# The Political Economy of Central Banks and Banking Regulation

*Inaugural-Dissertation*
*zur Erlangung des akademischen Grades*
*eines Doktors der Wirtschaftswissenschaft*

Eingereicht am
Fachbereich Wirtschaftswissenschaft
der Freien Universität Berlin
von

Diplom-Volkswirt Till Mueller

Geboren in Wiesbaden

Tag der Disputation: 06. Februar 2009

Erstgutachter: Prof. Dr. Helge Berger

Zweitgutachter: Prof. Dr. Ronnie Schöb

# Table of Contents

# List of Figures and Tables

# Abstract

The political economy approach abandons the assumption of politicians always acting as benevolent social planners. Instead, it assumes that policymakers are self-interested individuals who may follow objectives that differ from those of society. In this thesis, three self-contained essays explore the political economy of two topical issues in macroeconomics: central bank independence and banking regulation.

**Political Determinants of Central Bank Independence (CBI)**

From a normative perspective, there is little disagreement that the implementation of an independent central bank can be welfare improving. Nevertheless the degree of CBI varies considerably across countries. This paper analyzes the factors that may force incumbent politicians to choose different degrees of CBI. When making this choice, policymakers face a central trade-off: While an independent central bank raises the costs of future policy changes for political successors it also reduces the chances to influence current monetary policy.

**How Should Large and Small Countries Be Represented in a Currency Union?**

The European Central Bank (ECB) is assigned to take a European perspective when conducting monetary policy. However, national central bank governors hold the majority in the ECB's decision making body, the ECB Council. If national central bank governors adopt – at least to some degree – a national viewpoint, this may distort monetary policy from the European perspective. This paper derives the optimal voting weights of national central bank governors in the ECB Council that minimize the distortions of monetary policy from the European first best.

**On the Regulation of Multinational Banks in Europe – Who Should Be in Charge?**

While cross-border integration in the European banking sector has gained momentum, responsibility for the prudential regulation of banks remains mainly in the national domain. This paper compares the welfare effects of two alternative regulatory regimes for the European Union: home and host country regulation. For the European Union, the welfare implications of choosing either regime depend on a number of factors, such as the degree of economic integration or the intensity of competition in the union's banking sector.

# 1. Introduction

The notion of benevolent social planners is widely used in economic theory. This standard approach of public finance allows drawing extremely useful normative policy conclusions. However, models assuming that politicians are solely concerned with the maximization of some social welfare function often fail to explain *actual* policymaking. In particular, they have difficulties in explaining why some countries constantly deviate from first-best economic policies or why comparable countries choose very different policies when facing similar economic problems (Alesina, 1994). There are multiple policy fields in which many countries clearly fail to implement first-best economic policies, for instance, in the actual choice of public debt and deficits (Persson and Svensson, 1989) or in the design of real-world tax systems (Mirrlees, 1971, Atkinson and Stiglitz, 1972).

The political economy approach treats political decision-makers as self-interested individuals who may not only be concerned with the maximization of social welfare. Alesina and Cukierman (1987, p.1) summarize the main driving forces of policymakers:

"Politicians are generally motivated by two desires: they want to hold office as long as possible and have preferences over policy issues. On one hand they are selfish, in the sense that they care about their appointment per se, on the other hand they represent the interest

9

of their constituencies and, generally, different constituencies have different preferences over policy issues."

The authors point at the two potential motivations of politicians that received most attention in the literature: opportunism and ideology. On the one hand, policymakers may be office-seeking and thus act opportunistically due to prestige considerations, material gains (possibly including salaries or the chance of corruption), or generally an 'ego rent' arising from holding office (Rogoff, 1990). On the other hand, 'partisan politicians' (Hibbs, 1977) may share the ideological views of certain groups of voters which will generally not coincide with those of society as a whole. Of course, ideological and opportunistic motives are not mutually exclusive and we should expect even partisan policymakers to sometimes show opportunistic behavior as they will only be able to implement their preferred policies when holding office (Alesina and Rosenthal, 1995). In addition, one should not abandon the assumption of benevolence altogether. After all, politicians may be driven by the wish to maximize social welfare, at least to some degree.

By incorporating this kind of self-interest into the analyses, political economy models can help to explain why politicians implement certain policies even though they are at odds with first-best welfare-maximizing solutions. Moreover, policies that may seem suboptimal or even irrational in the first place can be interpreted as the outcome of rational utility-maximizing behavior of individuals, i.e. policymakers.[1] Therefore, the political economy approach provides powerful tools for positive analysis.

Political economy, however, is not only valuable from a positive point of view but also can deliver important insights for normative analysis. In fact, understanding political decision-makers' motives that distract their objectives from those of society is a crucial step towards designing institutions that minimize deviations from first-best economic outcomes. Drazen (2000, p.7) highlights the normative relevance of political economy approaches as follows:

"[…] normative political economy would ask the question of how, given the existing political constraints, societies can be led to best achieve specific economic objectives. This includes not only how to "overcome" political constraints within the existing

---

[1] Of course, these policies remain suboptimal for society.

institutional framework, but also the design of political institutions to better achieve economic objectives."

This thesis explores two important policy issues in macroeconomics, central bank independence and banking regulation, in three self-contained essays, each adopting a political economy perspective.

Essays one and two (chapter 2-3) both analyze the political economy of central bank independence (CBI), albeit from different angles. The first essay (*Political Determinants of Central Bank Independence*) clearly has a positive focus as it develops a model that helps to explain why different countries implement different degrees of CBI although a higher level of CBI should generally imply welfare improvements. In contrast, the second essay (*How Should Large and Small Countries Be Represented in a Currency Union?*) primarily conducts a normative analysis. It discusses the optimal voting weights of national central bank governors within the European Central Bank's Governing Council, given that these national representatives do not take a purely European perspective as requested by the Maastricht Treaty.

Chapter 4 presents the third essay (*On the Regulation of Multinational Banks in Europe – Who Should Be in Charge?*). It discusses the welfare implications of two different regulatory regimes for the European Union (EU), given that banking regulation in the union mainly stays in the national domain. Hence, the third essay shares both, the normative focus and the European perspective with essay number 2. In what follows, each essay will briefly be reviewed separately.

## Review of Chapter 2:
### Political Determinants of Central Bank Independence

The degree of central bank independence (CBI) varies considerably across countries (Cukierman, 2007, Eijffinger and De Haan, 1996). In this essay, it is argued that this circumstance can hardly be explained by a model that builds on the notion of benevolent politicians as the creation of an independent central bank should generally imply welfare improvements. The literature discusses several reasons for why granting a high degree of independence to the central bank is sound

policy. For instance, as shown by Rogoff (1985) the delegation of monetary policy to an independent and inflation-averse central banker can lower the inflationary bias stemming from the time inconsistency problem of monetary policy (Kydland and Prescott, 1977, Barro and Gordon, 1983). Another prominent argument in favor of CBI builds on the literature dealing with political business cycles. An independent central bank should reduce the likelihood and the magnitude of politically induced distortions of monetary policy and thereby improve welfare.

The paper presented in chapter 2 demonstrates how different degrees of CBI may be the result of 'strategic policy-making'. Incumbent politicians may act strategically by taking into account the impact of their policy choices today on political successors' policy options in the future. 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. Therefore, incumbent politicians face a trade-off when deciding on the degree of CBI: current influence on monetary policy versus policy durability.

The essay shows how various factors influence this trade-off and thereby the institutional choice. The relationship between purely partisan parties 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. In the model, a high degree of CBI is associated with a longer term length of central bankers. As a consequence, politicians cannot replace a central banker and thus have no means to exert pressure on the central bank. However, neither party can reverse the initial appointment decision which thus is durable. In contrast, the term length of central bankers is shorter under a low level of CBI. 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.

The model predicts that incumbent politicians will tend to choose higher degrees of CBI if their re-election prospects are bad, if they place more weight on future policy outcomes, and if they are better able to screen candidates' preferences. 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 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 appointing 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. 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.

## Review of Chapter 3:

### How Should Large and Small Countries Be Represented in a Currency Union?[2]

The recent extension of the Euro area was preceded by a reform of voting modalities in the Governing Council of the European Central Bank (ECB). This reform introduced a rotation scheme in the Council whereby only a fraction of national central bank governors hold voting rights in each meeting.[3] This institutional change did not only aim at limiting the overall size of the decision-making body, but also introduced some implicit weighting of member states via asymmetric rotation and thereby abandoned the "one country, one vote principle". However, the mismatch between relative economic size and voting rights in the Governing Council is still apparent, that is, large countries are still substantially under-represented while the opposite is true for small countries.

In this paper, the optimal voting weights of national central bank governors in a federal central bank's decision-making body are derived, such as the ECB's Governing Council. For the Euro area, the objectives defined by the Maastricht Treaty are taken as first-best benchmark for monetary policy. It is shown how actual policy-making may differ from this benchmark. In particular, monetary policy may be distorted from an EU perspective if national central bank governors take – at least to some degree – a national point of view and national objectives differ from common, union-wide goals. In the model, national preferences over monetary policy are

---

[2] This paper is joint work with Helge Berger.
[3] For a detailed description of the reform, see ECB (2003) and Berger (2006).

subject to random shocks. This may reflect varying partisan political influence at the nation level due to, for instance, a change in government. The optimal voting weights that are derived bring actual monetary policy as close as possible to the first-best benchmark.

In principle, optimal voting weights reflect two opposing forces: the wish to insulate common monetary policy from changing preferences at the national level, and the attempt to avoid an overly active or passive reaction to idiosyncratic national economic shocks. As a rule, small (large) countries should be over-represented (under-represented) in the Council if their preferences are not extremely volatile (stable).[4] Therefore, a perfect match between economic size and voting rights is rarely optimal. On the other hand, the "one country, one vote principle" will not be optimal either, as long as there is economic volatility, and preference shocks are not perfectly symmetrical. Moreover, optimal weights depend on the stochastic properties of economic and preferences shocks. If, for instance, a country becomes more volatile in terms of its inflation preferences, this will unambiguously reduce its optimal voting weight in the Council.

## Review of Chapter 4:
### On the Regulation of Multinational Banks in Europe – Who Should Be in Charge?

Despite the ongoing cross-border integration in financial markets, prudential banking regulation in the European Union (EU) stays mainly in the national domain. Both, the home and the host country, are involved in the regulation of multinational banks, depending on the form of foreign representations. A number of potentially severe problems arise from the national orientation. For instance, national regulators may fail to internalize negative externalities on other countries implied by domestic bank failures. As a consequence, regulation may be provided at a suboptimal low level from an EU perspective. Moreover, national regulators may have the incentives to implement looser regulatory standards in order to attract multinational banks' investments, potentially implying a 'race to the bottom'.

---

[4] This leaves room for the counterintuitive result, as a small (large) country should be under-represented (over-represented) if it is extremely instable (stable) in terms of preference volatility.

There is little disagreement that a *first-best* solution to these and other problems will include a shift of responsibilities for prudential banking regulation to the EU level, at least for Pan-European banks. However, there are serious doubts that such a centralized approach is politically feasible at the moment (Favero et al., 2000, Vesala, 2005). Therefore, this paper discusses optimal *second-best* regulatory regime choices for the EU, given that prudential banking regulation remains national competence. In particular, it analyzes how the assignment of full responsibility for banking regulation to either the home or the host country effects EU welfare.

In the model presented in chapter 4, national regulators aim at attracting multinational banks' investments and at safeguarding financial stability in their jurisdictions. Therefore, they disregard externalities on other countries when setting the regulatory standards. In principle, both regimes have their specific strengths and weaknesses. Host country regulation, on the one hand, facilitates international regulatory arbitrage by banks. This causes a tendency for national regulators to race to the bottom implying looser regulation on average. In contrast, banks' chances to pursue international regulatory arbitrage are smaller under home country regulation as – in this case – banks cannot escape easily from the rules set by their domestic regulator. Consequently, regulatory standards are stricter under home country regulation on average. Under host country regulation, on the other hand, national regulators take into account specific country characteristics more strongly, because they hold regulatory responsibility for all banking units doing business in their country. As a consequence, rules are more differentiated among countries, with less stable countries implementing stricter regulation.

The model shows how the optimal second-best regime choice will generally depend on the relative importance of these advantages and disadvantages. In particular, home country regulation will be more likely the optimal choice if (i) countries are similar in their reaction to macroeconomic shocks, (ii) the competition in the European banking sector is stiff, (iii) the difference in efficiency between foreign and domestic regulators is small, and (iv) the overall financial stability in the EU is high.

# References

Alesina, A. (1994) *Political Models of Macroeconomic Policy and Fiscal Reforms*, in: Voting for Reform – Democracy, Political Liberalization, and Economic Adjustment, Haggard, S. and S. B. Webb (eds.), Oxford University Press, Oxford

Alesina, A. and A. Cukierman (1987) *The Politics of Ambiguity*, NBER Working Paper 2468

Alesina, A. and H. Rosenthal (1995) *Partisan Politics, Divided Government, and the Economy,* Cambridge University Press, New York

Atkinson, A. B. and J. E. Stiglitz (1972) *The Structure of Indirect Taxation and Economic Efficiency*, Journal of Public Economics, 1, 97-119

Barro, R. J. and D. B. Gordon (1983) *A positive Theory of Monetary Policy in a Natural Rate Model,* The Journal of Political Economy, 91 (4), 589-610

Berger, H. (2006) *Optimal central bank design: Benchmarks for the ECB*, The review of International Organizations, 1 (3), 207-35

Cukierman, A. (2007) *Central Bank Independence and Monetary Policymaking Institutions – Past Present and Future*, CEPR Discussion Paper 6441

Drazen (2000) *Political Economy in Macroeconomics*, Princeton University Press, Princeton, New Jersey

ECB (2003) *The Adjustment of Voting Modalities in the Governing Council*, Monthly Bulletin May, 73-83

Eijffinger, S. and J. De Haan (1996) *The Political Economy of Central Bank Independence,* IMF Special Papers in International Economics

Favero, C., Freixas, X., Persson, T. and C. Wyplosz (2000) *One Money, Many Countries – Monitoring the European Central Bank No. 2,* CEPR London

Hibbs, D. A. (1977) *Political Parties and Macroeconomic Policy*, The American Political Science Review, 71 (4), 1467-87

Kydland, F. E. and E. C. Prescott (1977) *Rules Rather than Discretion: The Inconsistency of Optimal Plans*, Journal of Political Economy, 85, 473-91

Mirrlees, J. A. (1971) *An Exploration in the Theory of Optimum Income Taxation*, Review of Economic Studies, 38, 175-208

Persson, T. and L. Svensson (1989) *Why a Stubborn Conservative Would Run a Deficit? Policy with Time Consistent Preferences*, Quarterly Journal of Economics, 104, 325-45

Rogoff, K. (1985) *The Optimal Degree of Commitment to an Intermediate Monetary Target*, Quarterly Journal of Economics, 110, 1169-1190

Rogoff, K. (1990) *Equilibrium Political Budget Cycles*, American Economic Review, 80, 21-36

Vesala, J. (2005) *Which Model for Prudential Supervision in the EU? Comments on Daniele Nouy, "Ensuring Financial Stability through Supervisory Cooperation"* 33rd Economics Conference 2005, Oesterreichische Nationalbank

# 2. Political Determinants
## of Central Bank Independence

**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.

## 2.1 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).[1] However, as noted by Cukierman (1992), de facto independence may well differ from what is formally laid down in central bank laws.[2] 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,

---

[1] 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).

[2] 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).

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 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'.[3] 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

---

[3] 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).

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.

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.

## 2.2 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 (Kydland 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.[4] 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).[5]

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

---

[4] 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).
[5] 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).

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) 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.[6]

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

---

[6] Exceptions are Cukierman (1994), Moser (1999), Keefer and Stasavage (2003), and Crowe (2006).

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 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.[7]

## 2.3 The Model

Consider two purely partisan political parties, $i = L, R$.[8] 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).[9] 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

---

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

[8] In this paper, the terms politicians and parties are used synonymously.

[9] 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).

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.[10]

Figure 2.1 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 party faces the exogenous probability of reelection *p* (the opponent wins with $1 - p$).[11] 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.
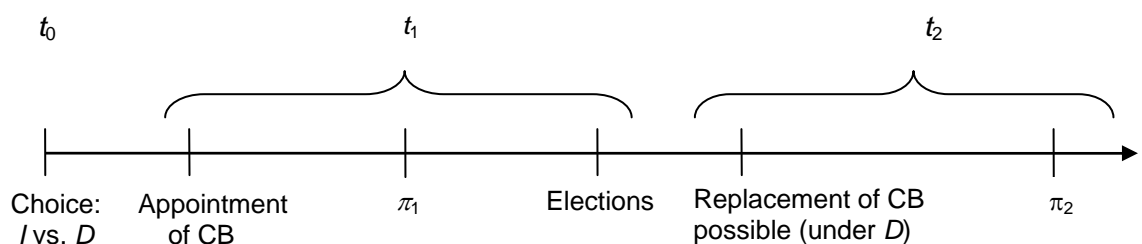


**Figure 2.1.** *Sequence of Events.*

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.[12] Paterson (2005), for instance, argues that institutions reinforce the existing distributions of political and economic power in society which prevents institutional

---

[10] 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*.

