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## **Political Determinants of Central Bank Independence**

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# Political Determinants of Central Bank Independence

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## Abstract

From a normative perspective, it is striking that the degree of central bank independence (CBI) varies considerably across countries. Taking a political economy perspective, this paper demonstrates how different degrees of CBI may be the result of ‘strategic policy-making’. While an independent central bank reduces the incumbent politician’s chances to influence current monetary policy it also raises the costs of future policy changes for political successors. Hence, when deciding on the degree of CBI, incumbent politicians face a trade-off: current influence on monetary policy versus policy durability. This paper shows how various factors change this trade-off and hence the institutional choice. The model predicts that the level of CBI incumbent politicians choose will increase in politicians’ ability to screen central bankers’ preferences, in the degree of political polarization, and in the weight politicians place on future policy outcomes. In contrast, the likelihood for the implementation of an independent central bank decreases in the re-election prospects of incumbents and in the utility central bankers receive from holding office.

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## 1. Introduction

The degree of central bank independence (CBI) varies considerably across countries (Cukierman, 2007, Arnone et al., 2006). This is revealed by both, ‘de jure’ and ‘de facto’ measures of CBI (Eijffinger and De Haan, 1996). De jure measures are based on the analysis of central bank statutes and typically include criteria like the term duration of central bankers, a central bank’s budgetary autonomy, and procedures for central bankers’ appointment (Alesina, 1988, Grilli et al., 1991, Eijffinger and Schaling, 1992).<sup>1</sup> However, as noted by Cukierman (1992), de facto independence may well differ from what is formally laid down in central bank laws.<sup>2</sup> In this regard, Chappell et al. (1993) present empirical evidence for two main sources of political sway on the central bank which also may vary in their importance for different countries. While the first source stems from direct political pressure (‘direct channel of political influence’), the second source rests on politicians’ ability to nominate central bankers that share their ideological preferences and act accordingly (‘indirect channel of political influence’). Hence, political influence may be the result of partisan appointments to the central bank (Waller, 1992).

There is a broad consensus among economists that granting a high level of independence to the central bank is sound policy. This view mainly rests on two theoretical arguments and is also largely supported by empirical evidence (Eijffinger and De Haan, 1996, Berger et al., 2001). First, as shown by Rogoff (1985), delegating monetary policy to an independent and inflation-averse (‘conservative’) central banker can serve as a commitment device to circumvent the famous time inconsistency problem of monetary policy (Kydland and Prescott, 1977, Barro and Gordon, 1983). The second argument in favor of CBI abandons the assumption of politicians acting as benevolent social planners. In this regard, two potential sources that may distort politicians’ preferences from those of society are proposed. First, politicians may aim at increasing their chances of re-election, using monetary policy and thereby create a so called opportunistic political business cycle (Nordhaus, 1975, Persson and Tabellini, 1990). Second, if politicians have partisan preferences, a shift in the composition of government should imply changes in the conduct of monetary policy, and hence a ‘partisan

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<sup>1</sup> This ‘legal approach’ has been criticized for the somewhat arbitrary choice of criteria included and the subjective interpretation of central bank statutes (Eijffinger and De Haan, 1996).

<sup>2</sup> Cukierman et al. (1992) suggest using the turnover rate of central bank governors as an indicator for the level of CBI. The underlying idea is that a longer term length of central bankers is associated with a higher degree of CBI and vice versa. It has been argued, however, that causality may run in the opposite direction since a subservient central banker could virtually hold office forever (Eijffinger and De Haan, 1996).

political business cycle' (Hibbs, 1977, Alesina, 1987). Granting a high degree of autonomy to the central bank should limit these politically induced distortions and hence the scope for political business cycles. Given these potentially large benefits of an independent central bank, one can doubt that the actual degree of CBI is chosen optimally – in a welfare-maximizing sense – in every country. In other words, it seems difficult to explain the variations of CBI across countries when adopting a normative point of view.

Taking a political economy perspective instead, this paper argues that the degree of CBI may be the result of 'strategic policy-making'.<sup>3</sup> It has been shown that incumbent politicians may act strategically by taking into account the impact of their decisions today on their successors' future policy options. In this regard, the 'strategic use of deficits' has received a great deal of attention (Alesina and Tabellini, 1990, Persson and Svensson, 1989, and Tabellini and Alesina, 1990). Persson and Svensson (1989), for instance, demonstrate that governments that face uncertainty about re-election may choose higher budget deficits than they would if re-election was certain, to limit the room for maneuver of subsequent governments. This paper demonstrates how similar strategic considerations may drive incumbent politicians to establish different degrees of CBI. For incumbents there are costs and benefits associated with an independent central bank. While a high level of CBI effectively constraints subsequent governments by raising the costs for future policy changes it also reduces the incumbent's influence on current monetary policy. Hence, when deciding on the degree of CBI, incumbent politicians face a trade-off: policy durability versus current influence.

The model presented below shows how various factors determine this trade-off and hence the institutional choice. To do so, the relationship between purely partisan parties, differing in their preferences over monetary policy, and a central banker is modeled as a signaling game. Central bankers, like politicians, have ideological preferences over monetary policy but additionally receive utility from holding office. If a high degree of CBI is implemented, politicians will not have the means to exert pressure on the central bank since central bankers cannot be replaced. However, neither party can reverse the initial appointment decision which thus is durable. On the contrary, a low level of CBI is associated with a shorter term length of central bankers. In this case, the 'threat of replacement' may force central bankers to act opportunistically, i.e. conduct monetary policy in line with politicians' preferences, to maximize their expected time in office.

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<sup>3</sup> This argument follows Hanssen (2004) who discusses the level of judicial independence in a similar framework. Related arguments are made by Goodman (1991), Bernard et al. (2002), and Dreher et al. (2007).

The model predicts that the level of CBI incumbent politicians choose will be higher, the worse their re-election prospects are, the more weight they place on future policy outcomes, and the better their ability to appoint an ideologically desired candidate is. If the incumbent's probability of being re-elected is high, the relative advantage of CBI in terms of durability shrinks compared to the disadvantage of forgone current influence since the political opponent is less likely to hold office and, thus, to be in the position to reverse the currently incumbent's appointment decision. Similarly, policy durability gains importance when the future becomes more relevant for politicians. However, if the incumbent's probability of selecting an ideologically desired candidate is low, this may turn the benefits of CBI into a disadvantage for the incumbent since he cannot correct a possibly wrong appointment decision. Moreover, the likelihood for the implementation of an independent central bank is positively affected by the degree of political polarization but negatively by the utility central bankers receive from holding office and by the weight they place on future developments. As discussed below, the intuition behind these results derives from the incentives for central bankers to act opportunistically by satisfying the incumbent's policy demands in order to maximize their expected time in office.

