basic case per definition. But the optimal inflation rate has a higher inflation bias with respect to the capacity utilisation target of the governments. With respect to the idiosyncratic shocks, optimal inflation is higher but lower with respect to the aggregated shock. Therefore, the expected loss is lower with respect to the aggregated shock if the central bank decisions is overridden with the determination of inflation by the governments. For the idiosyncratic shocks, the same picture arises as with an abolishing of independence. The higher the political weight of a country, the better it can assert its interests in the determination of the inflation rate and the more so, the country's expected loss is lower with accountability.

For the change of the expected loss with regard to the inflation bias, the development depends on the relationship between the capacity utilisation targets. For

$$\lambda_1 = \frac{\eta^2 - \gamma h\eta + 2\lambda - (\gamma h + \eta)\lambda^2}{2\eta}$$

this part of the expected loss will not change with the use of the accountability mechanism. Is the capacity utilisation target of government 1 higher than this critical value, the expected loss decreases with the overriding of the central bank decision and *vice versa*.

For the replacement of the central banker (M3) there is an additional influence in the form of the development of the relative inflation aversion of the central bank. One would expect that if the central banker is more conservative, all governments would gain and an agreement does not seem to be problematic. But this must not be the case, since the reaction of the expected loss with respect to a higher weight of the inflation gap is different for the various shocks. If a more conservative central banker decides about the optimal inflation rate, this would result in lower inflation expectations and lower optimal inflation. But for a government, the consideration of the capacity utilisation gap would not be optimal. Because of the lower inflation bias, the expected loss arising from the inflation bias is lower than in the basic case. But with respect to the aggregated shock, the government would not be better off with a more conservative central banker. Because of the high weight the central banker would assign to fighting inflation, the aggregated shock stabilisation would not get a high priority. But the stabilisation of of idiosyncratic shocks would get a higher weight and the

government would expect to win with a more conservative central banker. The latter result occurs with respect to the idiosyncratic shocks of both countries.

For all three accountability mechanisms, overriding of central bank decisions and more conservative central banker, there is no change of the expected loss if the central bank is completely dependent, $\gamma = 1$. This is compatible with the view that it is not sensible to hold a completely dependent central bank accountable, because there is no leeway in decision-making for the bank and the whole monetary policy is dominated by the interests of the governments.

For a perfectly independent central bank, $\gamma = 0$, the qualitative picture would not change for the overriding of central bank decisions. Still, the change of the expected loss of government 1 would depend on the variance of the different shocks and the capacity utilisation targets of the governments. The expected gain from the replacement of the central banker would depend on the relative weight the new central banker places on the inflation target and the prescription of an inflation target by the government had no effect.

Because of the inconsistent picture with respect to the change of the expected loss of a representative government, there is no clear statement possible about the introduction of the accountability mechanism in a monetary union. The problem is aggravated by the structure of the loss change. For two of the mechanisms, the change of the expected loss is in opposite directions for the idiosyncratic shocks. Because the countries would gain with respect to its own shock but not with respect to the shocks of the other country, an agreement does not seem possible. Only the appointment of a more conservative central banker would find the approval of both governments with respect to the idiosyncratic shocks. With respect to the aggregated shock and the inflation bias, the decisions of both governments would be coincide. The expected loss arising from the aggregated supply shock would lead to the introduction of the accountability mechanisms to override central bank decisions. But the more conservative central banker would not appointed. The picture will be most inconsistent with respect to the expected loss arising from the inflation bias. For the one-time overriding of central bank decisions, the expected approval of governments depends on the relationship between the capacity utilisation targets. The more conservative central banker would gain unanimous approval and the abolishing of independence will unanimously turned down.

Summarising, we cannot give a definite answer whether the countries would agree upon these accountability mechanisms. Therefore, the introduction of account-

ability mechanisms seems not to be very likely if the central bank has already a certain degree of independence granted. On the other hand, it is also not very likely that central bank independence is abolished.

6 Conclusion

Independence and accountability of a central bank are two concepts closely related. Whereas independence is important for economic performance, accountability is mostly used to stress the democratic responsibility of a central bank. There is theoretical and empirical evidence that reveals delegating monetary policy to an independent central bank results in a gain in terms of a lower inflation rate, at least for industrialised countries (Hayo and Hefeker 2002). Whether there are costs in terms of output growth and stabilisation is not that clear (see Eijffinger and de Haan 1996 or Berger et al. 2000). Also, holding the central bank accountable results in costs. Part of these costs is caused by the political institutions which help to hold the central bank responsible for its decisions and the size of the costs will depend on the instrument used.

In a monetary union the institution that holds the central bank accountable will bring together different national interests. Although the central bank conducts monetary policy for the whole monetary union and is concerned with the economic situation at the aggregate level, the national interests are affected by the economic circumstances at the country level. In this paper we have assumed that the national interests are represented by the governments. But the analysis could be translated to every institution which has to deal with different national interests. In this case, costs of holding the central bank accountable are crucially determined by the possibility of reaching an agreement between conflicting interests. An agreement is more likely if all governments gain by using an accountability mechanism.