[11] 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*.

[12] Acemoglu and Robinson (2006) discuss the question of institutional persistence in detail.

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.

### 2.3.1 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 views on what inflation rate should be targeted.[13] Parties' preferences are common knowledge and captured by the following loss function:

$$(2.1) \quad V^i = \sum_{t=1,2} \beta_P^{t-1} \left( \pi_t - \pi_i \right)^2, \ i = L, R \ .$$

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.[14] 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.[15] 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:

$$(2.2) \quad V^{CB} = \sum_{t=1,2} \beta_{CB}^{t-1} \left[ \chi L_t + \left( 1 - \chi \right) \left( \pi_t - \pi_{CB} \right)^2 \right]$$

---

[13] 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).

[14] 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.

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

Career concerns are captured by the dummy variable $L_t$ which is zero if the CB holds office and a positive constant $\left(\overline{L}\right)$ otherwise, i.e. not holding office implies a loss for the CB.[16] 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.

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].

### 2.3.2   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.

#### 2.3.2.1 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 ($\pi_1 =$

---

[16] 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 $L_t = 0$.

$\pi_2 = \pi_{CB}$). 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 (2.1), $L$'s expected loss of choosing institution $I$ equals

$$(2.3) \quad E\left(V^L\right)_I = \left(1 + \beta_P\right)\left(1 - \delta\right)\left(\pi_R - \pi_L\right)^2$$

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 (2.3).

### 2.3.2.2 Dependence

The signaling game that evolves under $D$ is illustrated in Figure 2.2, for the case where $L$ initially holds governmental power.[17] 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 2.2. 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 $\delta$.

---

[17] Note that Figure 2.2 does not distinguish CBs' types according to their degree of opportunism. Hence, Figure 2.2 does not provide the complete game in extensive form. Nevertheless, it is helpful for illustration purposes.

*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 2.2). 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. $\mu_L = \text{prob}(\pi_{CB} = \pi_L \mid \pi_1 = \pi_L)$. Similarly, the probability that a rightist CB holds office, given that $\pi_1 = \pi_R$ is given by $\mu_R = \text{prob}(\pi_{CB} = \pi_R \mid \pi_1 = \pi_R)$.
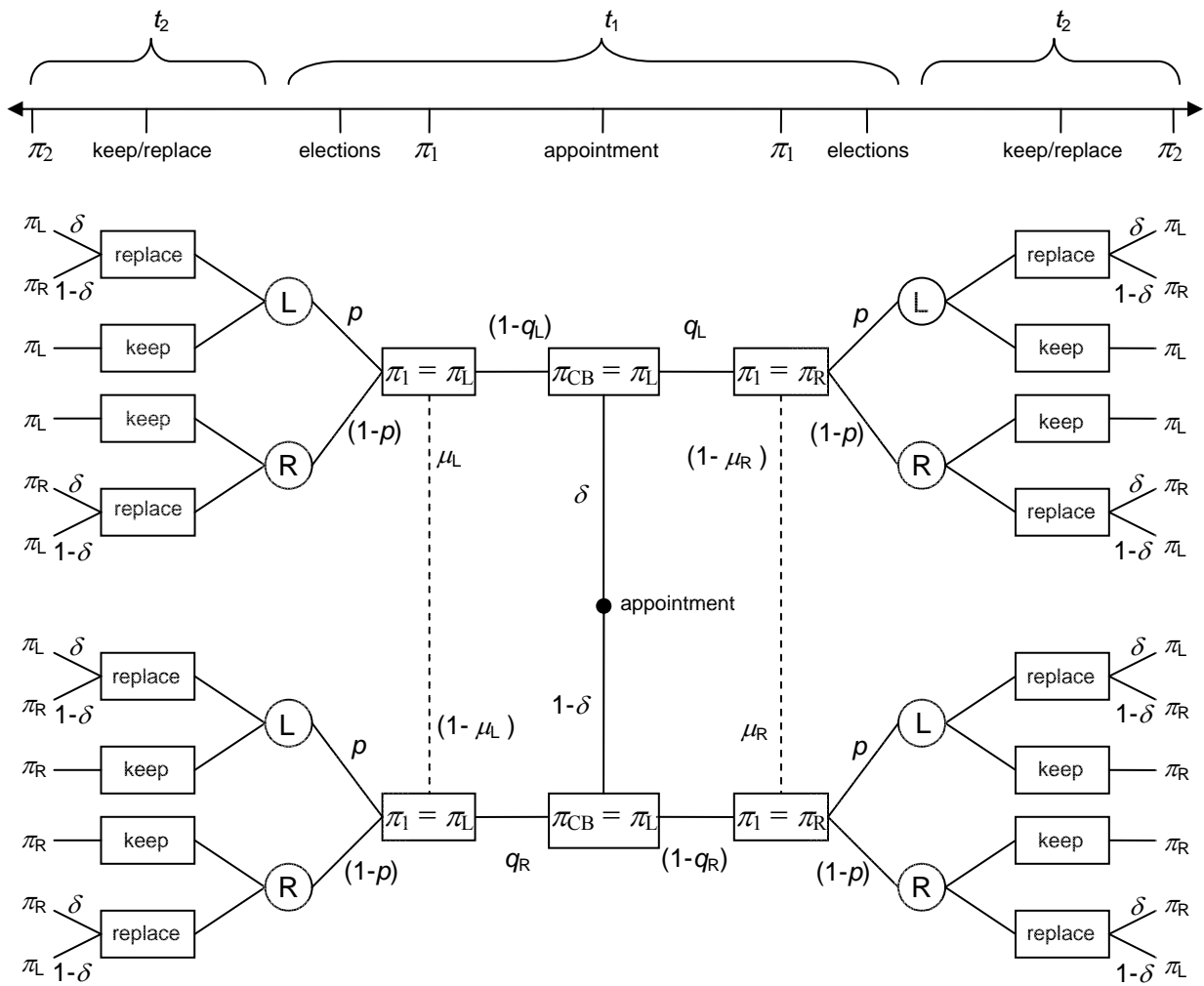


**Figure 2.2.** *Signaling Game under D.*

*L* initially incumbent.

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 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 $\pi_1 = \pi_i$*).

*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.[18]

*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.

---

[18] 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.

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 (2.2)]:

$$(2.4) \quad E\left(V^{CB}\right)_D^{ideol.} = (1-p)\beta_{CB}\left[\chi\overline{L} + (1-\chi)\delta(\pi_R - \pi_L)^2\right]$$

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 $\overline{L}$ 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:

$$(2.5) \quad E\left(V^{CB}\right)_D^{opp.} = (1-\chi)(\pi_R - \pi_L)^2 + p\beta_{CB}\left[\chi\overline{L} + (1-\chi)(1-\delta)(\pi_R - \pi_L)^2\right]$$

The first term in (2.5) 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 $E\left(V^{CB}\right)_D^{opp.} < E\left(V^{CB}\right)_D^{ideol.}$.[19] Comparing Equations (2.4) and (2.5) and rearranging shows that a leftist CB will act opportunistically if $(1-\chi)(\pi_R - \pi_L)^2\left[1 + \beta_{CB}(p - \delta)\right] < \beta_{CB}\chi(1 - 2p)\overline{L}$. 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

---

[19] 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.

opportunistically. Specifically, for $p < 0.5$ the condition for opportunistic behavior of a leftist CB can be rewritten as:

$$(2.6) \quad \chi > \frac{\left[1 + \beta_{CB}(p - \delta)\right](\pi_R - \pi_L)^2}{\beta_{CB}(1 - 2p)\overline{L} + \left[1 + \beta_{CB}(p - \delta)\right](\pi_R - \pi_L)^2} \equiv \chi_L^{crit.}$$

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:

$$(2.7) \quad \chi > \frac{\left[1 + \beta_{CB}(1 - \delta - p)\right](\pi_L - \pi_R)^2}{\beta_{CB}(2p - 1)\overline{L} + \left[1 + \beta_{CB}(1 - \delta - p)\right](\pi_L - \pi_R)^2} \equiv \chi_R^{crit.}$$

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 (2.6) and (2.7). 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 (2.6) and (2.7) 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:

$$(2.8) \quad q_L = \begin{cases} \dfrac{\beta_{CB}(1-2p)\overline{L}}{\beta_{CB}(1-2p)\overline{L}+\left[1+\beta_{CB}(p-\delta)\right](\pi_R-\pi_L)^2} & \text{if} \quad p < 0.5 \\ 0 & \text{if} \quad p \geq 0.5 \end{cases}$$

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

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 2.1:** The following strategies of politicians, leftist and rightist CBs together with the posterior beliefs of politicians $\mu_L = \dfrac{\delta(1-q_L)}{\left[\delta(1-q_L)+(1-\delta)q_R\right]}$ ,

$\mu_R = \dfrac{(1-\delta)(1-q_R)}{\left[\delta q_L+(1-\delta)(1-q_R)\right]}$ 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 $\pi_1 = \begin{cases} \pi_R & \text{if} \quad \chi > \chi_L^{crit.} \\ \pi_L & \text{if} \quad \chi \leq \chi_L^{crit.} \end{cases}$, Rightist CBs set $\pi_1 = \begin{cases} \pi_L & \text{if} \quad \chi > \chi_R^{crit.} \\ \pi_R & \text{if} \quad \chi \leq \chi_R^{crit.} \end{cases}$.

**Proof:** See Appendix.

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

$$(2.9) \quad E(V^L)_D = \left\{ \begin{aligned} &(1-\delta)+\beta_P\left[1-\delta(1+p-\delta)\right]+q_L\delta\left[1+\beta_P(p-\delta)\right] \\ &\quad -q_R(1-\delta)\left[1+\beta_P(1-p-\delta)\right] \end{aligned} \right\}(\pi_R-\pi_L)^2.$$

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.[20]

### 2.3.3 Results

To shed light on the determinants of the institutional choice, it is convenient to rewrite (2.9) as

$$(2.10) \quad E\left(V^L\right)_D = E\left(V^L\right)_I + \kappa ,$$

with $\quad \kappa = \left(\pi_R - \pi_L\right)^2 \left[ \beta_P \delta \left(\delta - p\right) + q_L \delta \left[1 + \beta_P \left(p - \delta\right)\right] - q_R \left(1 - \delta\right)\left[1 + \beta_P \left(1 - p - \delta\right)\right]\right]$ .

Since the incumbent will choose the institution that results in the higher expected pay-off, it directly follows from (2.10) 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.[21]

The following cases can be distinguished and are illustrated in Figure 2.3.[22] First, the incumbent is indifferent between both institutions ($\kappa = 0$) if $p = \delta = 0.5$ (**point A** in Figure 2.3). 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 $L$ indifferent between $I$ and $D$.[23] Second, the optimal choice will be $I$ ($\kappa > 0$) if $\delta > 0.5 > p$ (**area I** in Figure 2.3).[24] Third, $D$ will be the optimal choice ($\kappa < 0$) if $p > \delta > 0.5$ (**area II** in Figure 2.3).[25] Finally, for $\delta > p > 0.5$ one cannot sign $\kappa$ straightaway. Plugging in $q_R$ from (2.8) and rearranging shows that $\kappa$ is positive and therefore $I$ the optimal choice if:

---

[20] Note that both forms of opportunism will never occur simultaneously [see Equation (2.8)].

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

[22] Figure 2.3 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 2.3.

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

[24] 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 $\kappa > 0$.

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

$$(2.11) \quad \left(\pi_R - \pi_L\right)^2 > \frac{(2p-1)\beta_{CB}\left[(1-\delta)-\beta_P(1-p)(2\delta-1)\right]}{\beta_P\delta(\delta-p)\left[1+\beta_{CB}(1-p-\delta)\right]} \cdot \bar{L} \equiv \left(\pi_R - \pi_L\right)^2_{crit.}$$

A sufficient condition for this inequality to hold is $(\pi_R - \pi_L)^2_{crit.} < 0$. As the denominator of (2.11) is positive for the case of $\delta > p > 0.5$ considered here, inequality (2.11) 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, $(\pi_R - \pi_L)^2_{crit.} < 0$ and $I$ is always the optimal choice if $\delta > \delta_{crit.} > p > 0.5$ (**area III** in Figure 2.3) while both institutions are a theoretical possibility if $\delta_{crit.} > \delta > p > 0.5$ (**area IV** in Figure 2.3).[26]
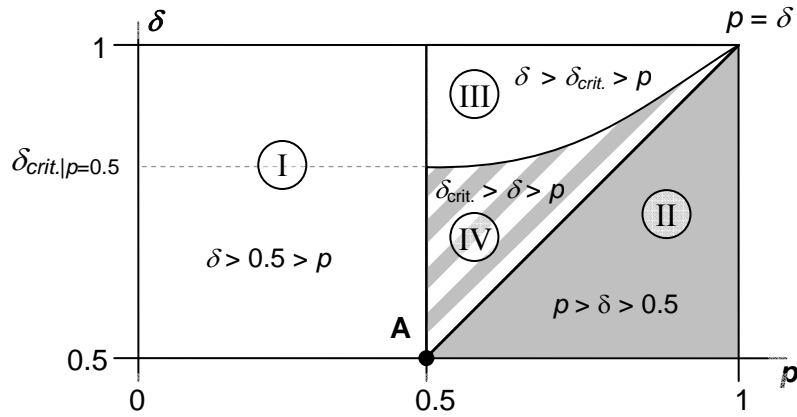


**Figure 2.3.** *Optimal institutional choice.*
Institution *I* is optimal in areas I and III; institution *D* is the optimal choice in area II; either institution can be optimal in area IV.

From these considerations the following result can be derived.

**Result 2.1:** 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).

---

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

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.[27] 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[28] 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 2.2:** 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,[29] this positive effect is 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 $I$.[30]

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

---

[27] Note that this is also true for the case of $\delta_{crit.} > \delta$ where both institutions are a theoretical possibility since (2.11) is less likely fulfilled for a higher $p$ as $\partial(\pi_R - \pi_L)^2_{crit.} / \partial p > 0$.

[28] From 1981 on, the Bank of Italy was restricted to finance government spending.

[29] Differentiating (2.3) and (2.9) implies this finding as $\partial E(L^L)_D / \partial\delta < 0$, $\partial E(L^L)_I / \partial\delta < 0$.

[30] Again, this is also true for the case of $\delta_{crit.} > \delta$ as a better screening ability makes (2.11) more likely fulfilled because $\partial(\pi_R - \pi_L)^2_{crit.} / \partial\delta < 0$ $\partial(\pi_R - \pi_L)^2_{crit.} / \partial\delta < 0$.

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 (2.11) holds, i.e. if the discrepancy between ideological preferences exceeds a critical threshold.[31] This directly leads to the following finding.

**Result 2.3:** 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.[32] 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 $(\overline{L})$. 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 $\overline{L}$ has the opposite effect on the institutional choice.

**Result 2.4:** If CBs receive a higher utility from holding office, this will lower the probability for the implementation of an independent central bank.

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

A similar effect arises if CBs put a larger weight on the future since $(\pi_L - \pi_R)^2_{crit.}$ 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.

---

[31] Recall that $\delta_{crit.} > \delta$ implies $(\pi_R - \pi_L)^2_{crit.} > 0$.
[32] For $p > 0.5$, only rightist CBs may act opportunistically.

**Result 2.5:** 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 (2.11) is more likely fulfilled with a higher $\beta_P$ ($\partial(\pi_L - \pi_R)^2_{crit.} / \partial\beta_P < 0$). 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.