## **2. Related Literature**

This paper relates to the literature on strategic policy-making and to the literature on the determinants of CBI. The latter may be subdivided into two strands, one that adopts a normative perspective and one – the political economy literature – predominantly taking a positive point of view. The normative literature mainly builds on the time-inconsistency problem (Kydlund and Prescott, 1977, Barro and Gordon, 1983) and the solutions proposed by Rogoff (1985) and Walsh (1995). Along these lines, Cukierman (1994) argues that the gains from CBI will be higher in countries that suffer from a large inflationary bias. Consequently, the incentives to establish an independent central bank should increase in factors worsening the inflationary bias, such as a high natural rate of unemployment (see also Eijffinger and Schaling, 1995 and Franzese, 1999). Similarly, the potential gains from CBI have been related to public debt (Cukierman, 1994). If CBI successfully moderates inflation expectations, the interest charge on government debt should decrease in the level of CBI. Hence, a large stock of public debt should strengthen the incentives to create an independent

central bank.<sup>4</sup> The empirical literature, however, does not find much support for these normative hypotheses (Dreher et al. 2007, De Haan and Van't Hag, 1995, Eijffinger and Schaling, 1995). This may not come as a surprise as the pure time inconsistency framework does not provide a convincing rationale for *not* implementing an independent central bank (Bernhard et al., 2002).<sup>5</sup>

The political economy literature, on the other hand, provides such a rationale by taking into account self-interests of political actors. One line of research stresses the 'opposition to inflation' as a potentially important determinant of CBI. Goodman (1991) argues that politicians may be forced to increase CBI by strong conservative coalitions in the society. In this regard, Posen (1993) identifies the financial sector as the main interest group advocating price stability and hence as the main driving force for CBI. A related argument is put forth by Hayo (1998) who points out that the general public attitude towards inflation – formed by 'historical feedback processes' – may be crucial for the choice of the degree of CBI.

A second set of political economy papers focuses on diverging interests of decision-makers. In this regard, the existence of checks and balances has been related to a country's level of CBI. Hallerberg (2002) argues that a multitude of veto players will limit politicians' ability to override the decisions of a central bank and thereby affect the degree of CBI. Similarly, Moser (1999) shows in a model with two veto-empowered decision-making bodies that the commitment to an independent central bank will only be credible if there are appropriate checks and balances at work (see also Keefer and Stasavage, 2003). A related body of research focuses on intra-coalition conflicts as a motive for delegating monetary policy (Bernhard and Leblang, 2002). Crowe (2006) presents a model on coalition formation in a two-dimensional policy space. He shows that it will be costly for agents to join a coalition if preferences over both policy dimensions are uncorrelated. In this case, limiting the policy space by delegating monetary policy to an independent central bank reduces the costs of coalition formation.

Finally, the wish to constrain future governments has been identified as a potentially important motive for the implementation of an independent central bank. Goodman (1991)

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<sup>4</sup> There is, however, also a political economy argument pointing in the opposite direction as the incentives to reduce the real stock of debt by creating surprise inflation should be stronger the higher the total amount of public debt is (Eijffinger and De Haan, 1996).

<sup>5</sup> Note that, in the standard time inconsistency framework, the costs in terms of suboptimal stabilization policy arise from the conservativeness of a central bank not from its independence (Berger et al., 2001).

suggests that incumbents' expectations regarding their time in office should be crucial for their assessment of the potential gains from 'tying the hands of political successors' (see also Bernhard et al., 2002 and Cukierman, 1992). The present paper formalizes this argument and shows how the costs of CBI, in terms of forgone current influence, and the benefits, arising from policy durability, are affected by various parameters. Hence, this paper contributes to the theoretical literature on the determinants of CBI which – up to now – is rare as most of the papers cited above either follow an empirical or an institutional approach.<sup>6</sup>

This article also relates to the literature on strategic policy-making. It has been suggested that incumbent politicians may choose certain policies in order to limit the policy options of potential successors. In this regard, it has been argued that office holders may increase deficits above a social optimal level to limit the fiscal latitude of political opponents (Alesina and Tabellini, 1990, Persson and Svensson, 1989). The notion of imposing restrictions on future decision-makers also appears in Glazer (1989) who discusses the choice of durability of investment projects. In his model, rational voters (and thus office-seeking governments) may opt for more permanent investment projects in order to restrict the set of policy choices of future voters.

The present work builds on – and therefore is closely related to – Hanssen (2004) who analyzes how strategic policy-making may determine the level of juridical independence. In his model, politicians face uncertainty about the ideological type of judges, but have perfect knowledge about a judge's attitude towards holding office, that is, politicians know whether a specific judge is motivated by opportunism *or* ideology. This paper extends Hanssen's model by allowing central bankers to be motivated by both, holding office *and* ideology, with central bankers' preferences being private knowledge. These extensions allow modeling the channels of political influence identified by Chappell et al. (1993). While the indirect channel – via the appointment process – requires central bankers to have ideological preferences, there are two necessary conditions for the direct channel – via political pressure – to appear. Central bankers must be office-seeking, at least to some degree, and politicians need to have the means to exert pressure on the central bank. In the model, the latter condition is only fulfilled if a low level of CBI has been established which gives rise to the direct channel of political influence. Moreover, these extensions have important technical implications. As central bankers do not know which party will hold governmental power and will be in the position to

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<sup>6</sup> Exceptions are Cukierman (1994), Moser (1999), Keefer and Stasavage (2003), and Crowe (2006).

replace them, a signaling game arises where both, the sender's type (central banker) and the receiver's type (politician) are uncertain when players choose their strategies.<sup>7</sup>

### 3. The Model

Consider two purely partisan political parties,  $i = L, R$ .<sup>8</sup> Parties only differ in their preferences over monetary policy, possibly reflecting varying preferences of the constituency they represent. With regard to monetary policy, it is often argued that rightist parties act in the interests of high income voters and are thus more inflation-averse than leftist parties which are more concerned with unemployment and output (Hibbs, 1977, Persson and Tabellini, 2002). The incumbent party nominates a central banker (CB) who conducts monetary policy. Like politicians, CBs have ideological preferences that can either be in line with party  $L$ 's preferences (a 'leftist' CB) or with those of party  $R$  (a 'rightist' CB).<sup>9</sup> CBs are additionally concerned with holding office, giving rise to career motivated ('opportunistic') behavior. In the beginning of the two-period game, the initially incumbent party (which, without loss of generality, is assumed to be  $L$ ) makes a binding choice on the institutional setting, i.e. on the degree of independence granted to the central bank. CBI is a discrete variable and can only take two values, 'high' (institution  $I$ ) or 'low' (institution  $D$ ). Institution  $I$  guarantees the CB a two-period term length. As a consequence, the politician cannot punish the CB for conducting the undesired monetary policy by replacement. In contrast,  $D$  is associated with a one-period term length of CBs. Here, the CB can be replaced in the beginning of period two by the party that holds governmental power at that time.<sup>10</sup>

Figure 1 depicts the sequence of events. At the institutional stage,  $t_0$ , the incumbent party  $L$  chooses  $I$  or  $D$ . At the beginning of period 1,  $L$  nominates a CB selected from a large set of candidates (see below). The CB then carries out monetary policy, by directly controlling the inflation rate in period 1 ( $\pi_1$ ) which is assumed to be a discrete variable that can only take two values,  $\pi_t \in \{\pi_L, \pi_R\}$ ,  $t = 1, 2$ . At the end of  $t_1$ , elections are held where the incumbent

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<sup>7</sup> Usually, in this kind of game, only the sender's type is unknown (Sibert, 2002, Chortareas and Miller, 2003).

<sup>8</sup> In this paper, the terms politicians and parties are used synonymously.

<sup>9</sup> The notion of partisan preferences of CBs is widely used in the literature (Waller, 1992, Lohmann 1997, Sieg, 1997) and empirical evidence is presented by Berger and Woitek (2005).

<sup>10</sup> Note that, under  $D$  ('dependence') CBs are free to set monetary policy, too. However, career concerns may drive CBs to act in the interest of politicians. Hence, the level of de facto CBI is lower under  $D$ .

party faces the exogenous probability of reelection  $p$  (the opponent wins with  $1-p$ ).<sup>11</sup> Under  $I$ , the CB that has been nominated in  $t_1$  remains in office while under  $D$ , the CB can be replaced by the winner of the elections. Finally, the CB who holds office in  $t_2$  carries out monetary policy.