We have investigated different forms of holding the central bank accountable, e.g. change of decision-making, replacement of the central banker, determining an inflation target. As shown, mechanisms can result in an higher expected loss for a single government and therefore could not hope for to be agreed upon. Determining the inflation target for the central bank by the governments would result in a lower expected loss for every government, if the central bank is not completely independent in the first place, and a goal independent central bank would bring a higher inflation rate than a goal dependent bank. Therefore, it

seems fundamentally possible to reach an agreement between the governments for a change from a goal independent to a goal dependent central bank if the costs of the negotiations are not higher than the gain.

The next step would be to investigate what happens if the central bank accommodates the interests of the governments, regardless of its independence to prevent the use of the accountability instruments. Nevertheless, the costs of holding the central bank accountable are only partially explained and, therefore, need further investigation as well as the connection between independence and accountability.

Appendix

The change of the expected loss of government 1 for the different accountability mechanisms is determined by the difference between the expected loss in the basic case less the expected loss if the mechanism is in place:

$$\Delta^{Mk}E(L_1^G) = E[L_1^G] - E[L_1^{G,Mk}].$$

The change of the expected loss if the decision of the central bank is overridden for one time is given by

$$\begin{aligned}
\Delta^{M1}E(L_1^G) &= \left[\frac{b_1[\gamma(1+h)-1-\eta][\gamma b_1(1+h)-(1+\eta)(2-b_1)]}{(1+\eta)^2(1+h)}\right]\frac{\sigma_{u_1}^2+h^2\sigma_{v_1}^2}{2} \\
&+\left[\frac{b_2^2[\gamma^2(1+h)^2-(1+\eta)^2]}{(1+h)(1+\eta)^2}\right]\frac{\sigma_{u_2}^2+h^2\sigma_{v_2}^2}{2} \\
&+\left[\frac{(h-\eta)^2}{(1+\eta)^2(1+h)}\right]\frac{\sigma_\epsilon^2}{2} \\
&+\frac{(\gamma h-\eta)^2}{2\eta(1+h)}+\frac{\gamma h-\eta}{\eta(1+h)}\lambda_1+\frac{\gamma^2h^2-\eta^2}{2\eta^2(1+h)}\lambda^2+\frac{\eta-\gamma h}{\eta^2(1+h)}\lambda-c^{M1}.
\end{aligned}$$

If the independence of the central bank is abolished the change of the expected loss amounts to

$$\begin{aligned}
\Delta^{M2}E(L_1^G) &= \left[\frac{b_1[\gamma(1+h)-1-\eta][\gamma b_1(1+h)-(1+\eta)(2-b_1)]}{(1+\eta)^2(1+h)}\right]\frac{\sigma_{u_1}^2+h^2\sigma_{v_1}^2}{2} \\
&+\left[\frac{b_2^2[\gamma^2(1+h)^2-(1+\eta)^2]}{(1+\eta)^2(1+h)}\right]\frac{\sigma_{u_2}^2+h^2\sigma_{v_2}^2}{2} \\
&+\left[\frac{(h-\eta)^2}{2(1+h)(1+\eta)^2}\right]\frac{\sigma_\epsilon^2}{2}+\frac{(1-\lambda)^2[\gamma^2h^2-\eta^2]}{2h\eta^2}-c^{M2}.
\end{aligned}$$

If the central banker will be replaced we can identify the development of the expected loss $\Delta^{M3}E(L_1^G)$ as follows

$$\begin{aligned}
\Delta^{M3}E(L_1^G) &= \left[\frac{(1+h)\gamma^2b_1^2[(1+a)^2-(1+\eta)^2]}{(1+a)^2(1+\eta)^2}\right. \\
&\left.+\frac{2\gamma b_1(1+a)(1+\eta)(a-\eta)}{(1+a)^2(1+\eta)^2}\right]\frac{\sigma_{u_1}^2+h^2\sigma_{v_1}^2}{2} \\
&+\left[\frac{\gamma^2b_2^2h^2(1+h)(\eta+a+2)(a-\eta)}{2(1+\eta)(1+a)^2}\right]\frac{\sigma_{u_2}^2+h^2\sigma_{v_2}^2}{2} \\
&+\left[\frac{(a-\eta)[(h-a)(1+\eta)+(1+a)(h-\eta)]}{(1+\eta)^2(1+a)^2}\right]\frac{\sigma_\epsilon^2}{2} \\
&+\frac{h(\eta^2-a^2)\gamma(1-\lambda)}{2\eta^2a^2}-c^{M3}.
\end{aligned}$$

If the inflation target of the central bank is determined by the governments the change of the expected loss in comparison with the basic case is

$$\Delta^{M4} E(L_1^G) = \frac{h\gamma^2(1-\lambda)^2}{2\eta^2} - c^{M4}.$$

If the central bank selects the inflation target by itself the change of the expected loss is given by

$$\Delta^{M5} E(L_1^G) = \frac{(1-\lambda)^2[\gamma^2 h^2 - \eta^2]}{2h\eta^2} - c^{M5}.$$

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