## 2.4 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.

# References

Acemoglu, D., S. Johnson, and J. A. Robinson (2001) *The Colonial Origins of Comparative Development: An Empirical Investigation*, American Economic Review, 91 (5), 1369-1401

Acemoglu, D. and J. A. Robinson (2006) *De Facto Political Power and Institutional Persistence*, AEA Papers and Proceedings, 96 (2), 325-30

Alesina, A. (1987) *Macroeconomic Policy in a Two-Party System as a Repeated Game,* Quarterly Journal of Economics, 102, 651-78

Alesina, A. (1988) *Macroeconomics and Politics*, NBER Macroeconomics Annual, Cambridge University Press, Cambridge, MA

Alesina, A. and H. Rosenthal (1995) *Partisan Politics, Divided Government, and the Economy,* Cambridge University Press, New York

Alesina, A. and G. Tabellini (1990) *A Positive Theory of Fiscal Deficits and Government Debt*, Review of Economic Studies, 57 (3), 403-14

Arnone, M., B. Laurens, and J.-F. Segalotto (2006) *Measures of Central Bank Autonomy: Empirical Evidence for OECD, Developing, and Emerging Market Economies*, IMF Working Paper 06/228

Barro, R. J. and D. B. Gordon (1983) *A positive Theory of Monetary Policy in a Natural Rate Model,* The Journal of Political Economy, 91 (4), 589-610

Berger, H., J. De Haan and S. Eijffinger (2001) *Central Bank Independence: An Update of Theory and Evidence,* Journal of Economic Surveys, 15 (1), 3-40

Berger, H. and U. Woitek (2005) *Does Conservatism Matter? A Time-Series Approach to Central Bank Behaviour*, The Economic Journal, 115, 745-66

Bernhard, W., L. Broz, and W. Clark (2002) *The Political Economy of Monetary Institutions,* International Organization, 56 (4), 693-723

Bernhard, W. and D. Leblang (2002) *Political Parties and Monetary Commitments*, International Organization, 56 (4), 803-30

Chappell, H. W., T. M. Havrilesky, and R. R. McGregor (1993) *Partisan Monetary Policies: Presidential Influence Through the Power of Appointment*, Quarterly Journal of Economics, 108 (1), 185-218

Chortareas, G. E. and S. M. Miller (2003) *Central Banker Contracts, Incomplete Information, and Monetary Policy Surprises: In Search of a Selfish Central Banker?*, Public Choice, 116, 271-95

Crowe, C. (2006) *Goal-Independent Central Banks: Why Politicians Decide to Delegate*, IMF Working Paper 06/256

Cukierman, A. (1992) *Central Bank Strategy, Credibility and Independence; Theory and Evidence*, MIT Press, Cambridge, MA

Cukierman, A. (1994) *Commitment through Delegation, Political Influence and Central Bank Independence*, in: *A Framework for Monetary Stability*, J. O. De Beaufort Wijnholds, S. Eijffinger, L. H. Hoogduin (eds.), Kluwer, Boston, London, 55-74

Cukierman, A. (2007) *Central Bank Independence and Monetary Policymaking Institutions – Past Present and Future*, CEPR Discussion Paper 6441

Cukierman, A., S. B. Webb, and B. Neyapti (1992) *Measuring the Independence of Central Banks and Its Effects on Policy Outcomes*, The World Bank Economic Review, 6, 353-98

De Haan, J. and G.-J. Van't Hag (1995) *Variation in Central Bank Independence across Countries: Some Provisional Empirical Evidence*, Public Choice, 85, 335-51

Dreher, A., J. De Haan, and J.-E. Sturm (2006) *When Is a Central Banker Governor Fired? Evidence Based on a New Data Set,* KOF Working Paper 143

Dreher, A., J.-E. Sturm and J. De Haan (2007) *Does High Inflation Cause Central Bankers to Lose Their Job? Evidence Based on a New Data Set,* KOF Working Paper 167

Eijffinger, S. and J. De Haan (1996) *The Political Economy of Central Bank Independence,* IMF Special Papers in International Economics

Eijffinger, S. and E. Schaling (1992) *Central Bank Independence: Criteria and Indices,* Research Memorandum 548, Department of Economics, Tilburg University

Eijffinger, S. and E. Schaling (1995) *The Ultimate Determinants of Central Bank Independence*, Paper prepared for the CentER Conference 'Positive Political Economy: Theory and Evidence', Tilburg, January 23-24, 1995

Franzese, R. J. (1999) *Partially Independent Central Banks, Politically Responsive Governments, and Inflation*, American Journal of Political Science, 43 (3), 681-706

Fudenberg, D. and J. Tirole (1991) *Game Theory*, MIT Press, Cambridge, MA

Glaeser, E. L. and A. Shleifer (2002) *Legal Origins*, Quarterly Journal of Economics, 117 (4), 1193-1229

Glazer, A. (1989) *Politics and the Choice of Durability*, American Economic Review, 79 (5), 1207-13

Goodman, J. B. (1991) *The Politics of Central Bank Independence,* Comparative Politics, 23 (3), 329-49

Grilli, V., Masciandaro, D. and G. Tabellini (1991) *Political ans Monetary Institutions and Public Financial Policies in the Industrial Countries,* Economic Policy, 13, 341-92

Hallerberg, M. (2002) *Veto Players and the Choice of Monetary Institutions*, International Organization, 56 (4), 775-802

Hanssen, A. F. (2004) *Is There a Politically Optimal Level of Judicial Independence?*, American Economic Review, 94 (3), 712-29

Hayo, B. (1998) *Inflation Culture, Central Bank Independence and Price Stability*, European Journal of Political Economy, 14, 241-63

Hibbs, D. A. (1977) *Political Parties and Macroeconomic Policy*, American Political Science Review, 71 (4), 1467-87

Keefer, P. and D. Stasavage (2003) *The Limits of Delegation: Veto Players, Central Bank Independence, and the Credibility of Monetary Policy*, American Political Science Review, 97 (3), 407-23

Kydland, F. E. and E. C. Prescott (1977) *Rules Rather than Discretion: The Inconsistency of Optimal Plans*, Journal of Political Economy, 85, 473-91

Lohmann, S. (1997) *Partisan Control of the Money Supply and Decentralized Appointment Powers,* European Journal of Political Economy, 13, 225-46

Moser, P. (1999) *Checks and Balances and the Supply of Central Bank Independence*, European Economic Review, 43, 1569-93

Nordhaus, W. D. (1975) *The Political Business Cycle*, Review of Economic Studies, 42, 169-90

Paterson, B. (2005) *Institutions: Why are They Persistent and Why Do They Change?*, Society for Economic Dynamics, 2005 Meeting Paper 446

Persson, T. and L. Svensson (1989) *Why a Stubborn Conservative Would Run a Deficit? Policy with Time Consistent Preferences*, Quarterly Journal of Economics, 104, 325-45

Persson, T. and G. Tabellini (1990) *Macroeconomic Policy, Credibility and Politics*, Harwood Academic Publishers, New York

Persson, T. and G. Tabellini (2002) *Political Economics: Explaining Economic Policy,* MIT Press, Cambridge, MA

Posen, A. (1993) *Declarations are not Enough: Financial Sector Sources of Central Bank Independence*, NBER Macroeconomic Annual, 10, 253-74

Przeworski, A., Cheibub, J. A., Neto L., Papaterra, F. and M. Alvarez (1996) *What Makes Democracies Endure?*, Journal of Democracy, 7 (1), 39-55

Rogoff, K. (1985) *The Optimal Degree of Commitment to an Intermediate Monetary Target*, Quarterly Journal of Economics, 110, 1169-1190

Rogoff, K. (1990) *Equilibrium Political Budget Cycles*, American Economic Review, 80, 21-36

Sibert, A. (2002) *Monetary Policy With Uncertain Central Bank Preferences*, European Economic Review, 46, 1093-1109

Sieg, G. (1997) *A Model of Partisan Central Banks and Opportunistic Political Business Cycles*, European Journal of Political Economy, 13, 503-16

Tabellini, G. and A. Alesina (1990) *Voting on the Budget Deficit*, American Economic Review, 80, 37-49

Waller, C. (1992) *A Bargaining Model of Partisan Appointments to the Central Bank,* Journal of Monetary Economics, 29, 411-28

Walsh, C. E. (1995) *Optimal Contracts for Central Bankers*, American Economic Review, 85, 150-67

## Appendix (Proof of Proposition 2.1)

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 (2.6) and (2.7).

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

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

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

To proof Proposition 2.1, 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 $\mu_L = \dfrac{\delta\left(1 - q_L\right)}{\delta\left(1 - q_L\right) + \left(1 - \delta\right)q_R} \geq \delta$. This inequality is always fulfilled, as $\mu_L = 1$ 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 becomes $\mu_L = \dfrac{\delta}{\delta + \left(1 - \delta\right)q_R} \geq \delta$ 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 $\left(1 - \mu_R\right) = \dfrac{\delta q_L}{\delta q_L + \left(1 - \delta\right)\left(1 - q_R\right)} \leq \delta$. This inequality is always fulfilled as $(1 - \mu_R) = 0$ 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 inequality becomes $\left(1 - \mu_R\right) = \dfrac{\delta q_L}{\delta q_L + \left(1 - \delta\right)} \leq \delta$ 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 $(1-\mu_L)=\dfrac{(1-\delta)q_R}{\delta(1-q_L)+(1-\delta)q_R}\leq\delta$. 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 $(1-\mu_L)=\dfrac{(1-\delta)q_R}{\delta+(1-\delta)q_R}\leq\delta$ which always holds as $q_R\leq\dfrac{\delta^2}{(1-\delta)^2}\geq 1$.

In the case of $\pi_1 = \pi_R$, $R$ will keep the CB if $\mu_R=\dfrac{(1-\delta)(1-q_R)}{\delta q_L+(1-\delta)(1-q_R)}\geq\delta$. 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 $\mu_R=\dfrac{(1-\delta)}{\delta q_L+(1-\delta)}\geq\delta$ which is fulfilled if $\dfrac{(1-\delta)^2}{\delta^2}\geq q_L$.

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

To see that Proposition 2.1 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.[33] In this case, there is an important difference to the equilibrium defined by Proposition 2.1: since a party would replace a CB who conducted

---

[33] 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.

monetary policy in line with its preferences, there would only be opportunistic behavior of 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 $\pi_1 = \pi_R$.

# 3. How Should Large and Small Countries Be Represented in a Currency Union? [*]

## Abstract

The likely extension of the Euro area has triggered a debate on the organization of the ECB, in particular on the apparent mismatch between relative economic size and voting rights in the Council. We present a simple model of optimal representation in a federal central bank addressing this question. Optimal voting weights reflect two opposing forces: the wish to insulate common monetary policy from changing preferences at the national level, and the attempt to avoid an overly active or passive reaction to idiosyncratic national economic shocks. A perfect match between economic size and voting rights is rarely optimal, and neither is the "one country, one vote principle". Empirically, there are indications that the pattern of over- and under-representation of member countries in the ECB Council might be extreme by the standards of the US Fed and German Bundesbank and not always optimal.

---

[T]he co-responsibility and active involvement of the Länder, in the form of participation in the appointment of the Land Central Bank (...), are an important element in the Bundesbank's structure and independence.

Bundesbank (1992, p. 49-50)

Whether within the Convention or in bodies such as the European Central Bank, representatives of the large countries believe they are under threat of being tied up by a gang of small countries, which are by definition irresponsible and which, following enlargement, will form the majority within the Council in terms of numbers.

R. Goebbels, MEP Luxembourg (European Parliament 2003)

## 3.1 Introduction

The likely extension of the Economic and Monetary Union (EMU) has triggered a lively debate on the organization of monetary policy in the Euro area. Following a suggestion by the European Central Bank (ECB), current EMU member governments have agreed on a plan to reform the ECB's organizational structure with a view to (i) better match the economic and political weights of member countries in the ECB Council and (ii) limit the overall size of the Council.[1]

While there is variation in detail, it is probably fair to say that most academic papers discussing the merits of the reform (or its necessity) agree that limiting the overall size of the ECB Council is a crucial step to ensure efficiency in monetary policymaking in the Euro area.[2] Already today the ECB Council is exceptionally large in terms of members and – even after the reform – Euro area enlargement might leave the ECB with "too many [members] to decide on where to go to dinner," as Baldwin (2001) remarked.

---

[1] The reform has been agreed to at the government level, but formal ratification by current member states is pending.
[2] Studies discussing these and related arguments include, among others, Baldwin *et al.* (2001), Hefeker (2002), Gros *et al.* (2002), Fitoussi and Creel (2002), de Grauwe (2003), and Meade (2003).

There is less agreement, however, on whether – or to what degree – correcting the existing lack of correlation between the member countries' economic size and their voting power is sound policy. The current ECB structure, by following the "one country, one vote" principle, gives economically smaller countries a disproportional large vote. EMU enlargement is likely to amplify this problem, even with ECB reform. Most (if not all) prospective new members are small enough to be over-represented even after the reform; they also show stark differences in economic development compared to current members (de Haan *et al.* 2004).

The over-representation of smaller member states could introduce a bias into the ECB's decision-making. The Maastricht treaty would have the ECB stabilize inflation within the Euro area using the Harmonized Consumption Price Index.[3] This encourages the ECB to take a European perspective by evaluating the potential impact of national economic developments on Euro area inflation based on the respective relative economic size of a member country. If national central bank governors put at least some weight on national economic developments, their over-representation could distort this perspective by directing monetary policy toward national issues.

So, does the plan for ECB reform fall short? The answer is far from clear. While reducing the degree of over-representation will ensure that the decision-making process within the ECB Council will be more likely to resemble the perspective of a benevolent European social planner, there are a number of arguments that caution against a too ambitious reform. For instance, Gros and Hefeker (2002) and Benigno (2004) point out that over- and under-representation of member countries in the planner's target function or, equivalently, in the distribution of voting rights within the actual ECB Council, could be optimal if transmission mechanisms differ. How important these differences might be, is, however, mostly an empirical question.[4] Another argument is made by Casella (1992), who points out that over-representation could be a necessary condition for smaller countries to join a currency union.

---

[3] Euro area inflation is computed by Eurostat using a weighted average of (harmonized) current Euro area member inflation rates, where the weights are based on relative expenditure on final private domestic consumption. The distribution of relative consumption very closely mirrors that of relative GDP.

[4] Ciccarelli and Rebucci (2002) present evidence that suggests that transmission mechanisms have become fairly similar among current EMU members already during the 1990s.

The present paper adds central bank independence as a potentially crucial argument to this debate.[5] We focus on the need for federal central banks such as the ECB to strive for both, political independence from and fair representation of member states on their policymaking bodies. We show that the interplay between two opposing forces – (i) the wish to reduce the impact of national preference shocks on union-wide policymaking, and (ii) the attempt to minimize misrepresentation of any one country's relative economic size so as to avoid over- or under-reactions to national economic shocks – determines the optimal representation of national interest on the Council. Calibrating Council representation to moderate the impact of preference shocks helps to insulate common monetary policy from unwanted volatility when national targets might deviate from the common policy goal. Matching Council representation and economic weight, on the other hand, ensures that actual monetary policy stabilizes national economic shocks in line with the union ideal.

Optimal representation will, as a rule, weigh both arguments, reflecting economic size as well as the stochastic properties of economic and preference shocks. As a consequence, whether a country will be optimally over- or under-represented compared to its relative economic size depends on all these determinants. While one might expect that most small countries would be over-represented and most large countries would be under-represented (as is the case in the ECB today), this does not always hold true. For instance, it might be optimal to over-represent a large country if its policy preferences are very stable relative to other union members.

In what follows, Section 3.2 will briefly review recent related literature. Section 3.3 describes the model, the first-best benchmark policy, and derives the conditions for optimal representation of national interests within a currency union in the presence of economic and preference shocks. Section 3.4 allows for dependencies between shocks and hints at the impact of continued integration in the economic and preference domain on optimal representation. Section 3.5 provides a robustness check by allowing for alternative sources of national preference shocks. Section 3.6 attempts to put everything into perspective by comparing the degree of over- and under-representation relative to economic size for the

---

[5] Advantages of the "one country, one vote" principle based on considerations of political economy are also discussed in Berger (2002) and Berger *et al.* (2004).

ECB, the US Federal Reserve, and the German Bundesbank. In addition, determinants of optimal representation identified by the theoretical model are compared with actual misrepresentation within the ECB. Finally, Section 3.7 draws some conclusions.


## 3.2 Relation to Recent Literature


Our contribution is related to three intertwined strands in the literature on central bank design. One, including von Hagen and Süppel (1994) and Lohmann (1997, 1998), asks whether a central bank with a centralized or a decentralized structure is better suited to cope with partisan policy making at the national level. The argument is involved, but in general strong national representation in the joint central bank Council often leads to inefficiencies at the union level. For instance, in the Lohmann (1997) model, a more decentralized central bank organization increases the frequency at which the Council's median voter (and, thus, central bank policy) changes, resulting in unwanted volatility in monetary policy.

This contrasts with a somewhat more recent body of papers discussing the efficiency of alternative decision-making structures (see Gerling *et al.* (2003) for a survey). Gerlach-Kristen (2002), for instance, argues that committees with multiple members might be better suited than single individuals to process information, fostering efficient decision-making – a theoretical result supported by experimental evidence produced by Blinder and Morgan (2002).[6] Since much of the information that federal central banks are processing is regional, this can be taken to suggest that regional or national representation in the Council has advantages (Maier *et al.* 2003).[7] Thus, full centralization would not be optimal.