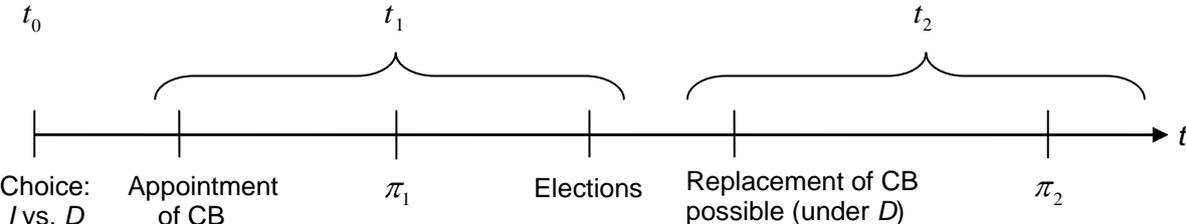


Figure 1. Sequence of Events.

Note that the model captures institutional persistence as a stylized fact, by assuming that the initially established central bank regime is left unchanged for the rest of the game. As shown by Acemoglu et al. (2001), institutions are long-lasting and only changed from time to time (see also Glaeser and Shleifer, 2002 and Przeworski et al., 1996). The literature offers several potential explanations.<sup>12</sup> Paterson (2005), for instance, argues that institutions reinforce the existing distributions of political and economic power in society which prevents institutional changes. Alternatively, institutional persistence has been related to the existence of checks and balances (Moser, 1999, Hallerberg, 2002) as veto players may block changes from the status quo. To capture the notion of institutional persistence in the model, it is assumed that there is a window of opportunity where the institution can be altered by the government at a certain point in time ( $t_0$ ) but remains unchanged throughout the two subsequent periods.

**3.1 Preferences and Information**

Parties only differ in their preferences over monetary policy and are solely motivated by ideological concerns. In particular, as in Alesina and Rosenthal (1995), parties have different

<sup>11</sup> The focus of this paper lies on the relationship between politicians and CBs. To simplify matters the second principal-agent-relationship between the electorate and politicians is ruled out by assuming an exogenous  $p$ .  
<sup>12</sup> Acemoglu and Robinson (2006) discuss the question of institutional persistence in detail.

views on what inflation rate should be targeted.<sup>13</sup> Parties' preferences are common knowledge and captured by the following loss function:

$$(1) \quad V^i = \sum_{t=1,2} \beta_P^{t-1} (\pi_t - \pi_i)^2, \quad i = L, R.$$

Deviations of actual inflation in period  $t$  from the respective party's bliss point of inflation ( $\pi_i$ ) generate a loss. The discount factor  $0 < \beta_P < 1$  is assumed to be identical for both parties.

CBs, like politicians, have ideological preferences over monetary policy. However, in contrast to politicians, CBs additionally receive utility from holding office.<sup>14</sup> This can be due to pecuniary rewards, prestige or generally the chance to extract private rents from holding office (Rogoff, 1990). As noted above, this is a prerequisite for politicians' ability to pressurize CBs and hence for the direct channel of political influence to appear.<sup>15</sup> As a consequence, CBs are – to some degree – driven by career concerns, possibly implying opportunistic behavior. In sum, CBs are motivated by both, ideology and opportunism which is reflected in the following loss function of CBs:

$$(2) \quad V^{CB} = \sum_{t=1,2} \beta_{CB}^{t-1} \left[ \chi L_t + (1 - \chi) (\pi_t - \pi_{CB})^2 \right]$$

Career concerns are captured by the dummy variable  $L_t$  which is zero if the CB holds office and a positive constant ( $\bar{L}$ ) otherwise, i.e. not holding office implies a loss for the CB.<sup>16</sup>

Accordingly, the ideological component is captured by  $(\pi_t - \pi_{CB})^2$  since deviations of actual inflation from the CB's bliss point ( $\pi_{CB}$ ) generate a loss, too. As stated above, a CB can be 'leftist' or 'rightist', i.e.  $\pi_{CB} \in \{\pi_L, \pi_R\}$ . Both motives are weighted by  $0 \leq \chi \leq 1$ . If  $\chi = 0$  the CB will solely be motivated by ideology whereas  $\chi = 1$  describes the case where the CB is exclusively driven by career concerns. Hence,  $\chi$  can be interpreted as the CB's 'degree of opportunism'. Finally, the discount factor  $0 < \beta_{CB} < 1$  is assumed to be equal for all CBs.

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<sup>13</sup> Since this paper examines the determinants and not the effects of CBI, it is important to allow for differences in parties' preferences over monetary policy. It is not crucial, however, where these differences are revealed. Hence, one could alternatively assume, as in Alesina (1987) that parties place a different relative weight on the real target in an objective function à la Barro and Gordon (1983).

<sup>14</sup> Including an additional 'office-seeking' component into the objective function of politicians would not change the results qualitatively, since the outcome of the elections is exogenous.

<sup>15</sup> Chortareas and Miller (2003) point out that selfishness of CBs is a necessary condition for implementing 'perfect contracts' as proposed by Walsh (1995).

<sup>16</sup> Note that a candidate appointed in the beginning of the game will at least hold office throughout the first period; hence, for these candidates it holds that  $L_1 = 0$ .

As in Sibert (2002), CBs' preferences are private knowledge. Specifically, neither the degree of opportunism ( $\chi$ ) nor the ideological bliss point ( $\pi_{CB}$ ) is directly observable for politicians when appointing a CB. However, the distributions of both criteria within the population of candidates are common knowledge. The same proportion of candidates share party  $L$ 's and  $R$ 's respective bliss point of inflation, that is, leftist and rightist CBs both make up 50% of the candidates' population. Moreover, it is assumed that each ideological group consists of a continuum of candidates with different degrees of opportunism ( $\chi$ ). The distribution of  $\chi$  is given by the continuous density function  $f(\chi)$  which is positive on the interval  $[0,1]$ .

### 3.2 Solving the Model

This section derives the incumbent party's expected loss from choosing either institution. While under  $I$ , there is no interaction between politicians and the CB after the appointment decision in  $t_1$ , under  $D$ , a signaling game arises where neither politicians (receivers) nor CBs (senders) know the type of the other player when choosing their strategies.

#### Independence

Under independence, the CB appointed in  $t_1$  cannot be punished by replacement and remains in office for two periods. Hence, opportunistic motives do not play a role when conducting monetary policy and each CB will set the inflation rate equal to his ideological bliss point ( $\pi_1 = \pi_2 = \pi_{CB}$ ). Therefore, under institution  $I$ , only the indirect channel of political influence appears, making it crucial for politicians to find an ideologically desired candidate. However, candidates' ideological preferences cannot be observed directly. Let  $\delta$  denote the probability for an incumbent party to appoint a CB who shares its ideological preferences. Since  $\pi_{CB}$  is equally distributed on  $\pi_L$  and  $\pi_R$ , random drawing implies  $\delta = 0.5$ . However, if parties have some form of screening technology at their disposal, this will increase their chances of selecting a desired candidate. In the extreme of perfect screening there would be no uncertainty ( $\delta = 1$ ). Hence,  $\delta$  depends positively on parties' ability to screen candidates and is restricted to the interval  $0.5 \leq \delta \leq 1$ . According to (1),  $L$ 's expected loss of choosing institution  $I$  equals

$$(3) \quad E(V^L)_I = (1 + \beta_P)(1 - \delta)(\pi_R - \pi_L)^2$$

where  $E$  denotes the expectations operator. If  $L$  ‘luckily’ appoints a leftist CB, a loss of zero will occur ( $\pi_1 = \pi_2 = \pi_L$ ), whereas a rightist CB is appointed with probability  $(1-\delta)$  who will set  $\pi_1 = \pi_2 = \pi_R$ , implying (3).