A third group of papers takes the influence of national interest on central bank Council policies as given – either because full centralization might not be optimal or because national representation is too deeply ingrained into the political setup of the currency union to be abandoned any time soon. The question is then how to deal with shocks to national

---

[6] Gersbach and Hahn (2001) explore similar issues from a transparency perspective.

[7] Also see Goodfriend (2000). Alan Greenspan frequently stresses that the information provided by the residents of the regional Federal Reserve Banks "contribute[s] vitally to the formulation of monetary policy" (Greenspan 2000, p. 2) in the case of the U.S. Federal Reserve System.

preferences within a federal central bank system. The best-known contributions addressing this question include Waller and Walsh (1996), who suggest long and overlapping contracts for Council members as a device to moderate the impact of national preference shocks (see also Lindner 2000), an idea already reflected in the actual term structure of ECB Council members.

Other recent proposals remain largely theoretical to date. The first such proposal would institute flexible majority rules for Council decisions (Gersbach and Pachl 2004). These rules would attempt to moderate demands for policy changes based on idiosyncratic national economic shocks by raising the majority requirements in line with the size of the desired interest rate change. A second proposal, from Heisenberg (2003), argues that increasing the transparency of Council decision-making would diminish national influences on policies, helping to constrain the problem of national preference shocks at its source. Finally, Bullard and Waller (2004) discuss the advantages of alternative decision-making arrangements, including simple majority voting, bargaining, and a supermajority design, in a general equilibrium framework.

The present paper adds to this small but growing literature. As we will argue below, optimizing over- or under-representation of national representatives on the federal central bank Council compared to the relative economic size of their respective countries is another tool that can be used to moderate the impact of national preference shocks on the common monetary policy. Whether the observed misrepresentation of economic size in the ECB Council can be reconciled with the theoretical argument is, of course, another, ultimately empirical, question. We shall revisit this issue toward the end of the paper.

## 3.3 The Model

### 3.3.1 The Economy and the First-Best Policy

The output gap in each member country of the currency union $i$, defined as the percentage deviation of the actual output level from the level of natural output $y_i^n$, is given by a standard Lucas supply function

$$(3.1) \quad y_i = \pi - \pi^e + \theta_i; \qquad \theta_i \sim \left(0, \sigma_{\theta_i}^2\right).$$

In what follows, we will assume that decision-makers are well aware of the

limits the Lucas function puts on real activity in the long run. Inflation, $\pi$, is assumed to be

similar across the currency union, that is, $\pi = \pi_i = \pi_{\neq i}$, and under the full control of the

common central bank. Inflation expectations, denoted by $\pi^e$, are set rationally, so that

$\pi^e = E\pi$, with expectation operator $E$. The last term in Equation (3.1), $\theta_i$, is a country-specific

economic shock with zero mean and known (positive) variance.

A reasonable assumption – one that seems to be broadly in line with the spirit of the

Maastricht treaty in the example of the ECB or the policy targets pursued by the US Federal

Reserve – is that the first-best policy minimizes a standard quadratic loss function based on

the deviations of inflation and the aggregate output gap, $y$, from their commonly (currency

union-wide) agreed target levels:

$$L^* = \left(\pi - \pi^*\right)^2 + \lambda y^2.$$

The term $\pi^* > 0$ is an exogenous inflation target, say 2 percent, and $\lambda$ is a coefficient

measuring the relative weight attached to output stabilization. We assume that the latter fulfills

$0 < \lambda < \infty$. The target level for the aggregate output gap has been set to zero, ensuring that

the first-best policy does not suffer from a time inconsistency problem. The aggregate output

gap is the weighted sum of the respective national output gaps, that is, $y = \sum \chi_i y_i$, where we

can define the economic weights of each country as the expected share in aggregate union

output: $\chi_i \equiv y_i^n / \sum y_i^n$. This allows us to express $L^*$ as

$$L^* = \left(\pi - \pi^*\right)^2 + \lambda \left(\sum \chi_i y_i\right)^2$$

or, in the two-country case,

$$(3.2) \quad L^* = \left(\pi - \pi^*\right)^2 + \lambda \left(\chi y_1 + (1 - \chi)y_2\right)^2$$

where $\chi$ and $(1 - \chi)$ denote the relative economic weight of country 1 and country 2,

respectively. In what follows, we will focus on the two-country case for simplicity.

The social planner sets inflation by minimizing (3.2), taking into account (3.1), yielding the

benchmark reaction function

$$\pi = \frac{1}{1+\lambda}\pi^* + \frac{\lambda}{1+\lambda}\left(\pi^e - \chi\theta_1 - (1-\chi)\theta_2\right).$$

Under rational expectations, equilibrium inflation in the first-best will be

$$\pi = \pi^* - \frac{\lambda}{1+\lambda}\left(\chi\theta_1 + (1-\chi)\theta_2\right) \equiv \pi_{FB},$$

which, using (3.1), implies actual output in the two member countries will be

$$y_1 = \frac{1}{1+\lambda}\left(-\lambda(1-\chi)\theta_2 + (1+\lambda(1-\chi))\theta_1\right) \equiv y_{1_{FB}},$$

$$y_2 = \frac{1}{1+\lambda}\left(-\lambda\chi\theta_1 + (1+\lambda\chi)\theta_2\right) \equiv y_{2_{FB}}.$$

Thus, the expected welfare (loss) under a first-best policy is

$$EL^*\left(\pi_{FB}, y_{1_{FB}}, y_{2_{FB}}\right) = \frac{\lambda\left(\chi^2\sigma_{\theta_1}^2 + (1-\chi)^2\sigma_{\theta_2}^2 + 2\chi(1-\chi)\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}\right)}{1+\lambda}$$

where $\varphi_{\theta_1, \theta_2}$ marks the coefficient of correlation (and $\varphi_{\theta_1, \theta_2}\sigma_{\theta_1}\sigma_{\theta_2}$ the covariance) between economic shocks in countries 1 and 2. The covariance term appears in $EL^*$ because, while the central bank "leans against the wind" with its stabilization policy, it never fully compensates economic shocks in either country as long as the relative weight of the real term in the underlying loss function $L^*$ is not infinitely high.

### 3.3.2 Actual Decision-Making

The purely union-wide perspective employed to derive the benchmark solution might not be a good description of actual decision-making in a federal central bank. While, for instance, the ECB (1999, p. 55) rightfully stresses that "members of the [Council] do not act as national representatives, but in a fully independent personal capacity," there is reason to assume that national economic considerations play at least some role in the voting behavior of governors in the Council.[8] This assumption is supported by evidence of national (or regional) influences in other federal central bank systems. Berger and de Haan (2002) show that regional differences in growth and inflation influenced voting behavior in the pre-1999 Bundesbank Council; Meade and Sheets (2002) find that Federal Reserve FOMC members do take into

---

[8] The assumption that national interests play at least some role also is fairly wide-spread in the academic literature. See, among others, the contributions by von Hagen and Süppel (1994), Lindner (2000), Aksoy *et al.* (2002), Gros and Hefeker (2002, 2003), Gersbach and Pachl (2004), and Frey (2004).

account developments in regional unemployment when deciding monetary policy; and Heinemann and Huefner (2004) and Meade and Sheets (2002) argue that there might even be indications of regional voting behavior in actual ECB policy.

A simple, yet plausible, description of actual decision-making within the common central bank is a weighted voting approach or a form of Nash-bargaining in which voting weights are the fall-back positions.[9] In this case, decisions will be based on a loss function of the form

$$(3.3) \qquad L_A = \sum \alpha_i L_i$$

where $\alpha_i$ denotes the political weight of country $i$'s representative or governor in the Council, with $\sum \alpha_i = 1$. In other words, the loss function underlying actual central bank decisions is seen as a weighted sum of the individual loss functions of the member countries, $L_i$, where the political weights can differ from the economic weights, that is, $\alpha_i \overset{>}{\underset{<}{=}} \chi_i$.

Before moving on, note that the description of actual decision-making in the currency union's central bank Council ignores the role of a Board. In the current ECB, the Board casts 6 out of 18 votes in the Council; in the US Federal Reserves' FOMC the Board holds 7 out of 12 votes. Not taking into account the Board can be justified by the notion that the Board is likely to target a loss function similar to the social planner's described in (3.2). In the case of the ECB, for instance, the EU Treaty speci.es that the Board is appointed by "common accord of the governments of the member states at the level of Heads of State or Government, on a recommendation from the Council, after it has consulted the European Parliament and the Governing Council of the ECB"(EU 1997, Article 112 2. (b)). Arguably, this political process, which is highly centralized at the European level, tends to select Board members with a Euro area-wide perspective. With the Board following a first-best or Maastricht policy, however, analysis of possible deviations of ECB behavior from the Maastricht norm should focus (without loss of generality) on the behavior of national representatives.[10]

---

[9] This representation of decision-making abstracts from possible strategic interaction between Council members. For an analysis of coalition forming in the Council in light of EMU enlargement see, for instance, Baldwin *et al.* (2001).

[10] Frey (2004) takes a comparable view of the Board's perspective. He concludes that, as a consequence, in an OCA-type model, larger member countries prefer a more important role for the Board than smaller members.

But how will national central bank governors act in the Council? As already discussed, we assume that they base their decisions on a loss function thought to measure country $i$'s welfare:

$$(3.4) \qquad L_i = \left(\pi - \pi_i^*\right)^2 + \lambda y_i^2$$

where $\pi_i^*$ (to which we will return in a moment) is the target level for inflation.

This specification resembles that of the social planner with respect to the absence of an inflationary bias. As in (3.2), the loss function of country $i$ includes a real target compatible with the level of natural output in country $i$, and we assume that the relative weight of the real argument in (3.4), $\lambda$, is the same as in the first-best scenario.

There is, however, a difference with respect to the inflation bliss point. The national inflation target is defined as

$$(3.5) \qquad \pi_i^* = \pi^* + \varepsilon_i; \qquad\qquad \varepsilon_i \sim \left(0, \sigma_{\varepsilon_i}^2\right)$$

that is, country $i$'s inflation target might deviate from the common target, $\pi^*$, by a preference shock $\varepsilon_i$ with zero mean and known variance $\sigma_{\varepsilon_i}^2$.

Preference shocks can occur for various reasons, but the most natural explanation ties them to changing (partisan) government preferences concerning inflation. For instance, Hibbs (1977) and Alesina (1987) argue that policymakers – and thus the governments selecting the national governors in the currency union's central bank Council – have different objective functions, including (but not necessarily restricted to) the inflation target. As a consequence, shocks to the composition of government can lead to unexpected changes in national preferences concerning inflation. Alesina and Rosenthal (1995) discuss empirical evidence to support this view. A related theory, put forth by Bullard and Waller (2004), argues that changing preferences concerning inflation might reflect random changes in the political dominance of agents loosing (savers, for instance) and gaining (such as borrowers and wage earners) from

high inflation. This could influence the selection of national central bank governors for the common Council.[11]

An alternative, non-political-economic approach would interpret the shocks, $\varepsilon_i$, as country-specific deviations from the broader trend of structural inflation (along the lines of Balassa-Samuelson).[12]

While targeted inflation is a plausible explanation for the discord between different national Council members, it is not, of course, the only possible channel through which national preference shocks could influence common monetary policy. In particular, there could be partisan shocks to the preferred output gap or to the relative weight of the real argument in (3.4). However, allowing the output target instead of the inflation target to fluctuate around zero at the national level has little impact on the analysis. The same holds, broadly speaking, for preference shocks to $\lambda$. We shall return to this issue further below.

To compute actual central bank policy in the two-country case, we substitute (3.4) into (3.3) to get

$$(3.6) \quad L_A = \alpha\left(\left(\pi - \pi_1^*\right)^2 + \lambda y_1^2\right) + (1-\alpha)\left(\left(\pi - \pi_2^*\right)^2 + \lambda y_2^2\right).$$

Minimizing (3.6) with regard to inflation while taking into account (3.1) yields the reaction function

$$(3.7) \quad \pi = \frac{1}{1+\lambda}\left(\alpha\pi_1^* + (1-\alpha)\pi_2^*\right) + \frac{\lambda}{1+\lambda}\left(\pi^e - \alpha\theta_1 - (1-\alpha)\theta_2\right),$$

which, under rational expectations, implies the following actual equilibrium values for inflation and output:

---

[11] A related interpretation would be to assume that preference shocks reflect exogenous changes in fiscal fortitude, where, for example, governments with unexpectedly high deficits will adjust their inflation preferences upward.

[12] It has been argued, for instance, that the ECB's inflation target of (less then) 2 percent does not adequately reflect the Balassa-Samuelson effect, especially for the EU accession countries still on a real convergence path to the EMU core (Berger et. al 2004). In this case Equation (3.5) should be seen as a special case of the more general form $\pi_i^* = \pi^* + \bar{\pi}_i \varepsilon_i$, with the (somewhat unrealistic) assumption that the contribution of trend structural inflation to the national inflation target, $\bar{\pi}_i$, will be zero across countries. Note, however, that allowing $\bar{\pi}_i > 0$, while introducing an additional dimension in the discussion of optimal representation, would not alter the thrust of the results of the analysis.

$$\pi = \pi^* + \frac{1}{1+\lambda}\left[\alpha\varepsilon_1 + (1-\alpha)\varepsilon_2 - \lambda(\alpha\theta_1 + (1-\alpha)\theta_2)\right] \equiv \pi_A$$

$$y_1 = \frac{1}{1+\lambda}\left(\alpha\varepsilon_1 + (1-\alpha)\varepsilon_2 - \lambda(1-\alpha)\theta_2 + (1+\lambda(1-\alpha))\theta_1\right) \equiv y_{1_A}$$

$$y_2 = \frac{1}{1+\lambda}\left(\alpha\varepsilon_1 + (1-\alpha)\varepsilon_2 - \lambda\alpha\theta_1 + (1+\lambda\alpha)\theta_2\right) \equiv y_{2_A}.$$

## 3.4 Optimal Representation

Substituting $\pi_A$, $y_{1_A}$, and $y_{2_A}$ in (3.2) and taking expectations, we can compute the expected welfare loss associated with the actual monetary policy, $EL^*(\pi_A, y_{1_A}, y_{2_A})$ (see Appendix 3.1). The optimal representation of country 1, $\alpha^*$, is simply the value of $\alpha$ that minimizes the difference between $EL^*(\pi_A, y_{1_A}, y_{2_A})$ and expected welfare under the first-best policy, that is

$$\alpha^* \Leftrightarrow \arg\min\left(EL^*\left(\pi_A, y_{1_A}, y_{2_A}\right) - EL^*\left(\pi_{FB}, y_{1_{FB}}, y_{2_{FB}}\right)\right).$$

Country 2's optimal weight is, equivalently, $1 - \alpha^*$.

Optimal representation will depend not only on the weight of the real argument in the loss function, $\lambda$, and the economic weight, $\chi$, but also on both countries' economic and preference shocks and their possible interaction terms (see Appendix 3.1).

In the next Section we will take a closer look at what defines optimal representation, with a focus on its relation to a country's economic weight. To facilitate the analysis, we will start with the assumption that all shocks are independent. Analysis in subsequent Sections will allow for correlated shocks across and within countries.

### 3.4.1 The Baseline Case with Independent Shocks

Assuming that $\varphi_{\varepsilon_1, \varepsilon_2} = \varphi_{\theta_1, \theta_2} = \varphi_{\varepsilon_i, \theta_i} = \varphi_{\varepsilon_i, \theta_{\neq i}} = 0$ for $i \in \{1, 2\}$, the optimal weight for country 1 becomes

$$(3.8) \quad \alpha^* = \frac{\sigma_{\varepsilon_2}^2 + \chi\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)}{\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)},$$

which obviously satisfies $0 < \alpha^* < 1$ because $\chi < 1$ and $\sigma^2_{\varepsilon_1} > 0$.

### 3.4.1.1 Over- and Under-Representation

Equation (3.8) has a straightforward implication for the relation between economic size and a country's optimal voting weight. In particular, we find that

$$(3.9) \quad \alpha^* \overset{>}{\underset{<}{=}} \chi \Leftrightarrow \chi\sigma^2_{\varepsilon_1} \overset{<}{\underset{>}{=}} (1-\chi)\sigma^2_{\varepsilon_2}.$$

Broadly speaking, Equation (3.9) states that over-representation in the Council in relation to a country's economic size is more likely to be optimal for smaller countries with relatively stable preferences. Under-representation, on the other hand, is more likely to be optimal for larger countries with relatively volatile preferences. This becomes even clearer if we rewrite (3.9) to highlight the tension between economic size and relative preference stability:

$$(3.10) \quad \alpha^* \overset{>}{\underset{<}{=}} \chi \Leftrightarrow \chi \overset{<}{\underset{>}{=}} \frac{\sigma^2_{\varepsilon_2}}{\sigma^2_{\varepsilon_1} + \sigma^2_{\varepsilon_2}} \equiv \alpha_P.$$

Obviously, over-representation is optimal if a country's share in the currency union's GDP is lower than a critical threshold value, $\alpha_P$, measuring the other country's relative contribution to overall preference volatility. Vice versa, under-representation is optimal when a country is large relative to the other currency union member's contribution to preference volatility.

The threshold value $\alpha_P$ has an interesting interpretation. Note that according to (3.8) and (3.10), $\alpha^* \to \alpha_P$ as $\sigma^2_{\theta_1}, \sigma^2_{\theta_2} \to 0$, that is, $\alpha_P$ can be interpreted as the optimal political voting weight that results purely from trading off differences in the volatility of preferences between countries in the absence of economic shocks.

Equivalently, in the absence of preference shocks, the optimal political weight, $\alpha^*$, converges with a country's relative economic weight, $\chi$, which, according to Equation (3.2), is the weight it should receive under the first-best scenario: $\alpha^* \to \chi$ as $\sigma^2_{\varepsilon_1}, \sigma^2_{\varepsilon_2} \to 0$.

This suggests the following observation.

**Remark 3.1:** In general, optimal representation balances two opposing forces: the wish to reduce the impact of preference shocks on monetary policy (by bringing $\alpha^*$ as close as possible to $\alpha_P$), and the attempt to limit misrepresentation of a country's relative economic size to avoid an overly active or passive reaction to national economic shocks (by keeping $\alpha^*$ as closely as possible to $\chi$).

As a consequence, a country's optimal representation in the Council, $\alpha^*$, will always be in an interval defined by $\chi$ on the one hand and $\alpha_P$ on the other. Thus, whether a country will be over- or under-represented depends on the relative size of the country and the characteristics of both countries' preference shocks. Figure 3.1 illustrates both scenarios.
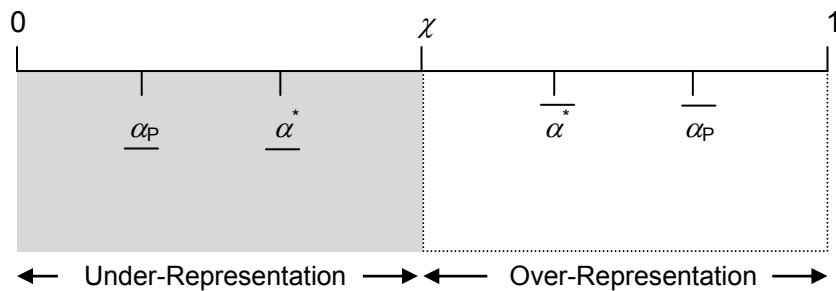


**Figure 3.1.** *An Illustration of the Baseline Model.*

Intuitively, we would expect small countries to be over-represented and large countries to be under-represented, but this is not necessarily the case. However, the intuitive scenario is the outcome if preferences are similar across the currency union:[13]

**Remark 3.2:** If preference shocks were sufficiently similar, over-representation would always be optimal for small countries and under-representation would always be optimal for large countries.

On the other hand, if differences in preference shocks are stark, there is room for a counterintuitive result:

---

[13] Equation (3.9) reduces to $\alpha^* \gtrless \chi \Leftrightarrow \chi \lessgtr (1-\chi) \equiv \alpha_P$ when $\sigma_{\varepsilon_1}^2 = \sigma_{\varepsilon_2}^2$. Obviously, similar outcomes can be found for asymmetrical preference shocks as long as the differences in preferences remain small compared to the differences in economic size.

**Remark 3.3:** Under-representation of a small country can be optimal if its inflation preferences are relatively volatile. By the same token, over-representation of a large country can be optimal if its inflation preferences are stable in comparison. Size continues to be important, however, as these outcomes are less likely for very small or very large countries, respectively.

**Proof:** (3.10) requires $\chi < \sigma^2_{\varepsilon_2} / \left( \sigma^2_{\varepsilon_1} + \sigma^2_{\varepsilon_2} \right)$ for $\alpha^* > \chi$. Thus, a large country with $\chi > \frac{1}{2}$ can only be over-represented if $\sigma^2_{\varepsilon_1} < \sigma^2_{\varepsilon_2}$. By the same logic, $\alpha^* < \chi$ requires $\sigma^2_{\varepsilon_1} > \sigma^2_{\varepsilon_2}$ for a small country with $\chi < \frac{1}{2}$. The inequalities for over- and under-representation are both more likely to be fulfilled if $|\chi - \frac{1}{2}| \to 0$. $\qquad\square$

Figure 2 depicts the two scenarios discussed in the Remark.
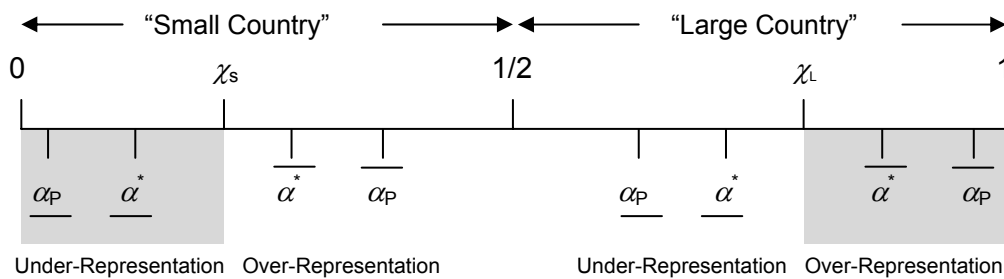


**Figure 3.2.** *Under- (Over-) Represented Small (Large) Countries.*

The above analysis suggests that the counterintuitive case of, for instance, a large country being over-represented, is most relevant when the actual overall difference in country sizes within the union is small. In the extreme case of a monetary union of economic equals (i.e., when $\chi = (1 - \chi) = \frac{1}{2}$), asymmetry in representation would always be optimal if there were asymmetries in preference shocks. As Figure 3.1 illustrates, in such a case countries with relatively more volatile inflation preferences would receive less than $\chi = \frac{1}{2}$ (and countries with relatively less volatile inflation preferences would receive more than $\chi = \frac{1}{2}$ ) of the voting rights in the joint central bank Council.

Finally, Equation (3.9) sheds light on the "one country, one vote" principle featured so prominently in the debate on ECB reform. It shows:

> **Remark 3.4**: In the absence of economic shocks and if preference shocks are symmetrical, optimal representation in the Council follows the "one country, one vote" principle no matter the distribution of economic size.

While this Remark does not quite rule out "one country, one vote" as an optimal solution, it marks it as a rather special case. Equations (3.8) and (3.10) imply $\alpha^* = 1 - \alpha^* = \alpha_P = \frac{1}{2}$ when economic shocks are absent (i.e. $\sigma^2_{\theta_1}$, $\sigma^2_{\theta_2} = 0$) and when preference shocks are perfectly symmetrical (and uncorrelated) $\sigma^2_{\varepsilon_1} = \sigma^2_{\varepsilon_2}$.

### 3.4.1.2 Comparative Statics

How does optimal representation change with the characteristics of economic and preference shocks? As one would expect, inspection of (3.8) reveals a clear-cut relation between representation and preference stability.

> **Remark 3.5:** An increase in the volatility of preference shocks unconditionally reduces the optimal weight a country receives in the Council.

This should not come as a surprise. If optimal representation indeed balances the attempt to correctly mirror a country's relative economic size with the need to reduce the impact of national preference shocks on the Council, a country that suffers a decrease in preferences stability will see its optimal representation in the currency union's central bank being reduced. The finding is independent of the initial degree of over- or under-representation. In contrast, the impact of a marginal increase in economic volatility depends on a country's initial status.

> **Remark 3.6:** An increase in economic volatility in a country reduces the gap between economic weight and optimal representation. Over-represented countries will see their optimal voting weight reduced, while under-represented countries will see their optimal voting right increased.

**Proof:** Taking the partial derivative of (3.8) and rearranging yields

$$\partial\alpha^* / \partial\sigma_{\theta_1} \gtrless 0 \Leftrightarrow \chi\sigma_{\varepsilon_1}^2 \gtrless (1-\chi)\sigma_{\varepsilon_2}^2,$$ which, by (3.9), implies the result. □

For given country size, neglecting economic shocks in favor of moderating preference shocks becomes more expensive (in welfare terms) as economic volatility increases. As a consequence, a country which is burdened with a more volatile economy should see its optimal voting right increase. Figure 3.3 illustrates the result.
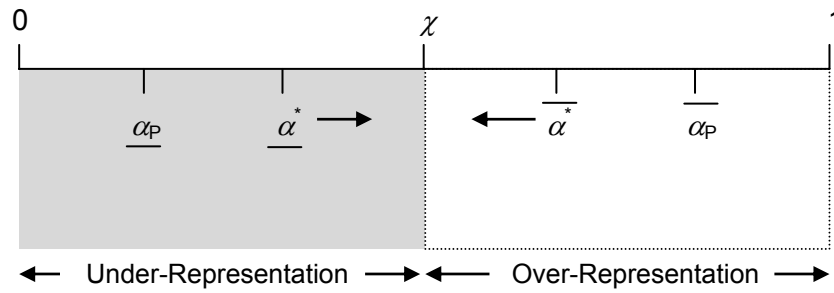


**Figure 3.3.** *An Increase in Economic Volatility in Country 1.*

### 3.4.2 Optimal Representation with Correlated Shocks

Allowing for dependencies between economic and political shocks across countries and within a country is interesting on at least two counts. First, introducing non-zero correlated shocks allows us to shed some light on the question of how closer integration of currency union member countries influences optimal representation. There is, for instance, the question of whether closer synchronization of business cycles will change the trade-off underlying optimal representation in favor of economic size or preference stability. In addition, allowing for dependencies between shocks serves as a robustness check for the baseline results built on the assumption of zero correlations.

### 3.4.2.1 Correlated Economic Shocks

Economic shocks are one obvious area where there could be cross-country dependencies. As discussed above, even under the first-best scenario, the central bank would only "lean against the wind" and not fully compensate for an economic shock impacting all member countries of the currency union. This could mean that the "residual" country shocks will continue to

influence all member countries in a correlated fashion. The correlation could be positive or negative. An example for a common shock with positive correlation would be an unanticipated change in oil prices. On the other hand, a surprise depreciation of the common currency, for instance, might help members that are net-exporters but hurt others that are net-importers, resulting in a negative correlation of economic shocks across countries.

The first insight from the model is that the baseline results on optimal representation hardly change when we allow for cross-country correlation of economic shocks. Allowing for $\varphi_{\theta_1,\theta_2} \neq 0$ but otherwise following the same steps as before, we find that the optimal weight for country 1 resembles (3.8), except for additional (additive) terms involving the cross-country covariance of economic shocks, $\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}$. In fact, the condition determining whether a country will be optimally over- or under-represented compared to its economic weight is identical to (3.9) in the no-correlation case. This generalizes and strengthens the baseline findings. Appendix 3.2 lays out the formal results in some detail.

A second finding can be summarized as follows:

> **Remark 3.7:** As the currency union's economies become more similar in terms of their economic shocks, countries with relatively stable preferences are likely to see their optimal voting weight increase.

The rationale is – in line with the discussion of Equation (3.10) earlier – that increased business cycle synchronization reduces the cost of moderating the impact of preference shocks on monetary policy, because a possible misrepresentation of economic size is now less likely to lead to a deviation of stabilization policy from its first-best benchmark.

Two comparative-static results lead to this conclusion (see Appendix 3.2). First, when business cycles are positively correlated across the currency union, and when country 1's economy is less volatile than country 2's to start with, then an increase in economic volatility in country 1, $\sigma_{\theta_1}$, will make the two economies more similar. In this case, it becomes less costly to offset preference shocks by allowing voting rights to deviate from relative economic size. As a consequence, optimal representation requires that the country's optimal weight in monetary

policy decisions should be based more on preference shock considerations, and the spread between economic and political weights in the currency union grows.[14] The second relevant result is that a higher coefficient of correlation between economic shocks will lead to higher optimal representation for the country initially over-represented and vice versa. Thus, once again, as economic shocks become more similar, the optimal spread between economic and political weights in the currency union increases.

This analysis suggests that currency unions should optimally pay more attention to relative preference stability considerations as their joint economy "matures" and becomes increasingly more integrated. If integration implies an increasing likeness of economic shocks, preference stability considerations should eventually dominate the calculation of members' optimal Council representation. In somewhat more formal terms: we find that $\alpha^*$ approaches the optimal weight in the absence of economic shocks, $\alpha_P$, as the correlation between national economic shocks approaches positive unity and the difference between the volatility of economic shocks reduces to zero.[15]

### 3.4.2.2 Correlated Preference Shocks

Next, we allow for correlation between preference shocks while assuming zero correlation between all other shocks. The idea is that surprise changes in inflation preferences might well take the form of union-wide "mood swings" that simultaneously affect all member countries and their representatives in the common central bank. Alternatively, one might speculate that preference changes are negatively correlated across countries.

While the optimal weight in this scenario once again resembles (3.8) in the case with independent shocks, allowing for $\varphi_{\varepsilon_1,\varepsilon_2} \neq 0$ influences the condition determining whether a country will be over- or under-represented compared to its economic size (see Appendix 3.3). In particular, if preference shocks are positively correlated, it might be optimal to over-represent (or under-represent) member countries with very stable (or very unstable) preferences irrespective of their economic size. The intuition is that a positive correlation of

---

[14] To be precise, country 1's optimal representation in the Council increases if it was initially over-represented relative to its economic weight, and it decreases if it was initially under-represented. See Appendix 3.2.

[15] Note that $\alpha_P$ remains unchanged from the baseline scenario (see Appendix 3.2).

preference shocks across countries reduces the chance that national preference shocks will neutralize each other within the Council. Increasing the voting weight of countries with very stable preference can be optimal to minimize the resulting unwanted volatility in joint monetary policy.

In addition, we can make a statement that parallels the similarity result in the case with correlated economic shocks:[16]

> **Remark 3.8:** As currency union member countries become more similar in terms of their preference shocks, economically large countries are likely to see their optimal voting weight increase and small countries are likely to see their optimal voting weights decrease.

The rationale behind this rests on the implied change in the balance of forces driving optimal representation. In this case, greater likeness of preference shocks reduces the potential gains from moderating these shocks by letting optimal voting weights deviate from economic size, thereby allowing preference shocks to compensate each other in the Council. As a consequence, large countries (which are more likely to be under-represented when shocks become more similar) should see their voting weights being increased and small (probably over-represented) countries should see them reduced.

Two comparative-static results support this conclusion (see Appendix 3.3). First, a rise in the correlation of preference shocks will increase a country's optimal voting weight if it is large in economic terms and its preferences are relatively stable. Second, an increase in country 1's preference volatility that brings its volatility level closer to country 2's will lead to a decrease in its optimal representation. Since, in this case, country 1 was blessed with more stable preferences at the outset, it was also over-represented before the change. As a consequence, the decrease in optimal representation brings its voting weight closer to its economic weight.

---

[16] See Appendix 3.3. The calculations assume that the starting point for $\alpha^*$ is not too extreme, that is, that we start from an interior solution.

The above analysis implies that increasing likeness of preference shocks – arguably a possibility within an ever more integrated currency union such as the U.S. or the European Union – should prompt the currency union to better tailor Council voting weights to members' economic size. It is straightforward to show that $\alpha^*$ approaches $\chi$ as the correlation between national preference shocks approaches positive unity, and the difference between the volatility of these shocks reduces to zero. Note that this possible "integration effect" runs counter to the implications of increasing likeness of economic shocks discussed in the previous Section.

### 3.4.2.3 Correlated Economic and Preference Shocks

If preference shocks are, at least in part, a consequence of changes in government, and if changes in government are influenced by economic conditions, preference and economic shocks might not be independent from each other. In fact, there is room for something akin to a political business cycle. For instance, one can imagine that voters elect a government that is more tolerant to inflation when economic activity is in decline, giving rise to a negative correlation between economic and preference shocks.

As with cross-country correlations, allowing preference shocks to be correlated with economic shocks within country 1 (i.e. $\varphi_{\varepsilon_1,\theta_1} \neq 0$) changes optimal representation and the conditions for over- or under-representations compared to the baseline (see Appendix 3.4) – albeit not fundamentally. Interestingly, however, under certain conditions a strong political business cycle in the sense just discussed might make it optimal to decrease a country's voting weight below its relative economic size.

> **Remark 3.9:** A negative correlation between preference shocks and economic shocks (a "political business cycle") amplifies country 1's policy demands in the Council after economic shocks – making optimal under-representation more likely.