### Dependence

The signaling game that evolves under  $D$  is illustrated in figure 2, for the case where  $L$  initially holds governmental power.<sup>17</sup> At the start of the game, the appointment decision takes place where a leftist candidate will become CB with probability  $\delta$ , while with  $(1-\delta)$  a rightist CB is appointed. The CB then sets the inflation rate in  $t_1$  equal to  $\pi_L$  or  $\pi_R$ . If, for example, a rightist CB has been appointed who acts according to his ideological preferences ( $\pi_1 = \pi_R$ ), the game proceeds to the lower part of the right hand side of figure 2. At the end of period 1, elections take place where  $L$  ( $R$ ) wins with  $p$  ( $1-p$ ). The winner of the elections then decides whether to *keep* or *replace* the CB. If the rightist CB stays in office, he will set  $\pi_2 = \pi_{CB}$  as every CB will act according to his ideological preferences in  $t_2$ . In contrast, if the CB is replaced, the new CB will be of the incumbent’s ideologically desired type with  $\delta$ .

### Politicians’ strategies

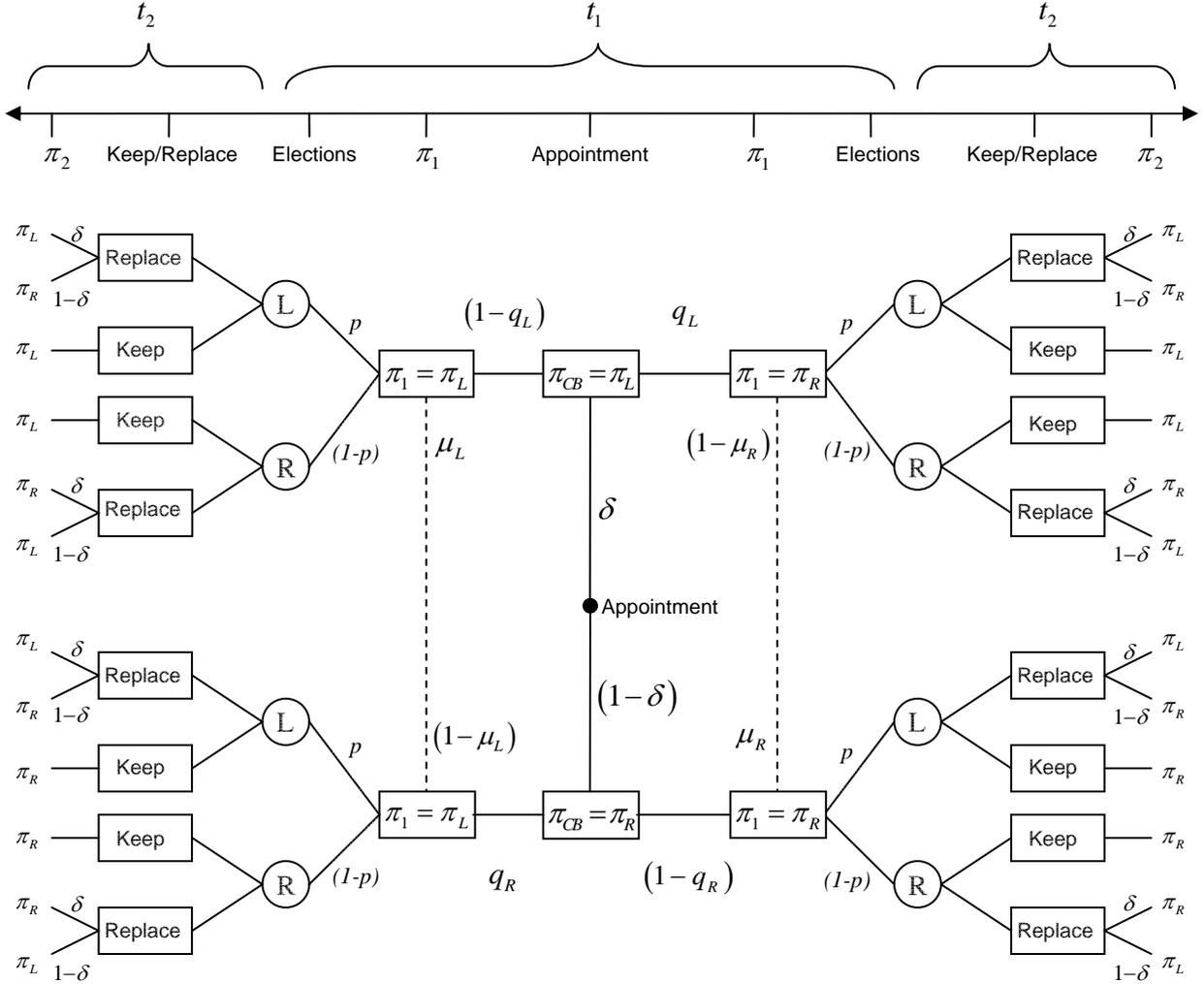
In the beginning of  $t_2$ , the winner of the elections can either *keep* or *replace* the CB, appointed in  $t_1$ . After observing  $\pi_1$ , politicians still face uncertainty about the CB’s ideological type. If, for instance, politicians observe  $\pi_1 = \pi_L$ , they do not know which node in the information set has been reached (illustrated by the dotted line on the left hand side in figure 2). Hence, politicians form posterior beliefs on CBs’ types. From the politicians’ perspective, let  $\mu_L$  denote the probability that the person in office is a leftist CB, given that the leftist policy has been carried out in  $t_1$ , i.e.  $\mu_L = \text{prob}(\pi_{CB} = \pi_L | \pi_1 = \pi_L)$ . Similarly, the probability that a rightist CB holds office, given that  $\pi_1 = \pi_R$  is given by  $\mu_R = \text{prob}(\pi_{CB} = \pi_R | \pi_1 = \pi_R)$ .

Politicians can pursue the following strategies. First, politicians can reward a CB who conducted monetary policy in line with their ideological preferences and punish a CB by

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<sup>17</sup> Note that figure 2 does not distinguish CBs’ types according to their degree of opportunism. Hence, figure 2 does not provide the complete game in extensive form. Nevertheless, it is helpful for illustration purposes.

replacement who did not, i.e. (*Keep CB* if  $\pi_1 = \pi_i$ , *Replace CB* if  $\pi_1 \neq \pi_i$ ). Second, politicians can *always keep* or *always replace* a CB, independent of the policy carried out in  $t_1$ . Finally, politicians can replace a CB who conducted monetary policy in line with their ideological preferences and keep a CB who did not, i.e. (*Keep CB* if  $\pi_1 \neq \pi_i$ , *Replace CB* if  $\pi_1 = \pi_i$ ).



**Figure 2.** Signaling Game under D.

L initially incumbent.

### CBs' strategies

As stated above, each CB will act according to his ideological preferences in  $t_2$  because he cannot be punished afterwards, implying  $\pi_2 = \pi_{CB}$ . Therefore, strategic considerations only play a role in the first period. In  $t_1$ , both ideological types of CBs have two strategies at their disposal. They can either act 'ideologically', i.e. in line with their ideological preferences ( $\pi_1 = \pi_{CB}$ ) or contrary to them ( $\pi_1 \neq \pi_{CB}$ ). The latter is termed opportunistic action as this

strategy is associated with a certain loss for the CB in  $t_1$  and thus can only be due to career concerns. Note that a CB does not know which party will be in the position to keep or replace him when choosing his strategy. However, CBs are forward-looking and take into account the likely outcome of the elections when trying to maximize their time in office, by satisfying politicians' policy demands.<sup>18</sup>

### *Equilibrium*

In the *Perfect Bayesian Equilibrium* of the game described here, strategies of all players as well as politicians' posterior beliefs about CBs' types have to be consistent (see, for instance, Fudenberg and Tirole, 1991). In what follows, I will derive the unique equilibrium of the game in pure strategies. It will be shown that the only strategy of politicians that is consistent with a pure strategy equilibrium is (*Keep CB* if  $\pi_1 = \pi_i$ , *Replace CB* if  $\pi_1 \neq \pi_i$ ). To complete the description of the equilibrium, one needs to derive CBs optimal actions, given that politician  $i$  plays this strategy of 'reward and punishment'. In a first step, the optimization problem of leftist CBs is analyzed.

Although, in the model, CBs are generally motivated by both, opportunism and ideology, their action can only be *either* ideological *or* opportunistic. A leftist CB who acts ideologically by setting  $\pi_1 = \pi_L$ , experiences the following expected loss [according to equation (2)]:

$$(4) \quad E(V^{CB})_D^{ideol.} = (1-p)\beta_{CB} \left[ \chi \bar{L} + (1-\chi)\delta(\pi_R - \pi_L)^2 \right]$$

Acting ideologically is associated with a loss of zero for the CB in  $t_1$ . If  $L$  wins the elections, the CB will stay in office and set  $\pi_2 = \pi_L$ . Hence, in this case, no loss will occur in  $t_2$  either. On the contrary, if  $R$  wins the elections, the CB will be replaced, implying a loss of  $\bar{L}$  for not holding office in  $t_2$  and an ideologically induced loss of  $(\pi_R - \pi_L)^2$  if  $R$  appoints a rightist CB which happens with probability  $\delta$ .

Similarly, the expected loss for a leftist CB from acting opportunistically ( $\pi_1 = \pi_R$ ) equals:

$$(5) \quad E(V^{CB})_D^{opp.} = (1-\chi)(\pi_R - \pi_L)^2 + p\beta_{CB} \left[ \chi \bar{L} + (1-\chi)(1-\delta)(\pi_R - \pi_L)^2 \right]$$

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<sup>18</sup> This implies that a politician whose chances of re-election are low (a 'lame duck') will never see his policy demands satisfied due to opportunistic behavior.

The first term in (5) describes the certain loss in period 1 resulting from opportunistic action. The second term is the loss the CB experiences if  $L$  wins the elections. In this case, the CB will be replaced and a rightist CB will be appointed with probability  $(1-\delta)$ .

A leftist CB will act opportunistically if  $E(V^{CB})_D^{opp.} < E(V^{CB})_D^{ideol.}$ .<sup>19</sup> Comparing equations (4) and (5) and rearranging shows that a leftist CB will act opportunistically if  $(1-\chi)(\pi_R - \pi_L)^2 [1 + \beta_{CB}(p-\delta)] < \beta_{CB}\chi(1-2p)\bar{L}$ . Since the left hand side of this inequality is non-negative this condition is never fulfilled for  $p \geq 0.5$ . That is, a leftist CB will never act opportunistically if  $p \geq 0.5$ . The intuition for this finding is straightforward: in expectation terms, opportunistic action will only pay off for a leftist CB if the certain loss of deviating from ideological preferences in  $t_1$  is outweighed by a sufficiently high chance of holding office in  $t_2$  which would imply  $L_2 = 0$  and  $\pi_2 = \pi_L$ . Hence, there is no reason for a leftist CB to act opportunistically by satisfying party  $R$ 's policy demands if  $R$ 's chances of being elected are low. However, if  $R$ 's election prospects are good, some leftist CBs will act opportunistically. Specifically, for  $p < 0.5$  the condition for opportunistic behavior of a leftist CB can be rewritten as:

$$(6) \quad \chi > \frac{[1 + \beta_{CB}(p-\delta)](\pi_R - \pi_L)^2}{\beta_{CB}(1-2p)\bar{L} + [1 + \beta_{CB}(p-\delta)](\pi_R - \pi_L)^2} \equiv \chi_L^{crit.}$$

Those CBs that place a relatively large weight on holding office compared to the ideological motive will choose the opportunistic action. Specifically, if the degree of opportunism ( $\chi$ ) exceeds a certain threshold ( $\chi_L^{crit.}$ ), a leftist CB will act opportunistically. Note that for  $p < 0.5$  it holds that  $0 < \chi_L^{crit.} < 1$ .

Going through the same steps as before, the condition for opportunistic behavior of rightist CBs can be derived. Rightist CBs will act opportunistically if  $E(V^{CB})_D^{opp.} < E(V^{CB})_D^{ideol.}$ . Here, the same logic applies as for leftist CBs, that is, no rightist CB will act opportunistically if  $p \leq 0.5$ . Conversely, for  $p > 0.5$  a rightist CB will act opportunistically if:

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<sup>19</sup> I assume that the marginal CB who is indifferent between both strategies will act ideologically. This is not crucial for calculating the ex ante probabilities for opportunistic behavior since  $\chi$  is a continuous variable.

$$(7) \quad \chi > \frac{[1 + \beta_{CB}(1 - \delta - p)](\pi_L - \pi_R)^2}{\beta_{CB}(2p - 1)\bar{L} + [1 + \beta_{CB}(1 - \delta - p)](\pi_L - \pi_R)^2} \equiv \chi_R^{crit.}$$

Each CB will *either* act opportunistically *or* ideologically. The individual choice will depend on the specific value of  $\chi$ ,  $p$ , and the respective  $\chi_i^{crit.}$  described by equations (6) and (7).

However, from the politicians' perspective, one can derive the probabilities for CBs to act opportunistically. Let  $q_L$  and  $q_R$  denote the probabilities for opportunistic behavior of leftist and rightist CBs, respectively. According to equations (6) and (7) these probabilities equal

$q_L = \int_{\chi_L^{crit.}}^1 f(\chi) d\chi$  and  $q_R = \int_{\chi_R^{crit.}}^1 f(\chi) d\chi$ . For simplicity, I assume that  $\chi$  is uniformly

distributed which delivers the following probabilities for opportunistic behavior:

$$(8) \quad q_L = \begin{cases} \frac{\beta_{CB}(1-2p)\bar{L}}{\beta_{CB}(1-2p)\bar{L} + [1 + \beta_{CB}(p-\delta)](\pi_R - \pi_L)^2} & \text{if } p < 0.5 \\ 0 & \text{if } p \geq 0.5 \end{cases}$$

$$q_R = \begin{cases} \frac{\beta_{CB}(2p-1)\bar{L}}{\beta_{CB}(2p-1)\bar{L} + [1 + \beta_{CB}(1-\delta-p)](\pi_L - \pi_R)^2} & \text{if } p > 0.5 \\ 0 & \text{if } p \leq 0.5 \end{cases}$$

The actions of both parties and all types of CBs, as well as politicians' posterior beliefs about the CB's type have to be consistent in equilibrium. Proposition 1 describes the unique Perfect Bayesian Equilibrium of the game in pure strategies that complies with these requirements.