The rationale behind this finding is that a negative correlation of output and preference shocks in country 1 increases the cost of over-representing a country in the Council. To see this, note that, according to Equation (3.7), the preferred inflation rate of country 1 is:[17]

$$\pi_1 = \frac{1}{1+\lambda}\left(\pi^* + \varepsilon_1\right) + \frac{\lambda}{1+\lambda}\left(\pi^e - \theta_1\right).$$

Over-representation of country 1 would mean that, for instance, a negative shock to the output gap ($\theta_1 < 0$) would trigger a too expansionary monetary policy at the union level, as country 1's preferred policy reaction ($-\theta_1\lambda/(1+\lambda) > 0$) would receive greater influence on Council decisions than suggested by its economic weight. This policy request would be further amplified if country 1 is, in addition, subject to an inflation preference shock pointed in the opposite direction as the output shock ($\varepsilon_1 > 0$ in this example), increasing the distance to the first-best policy.

The above analysis is reinforced by the comparative statics for optimal representation $\alpha^*$ (see Appendix 3.4 for details).[18] As one would expect, the optimal voting weight increases if the correlation between preference and economic shocks rises in circumstances in which the country's inflation preferences are relatively stable and economic volatility is high across the currency union. Moreover, a country will see its optimal representation in the Council increase if its economic shocks become more volatile and the correlation between economic and preference shocks is sufficiently positive and large. That is, unlike in the pervious scenarios, the impact of higher economic volatility does not depend on whether a country is initially over- or under-represented. As a consequence, the gap between economic weight and optimal representation might not be reduced. A related result is that a country might see its optimal voting weight increase after a marginal rise in preference volatility. This, too, is in strict contrast with all previous findings. The intuition is that the "blessings" hidden in a higher and positive correlation of preference and economic shocks depend on a certain balance between the two. For exceedingly volatile preferences, their potentially moderating impact becomes mute.

---

[17] Set $\alpha = 1$ in Equation (3.7) to arrive at the expression shown here.
[18] All results assume an interior solution, i.e., that $0 < \alpha^* < 1$.

## 3.5 Relative-Weight Preference Shocks

The principle results of the baseline model with uncertain national inflation preferences are robust with regard to alternate sources of preference uncertainty. In particular, optimal representation continues to depend not only on relative economic size, but also on the relative characteristics of economic and preference shocks. As a consequence, over-representation of large and under-representation of small countries remain a theoretical possibility.

Following Beetsma and Jensen (1998), we allow for preference shocks regarding the weight on the relative real target. In this case the individual loss functions of member countries become

$$(3.11) \quad L_i = \left(1 + \varepsilon_i\right)\left(\pi - \pi^*\right)^2 + \left(\lambda - \varepsilon_i\right)y_i^2$$

where $\varepsilon_i \sim (0, \sigma^2_{\varepsilon_i})$ and $\lambda > 0$ in line with the first-best policy. Again focusing on the two country case, actual central bank policy can be calculated based on the Lucas supply function (3.1) and the representation-weighted sum of national loss functions

$$L_A = \alpha\left(\left(1 + \varepsilon_1\right)\left(\pi - \pi^*\right)^2 + \left(\lambda - \varepsilon_1\right)y_1^2\right) + \left(1 - \alpha\right)\left(\left(1 + \varepsilon_2\right)\left(\pi - \pi^*\right)^2 + \left(\lambda - \varepsilon_2\right)y_2^2\right).$$

Based on the resulting equilibrium values for inflation and output, we can compute the expected welfare loss. Minimizing the latter with regard to country 1's voting weight in the Council, we find that optimal representation satisfies

$$(3.12) \quad \alpha^*_\lambda = \frac{\sigma^2_{\theta_2}\sigma^2_{\varepsilon_2} + \chi\lambda^2\left(\sigma^2_{\theta_1} + \sigma^2_{\theta_2}\right)}{\sigma^2_{\theta_1}\sigma^2_{\varepsilon_1} + \sigma^2_{\theta_2}\sigma^2_{\varepsilon_2} + \lambda^2\left(\sigma^2_{\theta_1} + \sigma^2_{\theta_2}\right)}$$

where the subscript "$\lambda$" marks the relative-weight preference shock scenario. Note that $0 < \alpha^*_\lambda < 1$.

Equation (3.12) reveals similarities and some differences with the inflation preference shock case depicted in (3.8). Comparing $\alpha^*_\lambda$ and $\alpha^*$, one notes that the terms involving economic volatility alone are similar. As opposed to what we saw in (3.8), however, the volatility of preference shocks in (3.12) does not appear independently. Instead, all $\sigma^2_{\varepsilon_i}$ terms are weighted by the variance of economic shocks, $\sigma^2_{\theta_i}$. This is due to the fact that – in a model without inflationary bias – relative-weight preference shocks only impact actual policy if there is a

shock to output. In the absence of economic shocks, that is if $y_i = 0$, the Council will set inflation equal to the inflation target (which in this case is constant).

In general, however, optimal representation continues to depend on relative economic size as well as on the relative characteristics of economic and preference shocks, just as in the baseline model.

Reflecting the similarities in optimal representation, the condition for over- and under-representation with relative-weight uncertainty resembles the condition in the baseline case and over-representation of large and under-representation of small countries remain a theoretical possibility. The condition for over- and under-representation becomes

$$(3.13) \quad \alpha_\lambda^* \underset{<}{\overset{>}{=}} \chi \Leftrightarrow \chi \sigma_{\theta_1}^2 \sigma_{\varepsilon_1}^2 \underset{>}{\overset{<}{=}} (1-\chi)\sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2,$$

which, except for the weighting of preference volatility, is identical with (3.9) in the baseline model. As before, given economic volatility, over-representation is more likely to be optimal for small and politically relatively stable countries. If economic shocks were symmetrical, Equations (3.9) and (3.13) would be identical.

Rearranging, we find that the critical value indicating the maximum country size for a country to be over-represented, $\alpha_{P\lambda}$, is implied by

$$(3.14) \quad \alpha_\lambda^* \underset{<}{\overset{>}{=}} \chi \Leftrightarrow \chi \underset{>}{\overset{<}{=}} \frac{\sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2}{\sigma_{\theta_1}^2 \sigma_{\varepsilon_1}^2 + \sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2} \equiv \alpha_{P_\lambda}.$$

Similar to $\alpha_P$ in Equation (3.10) in the case with inflation preference shocks, $\alpha_{P\lambda}$ measures the other country's relative contribution to overall preference volatility. As before, optimal representation can be interpreted as balancing preference shock moderation (by bringing $\alpha_\lambda^*$ closer to preference-uncertainty based optimal weight $\alpha_{P\lambda}$) and minimizing misrepresentation of economic size (by letting $\alpha_\lambda^*$ approach the first-best economic weight $\chi$). As a consequence, Remarks 3.1-3.4 in the baseline case also apply to the case of uncertain relative-weight preferences.

One difference between the baseline and the present model is the influence of economic volatility on optimal representation. While optimal representation continues to be decreasing

in the volatility of preference shocks in the present model, an increase in economic volatility now unconditionally reduces a country's optimal weight in the Council.

When preference uncertainty shifts from the inflation target to the relative weight, even under-represented countries will have their optimal representation reduced. The reason is that an increase in economic volatility amplifies the unwanted impact of preference shocks on monetary policy, leading to a decrease in $\alpha_{P\lambda}$. Because optimal representation weighs both $\chi$ and $\alpha_{P\lambda}$, the reduction in $\alpha_{P\lambda}$ "pulls" $\alpha^*_\lambda$ downward. While the forces that helped create an increase in optimal representation in the baseline model are still present, the negative effect stemming from higher preference-uncertainty always dominates (see Appendix 3.5).

## 3.6 Some Empirical Observations

How does the distribution of $\alpha_i$ and $\chi_i$ look in the example of the ECB? Under the current "one country, one vote" rule, the relative voting rights of national governors are strictly symmetrical, that is, $\alpha_i = 1/n$, if we disregard the votes allocated to the Board. As Figure 3.4 illustrates, for a hypothetical EMU with 24 members (assuming that the ten EU accession countries as well as Romania and Bulgaria, have joined the Euro area), this will change if the ECB reform is implemented and EMU enlargement proceeds, giving way to a (somewhat) more asymmetric voting scheme, in which $\alpha_i$ will be adjusted to better reflect economic size.[19]

To provide some perspective, it is interesting to relate the degree of misrepresentation in today's ECB, as well as in the hypothetical ECB with 24 members depicted in Figure 3.4, to the example of other federal central banks – namely the US Federal Reserve System and the German Bundesbank before the advent of the Euro. Table 3.1 shows two indicators of misrepresentation based on the sum of the squared deviation of the voting rights held by a country or region in the decision-making Council or committee and its GDP share.

---

[19] Political voting rights assume that the Board does not vote in line with country interests. For sources and notes see Tables 3.1 and 3.2 below.
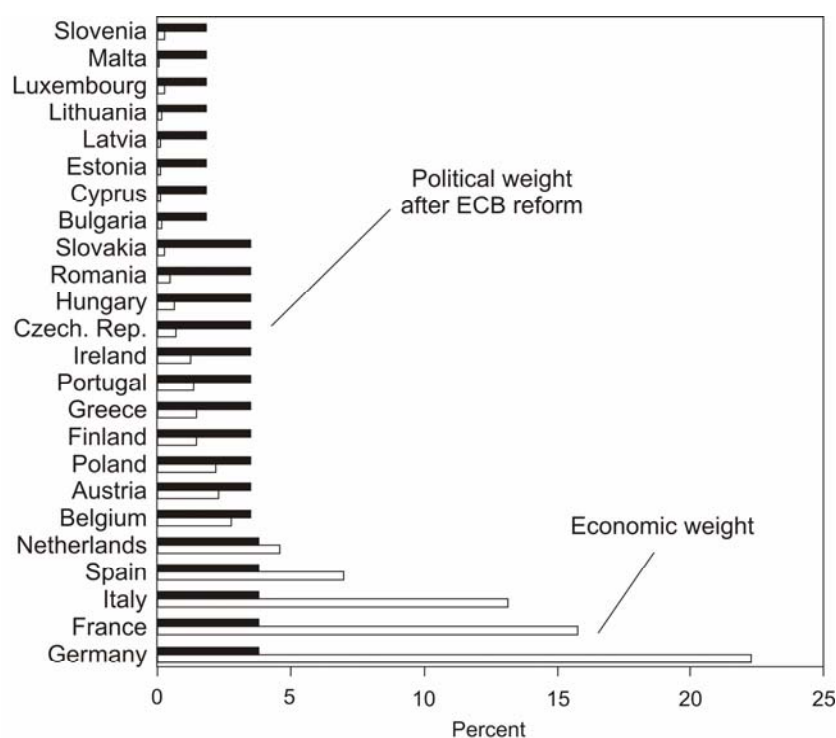
**Figure 3.4.** *Political and Economic Weights in the EMU24 Council.*

|  | US Federal Reserve | | German Bundesbank | | ECB before & after Enlargement | | |
|---|---|---|---|---|---|---|---|
|  | *1977* | *2001* | *1959* | *1992* | *2001* | *EMU24*<br>*w/o Reform* | *EMU24*<br>*with Reform* |
| STD | 4.46 | 5.54 | 8.48 | 5.70 | 11.26 | 12.47 | 11.34 |
| STD_Board | 0.41 | 0.66 | 2.65 | 0.91 | 4.60 | 7.88 | 5.99 |

**Table 3.1.** *Indicators of Misrepresentation in Federal Central Banks, 1959-2001.*

Sources: Bureau of Economic Analysis; US Federal Reserve; Statistisches Bundesamt; IFS; and own calculations.

Notes: "STD" measures the sum of the squared difference between national or regional vote shares in the overall decision-making committee and the relevant GDP or GSP share of the given year. It is assumed that the Board does not vote in the interest of the respective country. "STD_Board" assumes that the Board votes with each region or country in line with its GDP or GSP share. This increases (decreases) the political clout of large (small) member countries.[20] The data for the US Feds has been calculated by allocating state GSP data to Fed districts on a county-by-county basis. Rotation schemes have been taken into account in the calculation of Fed and ECB post-reform voting rights. In case of the Fed, with no major structural reform of representation in the post-war period, the years selected mark the time-span of the available data. In the case of the Bundesbank, 1959 and 1992 mark years with major structural reforms that helped to reduce misrepresentation.

---

[20] Berger (2002, Appendix I) discusses the effect of EMU enlargement on misrepresentation indicators under different assumptions on Board behavior.

| | (1) Cohesion | (1) < Avg. | (2) Change | (2) < Avg. | (3) GDP Share | (3) < Avg. | Consensus? (1) = (2) = (3) | Political Weight in excess of (3) |
|---|---|---|---|---|---|---|---|---|
| Germany | 1.57 | – | 0.07 | + | 30.33 | – | | -22.00 |
| France | 1.61 | – | 0.22 | – | 21.44 | – | – | -13.11 |
| Italy | 1.87 | – | 0.30 | – | 17.90 | – | – | -9.57 |
| Spain | 1.26 | + | 0.12 | + | 9.52 | – | | -1.19 |
| Netherlands | 1.30 | + | 0.09 | + | 6.24 | + | + | 2.10 |
| Belgium | 2.26 | – | 0.15 | + | 3.75 | + | | 4.58 |
| Austria | 0.61 | + | 0.06 | + | 3.09 | + | + | 5.24 |
| Finland | 1.96 | – | 0.20 | – | 2.00 | + | | 6.34 |
| Greece | 0.61 | + | 0.19 | – | 1.93 | + | | 6.41 |
| Portugal | 0.87 | + | 0.22 | – | 1.80 | + | | 6.54 |
| Ireland | 1.26 | + | 0.18 | – | 1.69 | + | | 6.65 |
| Luxembourg | 1.00 | + | 0.06 | + | 0.32 | + | + | 8.01 |
| Avg. | 1.35 | | 0.16 | | 8.33 | | | |
| Std. | 0.53 | | 0.08 | | 9.69 | | | |

**Table 3.2.** *EMU12: Indicators of Political Stability, GDP Share, and ECB Voting Rights, 1975-2000.*

Sources: IFS; Worldbank Database of Political Institutions based on Beck *et al.* (2001); Sturm *et al.* (2004); and own calculations.
Notes: Political data are 1975-1997/2000 averages; GDP data as of 2001. "Cohesion" (IPCOH in Worldbank parlance, available until 1997) measures the degree of political cohesion of the national government for a given year, with 0 indicating, for instance, a one-party majority parliamentary government, and 3 a minority government. The measure is based on (but not identical to) the Roubini and Sachs (1989) index of cohesion. "Change" (STABS in Worldbank parlance, available until 2000) indicates the number of veto players dropping from government within a year, meaning political parties within a parliamentary system and the president, or the largest party, in a presidential system. The index varies between 0 and 1. A high indicator value indicates less government stability. "GDP Share" measures the respective country's share in aggregate EMU12 or EMU24 GDP based on 2001 data (and annual average market exchange rates where applicable). "Political Weight in Excess of (3)" shows the difference between a country's voting power within the ECB Council (excluding the Board) and its GDP share. A positive sign indicates over-representation, a negative sign under-representation.

| | (1) Cohesion | (1) < Avg. | (2) Change | (2) < Avg. | (3) GDP Share | (3) < Avg. | Consensus? (1) = (2) = (3) | Political Weight in excess of (3) |
|---|---|---|---|---|---|---|---|---|
| Germany | 2.00 | – | 0.12 | + | 28.40 | – | | -23.07 |
| France | 1.57 | – | 0.23 | – | 20.08 | – | – | -14.74 |
| Italy | 1.57 | – | 0.41 | – | 16.76 | – | – | -11.43 |
| Spain | 1.57 | – | 0.07 | + | 8.92 | – | | -3.59 |
| Netherlands | 1.43 | – | 0.07 | + | 5.84 | – | | -0.51 |
| Belgium | 2.00 | – | 0.12 | + | 3.51 | + | | 1.33 |
| Austria | 1.00 | + | 0.05 | + | 2.89 | + | + | 1.96 |
| Poland | 1.00 | + | 0.07 | + | 2.75 | + | + | 2.10 |
| Slovenia | 1.67 | – | 0.11 | + | 0.32 | + | | 2.18 |
| Luxembourg | 1.00 | + | 0.05 | + | 0.30 | + | + | 2.20 |
| Bulgaria | 0.57 | + | 0.30 | – | 0.19 | + | | 2.31 |
| Lithuania | 0.17 | + | 0.10 | + | 0.18 | + | + | 2.32 |
| Cyprus | 1.00 | + | 0.05 | + | 0.14 | + | + | 2.36 |
| Latvia | 1.67 | – | 0.33 | – | 0.12 | + | | 2.38 |
| Estonia | 1.00 | + | 0.10 | + | 0.08 | + | + | 2.42 |
| Malta | 0.00 | + | 0.15 | + | 0.06 | + | + | 2.44 |
| Finland | 2.00 | – | 0.15 | + | 1.87 | + | | 2.98 |
| Greece | 0.43 | + | 0.25 | – | 1.80 | + | | 3.04 |
| Portugal | 0.86 | + | 0.10 | + | 1.68 | + | + | 3.17 |
| Ireland | 1.86 | – | 0.18 | – | 1.58 | + | | 3.27 |
| Czech Rep. | 1.57 | – | 0.30 | – | 0.85 | + | | 4.00 |
| Hungary | 1.57 | – | 0.33 | – | 0.77 | + | | 4.08 |
| Romania | 1.57 | – | 0.23 | – | 0.58 | + | | 4.27 |
| Slovakia | 1.60 | – | 0.17 | + | 0.31 | + | | 4.53 |
| Avg. | 1.28 | | 0.22 | | 4.17 | | | |
| Std. | 0.57 | | 0.16 | | 7.31 | | | |

**Table 3.3.** *EMU24: Indicators of Political Stability, GDP Share, and ECB Voting Rights (post reform), 1991-2000.*

Sources: IFS; Worldbank Database of Political Institutions based on Beck et al. (2001); Sturm et al. (2004); and own calculations.
Notes: "Change" based on 1991-2000 averages, "Cohesion" 1991-1997; GDP share as of 2001. See notes to Table 3.1 for a detailed explanation of the variables.

Strikingly, the misrepresentation of economic size in the ECB Council is about an order of magnitude more severe than in the Fed or, after the post-unification reform of 1992, the Bundesbank. This is true if the misrepresentation indicator ignores the role of the Board if we look at an EMU with 12 or 24 members, or if we look at the situation before or after the planned ECB reform. In other words, economic size plays a significantly smaller role in the distribution of voting rights within the ECB than in other federal central banks.

Can the comparatively stark pattern of misrepresentation of size in the ECB be explained by some of the determinants of optimal representation identified by the theoretical model? To answer this question, we need to find proxies for the latter – certainly not an easy feat. While it is straightforward to measure relative size (by GDP share, for instance), indicators of preference stability are less easily identified. One plausible assumption is that frequent changes of government are indicative of (or a prerequisite for) changing preferences. Moreover, such changes might be more significant when governments show a high degree of cohesion. Table 3.2 gives information on the degree of government cohesion, a measure of government change, and relative economic size for the existing 12 members of EMU. Table 3.3 does the same for the hypothetical EMU with 24 members.

Given the approximate nature of the indicators and, in the case of Table 3.3, the short time span covered, any interpretation of the data should be taken with a grain of salt. Nevertheless, a cautious interpretation of Tables 3.2 and 3.3 suggests that not all over- and under-representation of national representatives on the ECB Council could be easily justified. In only 5 out of 12 counties in Table 3.2, and in only 10 out of 24 countries in Table 3.3, do GDP share, change, and cohesion point in the same direction. Moreover, it would seem that actual over- or under-representation of very large and very small countries is least in line with the suggestions of the model.

## 3.7 Concluding Remarks

The question of optimal representation of regional interests within a federal central bank has received much attention recently. The likely extension of the Euro area has highlighted problems – such as a possible mismatch between relative economic size and voting rights in the decision-making committee – with the "one country, one vote" principle in a currency union such as EMU.

The present paper adds central bank independence as a potentially crucial argument to this discussion. We present a simple model of optimal representation in a federal central bank in which optimal voting weights reflect two opposing forces: the wish to insulate common monetary policy from changing preferences at the national level, and the attempt to avoid an overly active or passive reaction to idiosyncratic national economic shocks. Adjusting representation in the decision-making committee to moderate preference shocks insulates joint monetary policy from unwanted volatility when national or regional policy targets deviate from common goals. Basing representation on economic weight, on the other hand, helps to prevent national or regional economic shocks from undermining the common goal. Optimal representation weighs both arguments, reflecting economic size as well as the stochastic properties of economic and preference shocks.

An important theoretical result is that a perfect match between economic size and voting rights is rarely optimal, and neither is the "once country, one vote" principle. Consequently, whether a country should be over- or under- represented compared to its relative economic size depends on a number of different forces, including relative size, the relative weight of the real target, and the stochastic properties of economic and preference shocks. Some might intuitively expect small countries to be over-represented and large countries to be under-represented. But there is room for a counter-intuitive result: for instance, it might be optimal to over-represent a large country if its policy preferences are very stable relative to other union members.

Taking a closer look at the possible interaction of economic and preference shocks, we find that continued integration in the form of better business cycle synchronization and more

similar preferences can have opposing effects on optimal representation. Increasing likeness of preference shocks gives an incentive to tailor committee voting weights closer to economic size. Increasing likeness of economic shocks has the opposite effect: relative preference stability considerations gain in importance as economic shocks become more similar. Finally, allowing for political business cycle in the sense of a positive correlation between preference shocks and economic shocks within a country might help to moderate country 1's policy demands in the Council after economic shocks.

The basic results of optimal over- or under-representation are fairly robust with regard to alternative assumptions on shock correlations. Moreover, the principle findings seem to be independent of the source of preferences uncertainty. The baseline model assumes uncertain inflation preferences, but optimal representation continues to follow similar determinants when preference shocks are tied to the relative weight of the real argument in the national welfare functions, instead. As a consequence, for instance, over-representation of large and under-representation of small countries remains a possibility.

Empirically, there are indications that representation of member countries in the ECB Council might be extreme and not always optimal. A comparison of deviations of actual representation from relative economic size in the ECB Council with the US Federal Reserve's FOMC and the pre-Euro Bundesbank Council reveals that misrepresentation of economic size in the ECB is about an order of magnitude more severe. The theoretical model suggests two possible explanations. First, preference homogeneity within the German and the US currency areas might be higher than in today's Euro area or, somewhat less likely, business cycle synchronization could be better within the Euro area. In both cases the model implies that optimal representation within the ECB Council (relative to the two other federal central banks) should focus more on preferences than on economic size. Alternatively, of course, representation within the ECB Council might not be optimal in the first place. Indeed, even though the empirical proxies used need to be treated with caution, the ECB pattern of misrepresentation of economic size is difficult to explain with theoretically identified determinants of optimal representation alone. This suggests further room for discussion, even after the ECB reform.

# References

Aksoy, Yunus, Paul de Grauwe, and Hans Dewachter (2002), *Do Asymmetries Matter for EuropeanMonetary Policy?*, European Economic Review, 46(3), 443-69.

Alesina, Alberto (1987), *Macroeconomic Policy in a Two-Party System as a Repeated Game*, Quarterly Journal of Economics, 102, 651-78.

Alesina, Alberto and Howard Rosenthal (1995), *Partisan Politics, Divided Government, and the Economy*, Cambridge University Press: Cambridge.

Baldwin, Richard (2001), *The ECB's Number Problems*, Financial Times, London, December 4.

Baldwin, Richar, Erik Berglöf, Francesco Giavazzi, and Mika Widgren (2001), *Preparing the ECB for Enlargement*, CEPR Policy Paper, 6, CEPR: London.

Beck, Thorsten, George Clarke, Alberto Groff, Philip Keefer, and Patrick Walsh (2001), *New Tools in Comparative Political Economy: The Database of Political Institutions*, World Bank Economic Review, 15(1), 165-76.

Beetsma, Roel and Henrik Jensen (1998), *Inflation Targets and Contracts with Uncertain Central Bank Preferences*, Journal of Money, Credit, and Banking, 30(3), 384-403.

Benigno, Pierpaolo (2004), *Optimal Monetary Policy in a Currency Area*, Journal of International Economics, 63(2), 293-320.

Berger, H., 2002, *The ECB and Euro-Area Enlargement*, IMF Working Paper, 02/175.

Berger, H. and J. de Haan (1999), *A State Within a State? An Event Study on the Bundesbank*, Scottish Journal of Political Economy, 46(1), 17-39.

Berger, H. and J. de Haan (2002), *Are Small Countries too Powerful Within the ECB?*, Atlantic Economic Journal, 30 (3), 1-20.

Berger, Helge, Jakob de Haan, and Robert Inklaar (2004*), Is the ECB Too Decentralized?*, in: Hans-Werner Sinn, Mika Widgren, and Marko Köthenburger (eds.), European Monetary Integration, Cambridge: The MIT Press, 71-97.

Bindseil, U. (2001), *A Coalition-Form Analysis of the "One Country-One Vote" Rule in the Governing Council of the European Central Bank*, International Economic Journal, 15(1), 141-64.

Blinder, Alan and John Morgan (2002), *Are Two Heads Better Than One? Monetary Policy by Committee*, Journal of Money, Credit and Banking, forthcoming.

Bullard, James and Christopher Waller (2004), *Central Bank Design in General Equilibrium*, Journal of Money, Credit, and Banking, 36(1), 95-113.

Bundesbank (1992), *Monthly Report*, August, Deutsche Bundesbank: Frankfurt.

Casella, Alessandra (1992), *Participation in a Currency Union*, American Economic Review, 82(4), 847.63.

Ciccarelli, Matteo and Alessandro Rebucci (2002), *The Transmission Mechanism of European Monetary Policy: Is There Heterogeneity? Is it Changing over Time?*, IMF Working Paper, 02/54.

Eichengreen, Barry (1992), *Designing a Central Bank for Europe: A Cautionary Tale from the Early Years of the Federal Reserve System*, in: M. Canzoneri, V. Grilli, and R. Masson (eds.), *Establishing a Central Bank in Europe and Lessons from the US*, Cambridge: Cambridge University Press, 13-40.

European Union (1997), *Consolidated Version of the Treaty Establishing the European Community*, Official Journal of the European Communities, C 340, November 10.

European Parliament (2003), *Debates of the European Parliament*, Sittings of 11 March 2003, ECB Statute, available on the internet: http://www.europarl.eu.int.

European Central Bank (1999), *The Institutional Framework of the European System of Central Banks*, Monthly Bulletin, July, 55.63.

Fitoussi, Jean-Paul and Jerome Creel (2002), *How To Reform the European Central Bank*, CER: London.

Frey, Rainer (2004), *Welfare Implications of the Design of a Currency Union in Case of Member Countries of Different Sizes and Output Persistence*, Deutsche Bundesbank Discussion Paper, Series 1, 15/2004 (forthcoming in: Kredit und Kapital ).

Gerlach-Kristen, Petra (2002), *Monetary Policy Committees and Interest-Rate Setting*, Mimeo, University of Basel.

Gerling, Kerstin, Hans Peter Grüner, Alexandra Kiel, and Elisabeth Schulte (2003), *Information Acquisition and Decision Making in Committees: A Survey*, ECB Working Paper, 256.

Gersbach, Hans and Volker Hahn (2001), *Voting Transparency and Conflicting Interests in Central-Bank Councils*, Mimeo, University of Heidelberg.

Gersbach, Hans and Bernhard Pachl (2004), *Flexible Rules for Central Banks*, Mimeo, University of Heidelberg.

Goodfriend, Marvin (2000), *The Role of a Regional Bank in a System of Central Banks*, Federal Reserve Bank of Richmond Economic Quarterly, Winter, 7-25.

Grauwe, Paul de (2003), *The Monetary Union in an Enlarged Europe*, CESifo Economic Studies, 49(1), 103-21.

Greenspan, Alan (2000), *Productivity and Efficiency in the Federal Reserve System*, Speech delivered at the dedication of the new Birmingham Branch Building of the Federal Reserve Bank of Atlanta, December 8. Available via the internet: www.federalreserve.gov.

Gros, Daniel [Chairman] and others (2002), *The Euro at 25*, Special Report of the CEPS Macroeconomic Polcy Group, CEPS: Brussels.

Gros, Daniel and Carsten Hefeker (2002), *One Size Must Fit All: National Divergences in a Monetary Union*, German Economic Review, 3 (3), 247-62.

Haan, Jakob de, Helge Berger, and Robert Inklaar (2004), *Restructuring the ECB*, in: Helge Berger and Thomas Moutos (eds.), Managing EU Enlargement, Cambridge: The MIT Press, 29-66.

Hagen, Jürgen von and J. Süppel (1994), *Central Bank Constitutions for Federal Monetary Unions*, European Economic Review, 38, 774-82.

Hefeker, Carsten (2002), Monetary Policy in a Union of 27: Enlargement and Reform Options, Intereconomics, November/December, 315-20.

Hefeker, Carsten (2003), Federal Monetary Policy, Scandinavian Journal of Economics, 105, 641-59.

Heinemann, Friedrich and Felix Huefner (2004), Is the View from the Eurotower Purely European? National Divergence and ECB Interest Rate Policy, Scottish Journal of Political Economy, 51(4), 544-58.

Heisenberg, Dorthee (2003), Cutting the bank Down to Size: Efficient and Legitimate Decision-Making in the European Central Bank After Enlargement, Journal of Common Market Studies, 41(3), 397-420.

Hibbs, Douglas (1977), Political Parties and Macroeconomic Policy, American Political Science Review, 71, 1467-87.

Lindner, Axel (2000), Long-Term Appointment of Central Bankers: Cost and Benefits, European Journal of Political Economy, 16, 639-54.

Lohmann, Susanne (1997), Partisan Control of the Money Supply and Decentralized Appointment Powers, European Journal of Political Economy, 13, 225-46.

Lohmann, Susanne (1998), Federalism and Central Bank Independence: The Politics of German Monetary Policy, 1957-1992, World Politics, 50, 401-46.

Maier, Philipp, Beata Bierut, and Robert-Paul Berben (2003), The Role of Regional Information in the Optimal composition of a Committee, MEB Discussion Paper (De Nederlandsche Bank), 2003-08.

Meade, Ellen (2003), A (Critical) Appraisal of the ECB's Voting Reform, Intereconomics, forthcoming.

Meade, Ellen and D.N. Sheets (2002), Regional Influences on U.S. Monetary Policy: Some Implications for Europe, Centre for Economic Performance Discussion Paper, No. 523.

Waller, C. and Carl Walsh (1996), Central Bank Independence, Economic Behavior, and Optimal Term Length, American Economic Review, 85(5), 1139.54.

## Appendices

**Appendix 3.1 (Expected welfare under actual policy)**

Expected welfare under the actual policy is:

$$
EL^*\left(\pi_A, y_{1_A}, y_{2_A}\right) = \frac{1}{1+\lambda}\alpha^2\sigma_{\varepsilon_1}^2 + \frac{1}{1+\lambda}(1-\alpha)^2\sigma_{\varepsilon_2}^2
$$

$$
+ \left(\frac{\lambda^2}{1+\lambda}\alpha(\alpha-2\chi) + \lambda\chi^2\right)\sigma_{\theta_1}^2 + \left(\frac{\lambda^2}{1+\lambda}(1-\alpha)\cdot((1-\alpha)-2(1-\chi)) + \lambda(1-\chi)^2\right)\sigma_{\theta_2}^2
$$

$$
+ 2\frac{1}{1+\lambda}\alpha(1-\alpha)\cdot\varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2} + 2\frac{\lambda}{1+\lambda}\alpha(\chi-\alpha)\cdot\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1} + 2\frac{\lambda}{1+\lambda}\alpha((1-\chi)-(1-\alpha))\cdot\varphi_{\varepsilon_1,\theta_2}\sigma_{\varepsilon_1}\sigma_{\theta_2}
$$

$$
+ 2\frac{\lambda}{1+\lambda}(1-\alpha)\cdot(\chi-\alpha)\cdot\varphi_{\varepsilon_2,\theta_1}\sigma_{\varepsilon_2}\sigma_{\theta_1} + 2\frac{\lambda}{1+\lambda}(1-\alpha)\cdot((1-\chi)-(1-\alpha))\cdot\varphi_{\varepsilon_2,\theta_2}\sigma_{\varepsilon_2}\sigma_{\theta_2}
$$

$$
+ \left(2\frac{\lambda^2}{1+\lambda}(\alpha(1-\alpha)-\alpha(1-\chi)-\chi(1-\alpha)) + 2\lambda\chi(1-\chi)\right)\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}
$$

The optimal representation of country one is:

$$
\alpha^* = \frac{\begin{array}{c}\sigma_{\varepsilon_2}^2 + \chi\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2} - 2\chi\lambda^2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2} \\ -\lambda\left(\chi\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1} + (1+\chi)\varphi_{\varepsilon_2,\theta_2}\sigma_{\varepsilon_2}\sigma_{\theta_2}\right) + \lambda\left(\chi\varphi_{\varepsilon_1,\theta_2}\sigma_{\varepsilon_1}\sigma_{\theta_2} + (1+\chi)\varphi_{\varepsilon_2,\theta_1}\sigma_{\varepsilon_2}\sigma_{\theta_1}\right)\end{array}}{\begin{array}{c}\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - 2\left(\varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2} + \lambda^2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}\right) \\ -2\lambda\left(\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1} + \varphi_{\varepsilon_2,\theta_2}\sigma_{\varepsilon_2}\sigma_{\theta_2}\right) + 2\lambda\left(\varphi_{\varepsilon_1,\theta_2}\sigma_{\varepsilon_1}\sigma_{\theta_2} + \varphi_{\varepsilon_2,\theta_1}\sigma_{\varepsilon_2}\sigma_{\theta_1}\right)\end{array}}
$$

**Appendix 3.2 (The case with correlated economic shocks, $\left(\varphi_{\theta_1,\theta_2} \neq 0\right)$)**

The optimal weight for country 1 is

$$
(3.15) \quad \alpha^* = \frac{\sigma_{\varepsilon_2}^2 + \chi\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - \chi\lambda^2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}}{\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - 2\lambda^2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}},
$$

which is always within the permissible range $0 < \alpha^* < 1$ (see below).