### Proposition 1

The following strategies of politicians, leftist and rightist CBs together with the posterior

beliefs of politicians  $\mu_L = \frac{\delta(1-q_L)}{[\delta(1-q_L) + (1-\delta)q_R]}$ ,  $\mu_R = \frac{(1-\delta)(1-q_R)}{[\delta q_L + (1-\delta)(1-q_R)]}$  define the

unique perfect Bayesian equilibrium of the game in pure strategies if  $(1-\delta)^2/\delta^2 \geq q_L$ :

Politician  $i$  plays (*Replace CB* if  $\pi_1 \neq \pi_i$ , *Keep CB* if  $\pi_1 = \pi_i$ ),

Leftist CBs set  $\pi_1 = \begin{cases} \pi_R & \text{if } \chi > \chi_L^{crit.} \\ \pi_L & \text{if } \chi \leq \chi_L^{crit.} \end{cases}$ , Rightist CBs set  $\pi_1 = \begin{cases} \pi_L & \text{if } \chi > \chi_R^{crit.} \\ \pi_R & \text{if } \chi \leq \chi_R^{crit.} \end{cases}$ .

**Proof:** See Appendix.

Given this equilibrium,  $L$ 's expected loss from choosing institution  $D$  equals:

$$(9) \quad E(V^L)_D = \begin{cases} (1-\delta) + \beta_p [1-\delta(1+p-\delta)] + q_L \delta [1 + \beta_p (p-\delta)] \\ - q_R (1-\delta) [1 + \beta_p (1-p-\delta)] \end{cases} (\pi_R - \pi_L)^2.$$

The effect of opportunistic behavior on  $L$ 's expected loss from choosing  $D$  is ambiguous. While the likelihood of rightist CBs acting opportunistically ( $q_R$ ) increases  $L$ 's expected pay-off ( $[1 + \beta_p (1-p-\delta)] > 0$ ), the opposite is true for opportunistic behavior of leftist CBs,  $q_L$ , since  $[1 + \beta_p (p-\delta)] > 0$ . A positive  $q_L$  means that a fraction of leftist CBs will carry out monetary policy in line with  $R$ 's ideological preferences which implies this finding. Hence, from the incumbent's perspective, there is a form of 'desired' and 'undesired' opportunistic behavior, depending on his re-election prospects.<sup>20</sup>

### 3.3 Results

To shed light on the determinants of the institutional choice, it is convenient to rewrite (9) as

$$(10) \quad E(V^L)_D = E(V^L)_I + \kappa,$$

with  $\kappa = (\pi_R - \pi_L)^2 [\beta_p \delta (\delta - p) + q_L \delta [1 + \beta_p (p - \delta)] - q_R (1 - \delta) [1 + \beta_p (1 - p - \delta)]]$ . Since the incumbent will choose the institution that results in the higher expected pay-off, it directly follows from (10) that  $I$  ( $D$ ) is the optimal choice if  $\kappa > 0$  ( $\kappa < 0$ ), whereas the incumbent will be indifferent for  $\kappa = 0$ . A closer inspection of  $\kappa$  shows that the relation of  $p$  and  $\delta$  is of special importance for the institutional choice as, for some cases, this relation will determine the institution, irrespective of other variables.<sup>21</sup>

The following cases can be distinguished and are illustrated in figure 3.<sup>22</sup> First, the incumbent is indifferent between both institutions ( $\kappa = 0$ ) if  $p = \delta = 0.5$  (**point A** in figure 3). In this case, there is no opportunistic behavior of CBs ( $q_L, q_R = 0$ ), implying  $\pi_1 = \pi_2 = \pi_{CB}$ . Since  $\delta = 0.5$ , both institutions yield a probability of 0.5 for  $\pi_L$  in both periods, making  $L$

<sup>20</sup> Note that both forms of opportunism will never occur simultaneously [see equation (8)].

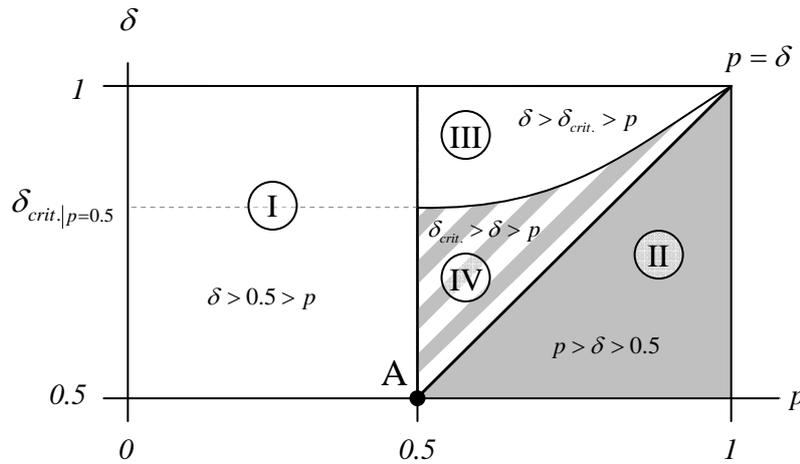
<sup>21</sup> This is true as long as there is political polarization. From  $(\pi_R - \pi_L)_{crit.}^2 = 0$  it follows that  $\kappa = 0$  and the incumbent is indifferent between  $I$  and  $D$ , independent of other variables.

<sup>22</sup> Figure 3 serves an illustration purpose and abstracts from the condition required for the equilibrium described by proposition 1. In fact, for  $p < 0.5$  ( $q_L > 0.5$ ),  $\delta$  has to be smaller than 1 which is ignored in figure 3.

indifferent between  $I$  and  $D$ .<sup>23</sup> Second, the optimal choice will be  $I$  ( $\kappa > 0$ ) if  $\delta > 0.5 > p$  (**area I** in figure 3).<sup>24</sup> Third,  $D$  will be the optimal choice ( $\kappa < 0$ ) if  $p > \delta > 0.5$  (**area II** in figure 3).<sup>25</sup> Finally, for  $\delta > p > 0.5$  one cannot sign  $\kappa$  straightaway. Plugging in  $q_R$  from (8) and rearranging shows that  $\kappa$  is positive and therefore  $I$  the optimal choice if:

$$(11) \quad (\pi_R - \pi_L)^2 > \frac{(2p-1)\beta_{CB}[(1-\delta) - \beta_P(1-p)(2\delta-1)]}{\beta_P\delta(\delta-p)[1 + \beta_{CB}(1-p-\delta)]} \cdot \bar{L} \equiv (\pi_R - \pi_L)_{crit.}^2$$

A sufficient condition for this inequality to hold is  $(\pi_R - \pi_L)_{crit.}^2 < 0$ . As the denominator of (11) is positive for the case of  $\delta > p > 0.5$  considered here, inequality (11) always holds if the nominator is negative. This is the case if  $\delta > [1 + \beta_P(1-p)]/[1 + 2\beta_P(1-p)] \equiv \delta_{crit.}$ . Therefore,  $(\pi_R - \pi_L)_{crit.}^2 < 0$  and  $I$  is always the optimal choice if  $\delta > \delta_{crit.} > p > 0.5$  (**area III** in figure 3) while both institutions are a theoretical possibility if  $\delta_{crit.} > \delta > p > 0.5$  (**area IV** in figure 3).<sup>26</sup>



**Figure 3.** Optimal institutional choice.

Institution  $I$  is optimal in areas I and III; institution  $D$  is the optimal choice in area II; either institution can be optimal in area IV.

From these considerations the following result can be derived.

<sup>23</sup> The same is true for the somewhat trivial case of  $p = \delta = 1$  where the incumbent will not face any loss under either institution.

<sup>24</sup> Precisely, both marginal cases  $\delta \geq 0.5 > p$  ( $q_R = 0, q_L > 0$ ) and  $\delta > 0.5 \geq p$  ( $q_R = 0, q_L \geq 0$ ) lead to  $\kappa > 0$ .

<sup>25</sup> In fact,  $p > \delta \geq 0.5$  and  $p \geq \delta > 0.5$  imply  $\kappa < 0$ , as  $q_R > 0, q_L = 0$ .

<sup>26</sup> Note that  $\delta_{crit.} > p$  for  $p < 1$ ,  $0.5 < \delta_{crit.} < 1$  for  $p = 0.5$ ,  $\delta_{crit.} = 1$  for  $p = 1$ , and  $\partial \delta_{crit.} / \partial p > 0$ .

**Result 1:** A higher probability of re-election lowers the probability for the implementation of an independent central bank.

The intuition for this result is the following. From the incumbent's point of view, there are two principle advantages associated with  $D$ . First, the incumbent may be able to correct a possibly wrong appointment decision, made in  $t_1$ , by replacing a CB who did not conduct the desired policy. Second, the threat of replacement may drive a CB to act opportunistically by satisfying the incumbent party's policy demands (direct channel of political influence). However, both principle advantages critically depend on the chances of being re-elected. If  $p$  is low, the political opponent is more likely to enjoy both advantages. Specifically, for  $p < 0.5$ , there will be opportunistic behavior in favor of  $R$  ( $q_L > 0$ ) and it is likely that  $R$  will be in the position to reverse  $L$ 's appointment decision. As a consequence, a higher  $p$  makes  $D$  relatively more attractive.<sup>27</sup> As  $p$  is attached to incumbency, not to a particular party, the probability of re-election can be interpreted in a broad sense, namely as a measure of political stability. In countries that are politically stable – in terms of the frequency of government change – the incumbents' re-election prospects should, all else equal, generally be better than in countries that face a high frequency of government change (Dreher et al., 2006, De Haan and Van't Haag, 1995). In this regard, Goodman (1991) attributes the institutional change towards a higher degree of CBI in Italy in 1981<sup>28</sup> to a generally more instable political environment where both political camps faced higher uncertainty about their future chances of holding office. The next result captures the impact of  $\delta$  on the institutional choice.

**Result 2:** A better screening ability favors the implementation of an independent central bank.

The basic advantage of  $I$  is that the appointment decision made in  $t_1$  cannot be reversed by the political successor; hence any appointment decision is durable. Therefore, the probability of selecting an ideologically desired candidate ( $\delta$ ) plays a crucial role under  $I$ . Although an improved screening ability makes  $L$  better off under both institutions,<sup>29</sup> this positive effect is

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<sup>27</sup> Note that this is also true for the case of  $\delta_{crit.} > \delta$  where both institutions are a theoretical possibility since (11) is less likely fulfilled for a higher  $p$  as  $\partial(\pi_R - \pi_L)_{crit.}^2 / \partial p > 0$ .

<sup>28</sup> From 1981 on, the Bank of Italy was restricted to finance government spending.

<sup>29</sup> Differentiating (3) and (9) implies this finding as  $\partial E(L^L)_D / \partial \delta < 0$ ,  $\partial E(L^L)_I / \partial \delta < 0$ .

weaker under  $D$  since it is partially contradicted by a better screening ability of party  $R$  who will enjoy the right to appoint a CB in  $t_2$  with  $(1-p)$ . Therefore, a higher  $\delta$  favors  $I$ .<sup>30</sup>

So far, the probability of re-election and parties' screening ability have been identified as important criteria underlying the institutional choice. When analyzing the other factors that may drive incumbents to establish a certain institution, it is reasonable to concentrate on the case of  $\delta_{crit.} > \delta > p > 0.5$  where both institutions are a theoretical possibility. In particular, an independent central bank will be established if inequality (11) holds, i.e. if the discrepancy between ideological preferences exceeds a critical threshold.<sup>31</sup> This directly leads to the following finding.

**Result 3:** Strong political polarization increases the likelihood for the implementation of an independent central bank.

Since the costs for politicians that arise from the undesired policy remain similar for both institutions, this result stems from a change in the probability of the undesired policy to occur. In particular, a higher degree of polarization changes the relative pay-offs from opportunistic and ideological behavior of rightist CBs.<sup>32</sup> Acting opportunistically becomes more costly because the certain loss in  $t_1$  arising from opportunistic behavior increases in  $(\pi_L - \pi_R)^2$  while the pay-off from the potential reward of holding office in  $t_2$  remains unchanged ( $\bar{L}$ ). This implies that a lower proportion of rightist CBs will act in line with  $L$ 's policy demands ( $\partial q_R / \partial (\pi_L - \pi_R)^2 < 0$ ) which increases  $L$ 's expected loss from choosing  $D$ . It is straightforward to see that a boost of  $\bar{L}$  has the opposite effect on the institutional choice.

**Result 4:** If CBs receive a higher utility from holding office, this will lower the probability for the implementation of an independent central bank.

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<sup>30</sup> Again, this is also true for the case of  $\delta_{crit.} > \delta$  as a better screening ability makes (11) more likely fulfilled because  $\partial(\pi_R - \pi_L)_{crit.}^2 / \partial \delta < 0$ .

<sup>31</sup> Recall that  $\delta_{crit.} > \delta$  implies  $(\pi_R - \pi_L)_{crit.}^2 > 0$ .

<sup>32</sup> For  $p > 0.5$ , only rightist CBs may act opportunistically.

An increase of  $\bar{L}$  raises the incentives for rightist CBs to act opportunistically and thereby favors the choice of institution  $D$  ( $\partial(\pi_R - \pi_L)_{crit.}^2 / \partial \bar{L} > 0$ ).

A similar effect arises if CBs put a larger weight on the future since  $(\pi_R - \pi_L)_{crit.}^2$  is increasing in  $\beta_{CB}$ . As the chance of holding office in  $t_2$  gets more relevant, the incentives for opportunistic behavior of rightist CBs will be amplified ( $\partial q_R / \partial \beta_{CB} > 0$ ), implying the following statement.

**Result 5:** If CBs place more weight on the future, this will make the choice of a low level of CBI more likely. In contrast, the probability for the implementation of an independent central bank will increase if the future becomes more relevant for politicians.

The likelihood for the implementation of an independent central bank will increase if politicians place a heavier weight on the future since (11) is more likely fulfilled with a higher  $\beta_P$  ( $\partial(\pi_R - \pi_L)_{crit.}^2 / \partial \beta_P < 0$ ). As the future becomes more relevant for politicians, the benefit of  $I$  in terms of policy durability gains importance. Conversely, myopic politicians will tend to choose  $D$ , as – for them – the current influence on monetary policy matters more than policy durability. De Haan and Van't Hag (1995) and Dreher et al. (2006) present empirical evidence for this relationship but have a different explanation. The authors argue that CBI mainly creates long-term benefits, in terms of lower average inflation rates, whereas the potential benefits from surprise inflation are of short-term character. Hence, a myopic government will tend to choose a lower level of CBI.

#### 4. Concluding Remarks

In this article, I argue that it is difficult to explain the differences in the degree of CBI across countries when adopting a normative point of view. Consequently, the present paper takes a political economy perspective and demonstrates how the degree of CBI in a country may be the result of strategic policy-making. For incumbent politicians, there are costs and benefits associated with a high level of CBI. While an independent central bank effectively constraints

future governments by raising the costs of future policy changes, it also limits the incumbent's chances to influence current monetary policy. Hence, incumbent politicians face a trade-off when choosing the degree of CBI: policy durability versus current influence on monetary policy. This trade-off, and thus the institutional choice, is influenced by various factors. The model predicts that the likelihood for incumbent politicians to implement an independent central bank will be higher, the worse their re-election prospects are, the more weight they place on future policy outcomes, and the better their ability to appoint an ideologically desired candidate is. Additionally, the probability for the implementation of an independent central bank increases in the degree of political polarization but shrinks in the utility central bankers receive from holding office and in the weight CBs place on future developments. In principle, the signaling model presented here could be applied to a wide range of fields. For instance, it could be used to analyze principal-agent-relationships within organizations, such as firms or the bureaucracy where preferences of both players (sender and receiver) are private knowledge.

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## Appendix (Proof of proposition 1)

Given politicians' strategy (*Replace CB* if  $\pi_1 \neq \pi_i$ , *Keep CB* if  $\pi_1 = \pi_i$ ), CBs' best responses are described by equations (6) and (7).

Politicians' posterior beliefs are calculated according to Bayes' rule:

$$\mu_L = \text{prob}(\pi_{CB} = \pi_L | \pi_1 = \pi_L) = \frac{\text{prob}(\pi_{CB} = \pi_L \cap \pi_1 = \pi_L)}{\text{prob}(\pi_1 = \pi_L)} = \frac{\delta(1-q_L)}{\delta(1-q_L) + (1-\delta)q_R}$$

$$\mu_R = \text{prob}(\pi_{CB} = \pi_R | \pi_1 = \pi_R) = \frac{\text{prob}(\pi_{CB} = \pi_R \cap \pi_1 = \pi_R)}{\text{prob}(\pi_1 = \pi_R)} = \frac{(1-\delta)(1-q_R)}{\delta q_L + (1-\delta)(1-q_R)}$$

To proof proposition 1, one has to show that neither politician has an incentive to deviate from his strategy, given these posterior beliefs and CBs strategies.

### Party L

In the case of  $\pi_1 = \pi_L$ , L will not deviate from its strategy, i.e. keep the CB if

$$\mu_L = \frac{\delta(1-q_L)}{\delta(1-q_L) + (1-\delta)q_R} \geq \delta. \text{ This inequality is always fulfilled, as } \mu_L = 1 \text{ for } p = 0.5$$

( $q_L, q_R = 0$ ) and for  $p < 0.5$  ( $q_R = 0, q_L \geq 0$ ). For  $p > 0.5$  ( $q_L = 0, q_R > 0$ ) the inequality

$$\text{becomes } \mu_L = \frac{\delta}{\delta + (1-\delta)q_R} \geq \delta \text{ which always holds as } 1 \geq q_R.$$

In the case of  $\pi_1 = \pi_R$ , L will replace the CB and hence not deviate if

$$(1-\mu_R) = \frac{\delta q_L}{\delta q_L + (1-\delta)(1-q_R)} \leq \delta. \text{ This inequality is always fulfilled as } (1-\mu_R) = 0 \text{ for}$$

$p = 0.5$  ( $q_L, q_R = 0$ ) and  $p > 0.5$  ( $q_L = 0, q_R > 0$ ), . For  $p < 0.5$  ( $q_R = 0, q_L \geq 0$ ) the

$$\text{inequality becomes } (1-\mu_R) = \frac{\delta q_L}{\delta q_L + (1-\delta)} \leq \delta \text{ which always holds since } q_L \leq 1.$$

## Party R

For  $\pi_1 = \pi_L$ , R will replace the CB and thus not deviate if  $(1 - \mu_L) = \frac{(1 - \delta)q_R}{\delta(1 - q_L) + (1 - \delta)q_R} \leq \delta$ .

This inequality always holds as  $(1 - \mu_L) = 0$  for  $p = 0.5$  ( $q_L, q_R = 0$ ) and for  $p < 0.5$  ( $q_R = 0, q_L \geq 0$ ). In the case of  $p > 0.5$  ( $q_L = 0, q_R > 0$ ) the inequality

becomes  $(1 - \mu_L) = \frac{(1 - \delta)q_R}{\delta + (1 - \delta)q_R} \leq \delta$  which always holds as  $q_R \leq \frac{\delta^2}{(1 - \delta)^2} \geq 1$ .

In the case of  $\pi_1 = \pi_R$ , R will keep the CB if  $\mu_R = \frac{(1 - \delta)(1 - q_R)}{\delta q_L + (1 - \delta)(1 - q_R)} \geq \delta$ . For  $p = 0.5$

( $q_L, q_R = 0$ ) and  $p > 0.5$  ( $q_L = 0, q_R > 0$ ) this inequality holds as  $\mu_R = 1 \geq \delta$ . For  $p < 0.5$

( $q_R = 0, q_L \geq 0$ ) the inequality becomes  $\mu_R = \frac{(1 - \delta)}{\delta q_L + (1 - \delta)} \geq \delta$  which is fulfilled if

$\frac{(1 - \delta)^2}{\delta^2} \geq q_L$ . Hence, party R has no incentive to deviate from its strategy if  $(1 - \delta)^2 / \delta^2 \geq q_L$ .

To see that proposition 1 describes the only equilibrium of the game in pure strategies, consider the three other possible strategies of politician  $i$ , namely ‘always keep CB’, ‘always replace CB’, and (Keep CB if  $\pi_1 \neq \pi_i$ , Replace CB if  $\pi_1 = \pi_i$ ). It is straightforward that the strategies ‘always keep CB’ and ‘always replace CB’ are not consistent with an equilibrium in pure strategies. If politicians played one of these strategies, CBs would never act opportunistically as this would not influence their expected time in office. Therefore, CBs would always reveal their types which, in turn, would imply that politicians were better off when deviating from their strategies.

If politicians played (Keep CB if  $\pi_1 \neq \pi_i$ , Replace CB if  $\pi_1 = \pi_i$ ), it would generally be optimal for some CBs to act opportunistically.<sup>33</sup> In this case, there is an important difference to the equilibrium defined by proposition 1: since a party would replace a CB who conducted monetary policy in line with its preferences, there would only be opportunistic behavior of

<sup>33</sup> Given this strategy, one can formally derive the critical thresholds for  $\chi$  that determine the proportions of leftist and rightist CBs acting opportunistically. However, these are not presented here as the specific values of the thresholds are not crucial to show that this strategy is not consistent with an equilibrium in pure strategies.

some leftist (rightist) CBs if  $p > 0.5$  ( $p < 0.5$ ). Similar to the equilibrium described above, there would be no opportunistic behavior if  $p = 0.5$ . Given these reactions of CBs, this strategy of politicians is not consistent with an equilibrium in pure strategies, either. To see this, consider the case of  $p = 0.5$  first. Here, CBs always reveal their types by setting their ideologically preferred inflation rate. This implies that it is optimal for party  $L$  ( $R$ ) to deviate from its strategy by keeping a CB who set  $\pi_1 = \pi_L$  ( $\pi_1 = \pi_R$ ) and replacing a CB who set  $\pi_1 = \pi_R$  ( $\pi_1 = \pi_L$ ). Similarly, for  $p > 0.5$ , politicians can deduce the CB's type if they observe  $\pi_1 = \pi_L$  as, in this case, there is no opportunistic behavior of rightist CBs. Therefore, it is optimal for politicians to deviate from their strategies if  $\pi_1 = \pi_L$ . In particular, party  $L$  ( $R$ ) will keep (replace) a CB who set  $\pi_1 = \pi_L$ . The same logic applies for  $p < 0.5$  as there is no opportunistic behavior of leftist CBs. As a consequence, politicians will deviate from their strategies, knowing that a rightist CB holds office, given that  $\pi_1 = \pi_R$ .

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