**Conditions for $0 < \alpha^* < 1$**

Since $\sigma_{\varepsilon_2}^2, \sigma_{\varepsilon_1}^2 > 0$, a sufficient condition for $\alpha^* > 0$ is that

$$
\varphi_{\theta_1,\theta_2} \leq \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)/2\left(\sigma_{\theta_1}\sigma_{\theta_2}\right).
$$

Because, by definition, $\varphi_{\theta_1,\theta_2} \leq 1$, this condition always holds if $\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)/2\chi\left(\sigma_{\theta_1}\sigma_{\theta_2}\right) \geq 1$ or $\left(\sigma_{\theta_1} - \sigma_{\theta_2}\right) \geq 0$ —which is always fulfilled. The condition for $\alpha^* < 1$ is

$$\sigma_{\varepsilon_1}^2 > (\chi - 1)\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2 - 2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}\right).$$

Because $\sigma_{\varepsilon_1}^2 > 0$ and $\chi < 1$, a sufficient condition for the inequality to hold is that the last bracket on the RHS be positive or zero, that is, $\varphi_{\theta_1,\theta_2} \leq \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)/2\sigma_{\theta_1}\sigma_{\theta_2}$ This is always fulfilled.

**Conditions for $\alpha^* \underset{<}{\overset{>}{=}} \chi$**

As in the baseline model, it holds that

$$\alpha^* \underset{<}{\overset{>}{=}} \chi \Leftrightarrow \chi\sigma_{\varepsilon_1}^2 \underset{>}{\overset{<}{=}} (1-\chi)\sigma_{\varepsilon_2}^2.$$

**Proof:** Going through the same movements as before, we get

$$\alpha^* \underset{<}{\overset{>}{=}} \chi \Leftrightarrow \chi\sigma_{\varepsilon_1}^2 \underset{>}{\overset{<}{=}} (1-\chi)\sigma_{\varepsilon_2}^2 \text{ when } \varphi_{\theta_1,\theta_2} < \frac{\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)}{2\lambda^2\sigma_{\theta_1}\sigma_{\theta_2}}$$

where the last inequality is always fulfilled . To see this, reformulate as

$$1 < \left(\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)\right)/2\lambda^2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}$$

or, equivalently,

$$\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2 - 2\lambda^2\varphi_{\theta_1,\theta_2}\sigma_{\theta_1}\sigma_{\theta_2}\right) > 0.$$

As $\sigma_{\varepsilon_1}^2$, $\sigma_{\varepsilon_2}^2 > 0$, this must be true if $\varphi_{\theta_1,\theta_2} \leq \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)/2\sigma_{\theta_1}\sigma_{\theta_2}$ . This inequality always holds as $\varphi_{\theta_1,\theta_2} \leq 1$ and $\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)/2\sigma_{\theta_1}\sigma_{\theta_2} \geq 1$ because $\left(\sigma_{\theta_1}^2 - \sigma_{\theta_2}^2\right)^2 \geq 0$. $\quad\square$

**Comparative Statics**

Taking the derivative of (3.15) with regard to economic volatility, rearranging, and consulting Equation (3.9) we find that

(3.16)  *scenario (a):*  $\quad \dfrac{\partial\alpha^*}{\partial\sigma_{\theta_1}} \underset{<}{\overset{>}{=}} 0 \Leftrightarrow \alpha^* \underset{>}{\overset{<}{=}} \chi \quad$ when $\quad \varphi_{\theta_1,\theta_2} < \dfrac{\sigma_{\theta_1}}{\sigma_{\theta_2}}$

(3.17)  *scenario (b):*  $\quad \dfrac{\partial\alpha^*}{\partial\sigma_{\theta_1}} \underset{>}{\overset{<}{=}} 0 \Leftrightarrow \alpha^* \underset{>}{\overset{<}{=}} \chi \quad$ when $\quad \varphi_{\theta_1,\theta_2} > \dfrac{\sigma_{\theta_1}}{\sigma_{\theta_2}}$

Also note that $\partial\alpha^*/\partial\sigma_{\theta_1} = 0$ when economic shocks are symmetrical in the sense that $\sigma_{\theta_1} = \sigma_{\theta_2}$.

In *scenario (a)*, business cycles are unsynchronized across countries, and a further increase in economic volatility in country 1 is likely to drive the economies even more apart. To see this, note that $\varphi_{\theta_1,\theta_2} < \sigma_{\theta_1}/\sigma_{\theta_2}$ implies either a negative correlation between economic shocks or, when the correlation is positive, that country 1's economy is more (or at least not significantly less) volatile than country 2's. In this case, Equation (3.16) demands that the weight of country 1 in the Council should be increasing if it was initially under-represented relative to its economic weight; and it should be decreasing if it was initially over-represented. This helps to reduce the spread between economic and political weights in the currency union.

The alternative *scenario (b)* depicts a currency union with positively correlated business cycles in which country 1's economy is less volatile than country 2's –thus, somewhat counter intuitively, the economies actually become more similar as $\sigma_{\theta_1}$ increases.[21] In this case, it becomes less costly to offset inflation preference shocks by allowing voting rights to deviate from the proportional representation of economic size. As a consequence, Equation (3.17) requires that the country's optimal weight in monetary policy decisions be based more on preference shock considerations. To be precise, country 1's optimal representation in the Council increases if it was initially over-represented relative to its economic weight; and it decreases if it was initially under-represented. That is, the spread between economic and political weights in the currency union grows.

Taking the derivative of (3.15) with regard to the **coefficient of correlation**, rearranging, and consulting Equation (3.9) yields:

$$\frac{\partial\alpha^*}{\partial\varphi_{\theta_1,\theta_2}} \underset{<}{\overset{>}{=}} 0 \Leftrightarrow \alpha^* \underset{<}{\overset{>}{=}} \chi \cdot$$

Finally, it is straightforward to show that higher **preference volatility** results in a reduction in optimal representation as in the no-correlation case.

---

[21] Note that the identifying inequality for *scenario (b)*, $\varphi_{\theta_1,\theta_2} > \sigma_{\theta_1}/\sigma_{\theta_2}$, requires $\varphi_{\theta_1,\theta_2} > 0$ and $\sigma_{\theta_1} < \sigma_{\theta_2}$ since $\varphi_{\theta_1,\theta_2} < 1$.

**Appendix 3.3 (The case with correlated preference shocks $\left(\varphi_{\varepsilon_1,\varepsilon_2} \neq 0\right)$)**

The optimal weight for country 1 is

$$(3.18) \quad \alpha^* = \frac{\sigma_{\varepsilon_2}^2 + \chi\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}}{\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - 2\varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}}.$$

**Conditions for $0 < \alpha^* < 1$**

The ratio (3.18) has a positive denominator.[22] But the nominator might be either positive or negative depending on the coefficient of correlation between preference shocks $(\varphi_{\varepsilon_1,\varepsilon_2})$, and the relative size of preference instability and economic volatility. In particular, $\alpha^* > 0$ requires

$$\varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2} < \sigma_{\varepsilon_2}^2 + \chi\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right).$$

and the condition

$$\varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2} < \sigma_{\varepsilon_1}^2 + (1-\chi)\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right)$$

secures that $\alpha^* > 0$. The RHS-terms in both inequalities reflect, in turn, the volatility of preference shocks, country size, and the welfare costs of output volatility. The LHS of both conditions consists of the covariance of preference shocks. Thus, in general, an internal solution for optimal representation requires that the welfare costs induced by the variance of economic shocks be large compared to the variance of inflation preferences. Note that a sufficient condition for an internal solution for optimal representation is that national shocks to inflation preference differ (only) moderately in terms of their volatility and correlation. To be more precise:

$$0 < \alpha^* < 1 \Leftarrow \varphi_{\varepsilon_1,\varepsilon_2} \leq \min\left(\frac{\sigma_{\varepsilon_1}}{\sigma_{\varepsilon_2}}, \frac{\sigma_{\varepsilon_2}}{\sigma_{\varepsilon_1}}\right)$$

**Conditions for $\alpha^* \underset{<}{\overset{>}{-}} \chi$**

We find that

$$(3.19) \quad \alpha^* \underset{<}{\overset{>}{-}} \chi \Leftrightarrow \chi\left(\sigma_{\varepsilon_1}^2 - \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}\right) \underset{>}{\overset{<}{-}} (1-\chi)\left(\sigma_{\varepsilon_1}^2 - \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}\right)$$

---

[22] The argument is the familar one: a sufficient condition for a positive denominator is $\varphi_{\varepsilon_1,\varepsilon_2} \leq (\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2)/2\,\sigma_{\varepsilon_1}\,\sigma_{\varepsilon_2}$, which is fulfilled because $\varphi_{\varepsilon_1,\varepsilon_2} \leq 1$.

This implies that over- (under-)representation will always be optimal if a country's preferences are very stable (very volatile) in relative terms and preference shocks are sufficiently positively correlated across countries. Formally:

$$\alpha^* > \chi \Leftarrow \sigma_{\varepsilon_1} < \sigma_{\varepsilon_2} \wedge \varphi_{\varepsilon_1,\varepsilon_2} > \sigma_{\varepsilon_1}/\sigma_{\varepsilon_2},$$

$$\alpha^* < \chi \Leftarrow \sigma_{\varepsilon_2} < \sigma_{\varepsilon_1} \wedge \varphi_{\varepsilon_1,\varepsilon_2} > \sigma_{\varepsilon_2}/\sigma_{\varepsilon_1}$$

**Proof:** According to (3.19), over-representation requires

$$\chi\left(\sigma_{\varepsilon_1}^2 - \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}\right) < (1-\chi)\cdot\left(\sigma_{\varepsilon_2}^2 - \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}\right),$$

which is always fulfilled for $\sigma_{\varepsilon_1}^2 < \varphi_{\varepsilon_1,\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2} < \sigma_{\varepsilon_2}^2$, or, equivalently, $\sigma_{\varepsilon_1}/\sigma_{\varepsilon_2} < \varphi_{\varepsilon_1,\varepsilon_2} < \sigma_{\varepsilon_2}/\sigma_{\varepsilon_1}$. Since, by definition, $\varphi_{\varepsilon_1,\varepsilon_2} \leq 1$, for $\sigma_{\varepsilon_1} < \sigma_{\varepsilon_2}$ this reduces to $\varphi_{\varepsilon_1,\varepsilon_2} > \sigma_{\varepsilon_1}/\sigma_{\varepsilon_2}$. Equivalently, under-representation requires $\varphi_{\varepsilon_1,\varepsilon_2} > \sigma_{\varepsilon_2}/\sigma_{\varepsilon_1}$ if $\sigma_{\varepsilon_2} < \sigma_{\varepsilon_1}$.

$\square$

**Comparative Statics**

Starting from an interior solution, an increase in the **volatility of preference shocks** reduces the optimal weight a country holds in the Council.

**Proof:** Taking the derivative of Equation (3.18) with regard to $\sigma_{\varepsilon_1}$, one finds that

$$\frac{\partial \alpha^*}{\partial \sigma_{\varepsilon_1}} < 0 \Leftarrow \varphi_{\varepsilon_1,\varepsilon_2} \leq \min\left(\frac{\sigma_{\varepsilon_1}}{\sigma_{\varepsilon_2}}, \frac{\sigma_{\varepsilon_2}}{\sigma_{\varepsilon_1}}\right)$$

As shown above, if the RHS-inequality is binding, we also have $0 < \alpha^* < 1$. $\square$

An increase in economic volatility suggests a higher optimal voting right in the Council, if the country was initially under-represented and vice versa. More formally:

$$\frac{\partial \alpha^*}{\partial \sigma_{\theta_1}} \underset{<}{\overset{>}{=}} 0 \Leftrightarrow \alpha^* \underset{>}{\overset{<}{=}} \chi \quad \text{theta??? nicht eps?}$$

**Proof:** Taking the derivative of (3.18) with regard to $\sigma_{\theta_1}$ leads to the condition

$$\frac{\partial \alpha^*}{\partial \sigma_{\theta_1}} \underset{<}{\overset{>}{=}} 0 \Leftrightarrow \chi\left(\sigma_{\varepsilon_1}^2 - \varphi_{\varepsilon_1\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}\right) \underset{<}{\overset{>}{=}} (1-\chi)\left(\sigma_{\varepsilon_2}^2 - \varphi_{\varepsilon_1\varepsilon_2}\sigma_{\varepsilon_1}\sigma_{\varepsilon_2}\right)$$

which by Equation (3.19) implies the above. $\square$

If the correlation between preference shocks across countries rises, a country is more likely to see its optimal voting weight increase, if its preferences are relatively stable and it is large in economic terms. To be precise:

$$\frac{\partial \alpha^*}{\partial \varphi_{\varepsilon_1 \varepsilon_2}} \begin{matrix} > \\ = \\ < \end{matrix} 0 \Leftrightarrow \sigma_{\varepsilon_1}^2 - \chi \lambda^2 \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) \begin{matrix} < \\ = \\ > \end{matrix} \sigma_{\varepsilon_2}^2 - (1-\chi)\lambda^2 \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right).$$

**Proof:** Taking the derivative of (3.18) with regard to $\varphi_{\varepsilon_1, \varepsilon_2}$ yields the above term, where the RHS of the last inequality is increasing in country 1's relative economic size, $\chi$, making the case $\partial \alpha^* / \partial \varphi_{\varepsilon_1, \varepsilon_2} > 0$ more probable to hold. This, trivially, is also true for a higher $\sigma_{\varepsilon_2}^2$ or a lower $\sigma_{\varepsilon_1}^2$. $\quad\square$

## Appendix 3.4 (The case with correlated economic and preference shocks $\left(\varphi_{\varepsilon_1, \theta_1} \neq 0\right)$)

Assuming that all cross-country shocks are independent but allowing economic and shocks to inflation preferences to be correlated within country 1 (i.e., $\varphi_{\varepsilon_1, \theta_1} \neq 0$), we find that the optimal weight for country 1 becomes

$$(3.20) \quad \alpha^* = \frac{\sigma_{\varepsilon_2}^2 + \chi \lambda^2 \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - \chi \lambda \varphi_{\varepsilon_1, \theta_1} \sigma_{\varepsilon_1} \sigma_{\theta_1}}{\sigma_{\varepsilon_1}^2 + \sigma_{\varepsilon_2}^2 + \lambda^2 \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) - 2\lambda \varphi_{\varepsilon_1, \theta_1} \sigma_{\varepsilon_1} \sigma_{\theta_1}}$$

While extreme values for $\alpha^*$ cannot be excluded in general in this case, the optimal voting weight is likely to fall into the permissible range $0 < \alpha^* < 1$ for a wide range of parameters (see below).

## Conditions for $0 < \alpha^* < 1$

The denominator of (3.20) is positive.[23] Thus $\alpha^* > 0$ requires the nominator to be positive, too. Obviously, this is more likely to be the case if preference shocks and economic shocks in country 2 are volatile. As far as country 1 is concerned, inspection of (3.20) reveals that, because $\sigma_{\varepsilon_2}^2, \sigma_{\theta_2}^2 > 0$, a sufficient condition for $\alpha^* > 0$ is

$$\varphi_{\varepsilon_1, \theta_1} \leq \frac{\lambda \sigma_{\theta_1}}{\sigma_{\varepsilon_1}},$$

---

[23] The denominator is positive if $\sigma_{\varepsilon_2}^2 \lambda^2 \sigma_{\theta_2}^2 > 2\lambda \varphi_{\varepsilon_1 \theta_1} \sigma_{\varepsilon_1} \sigma_{\theta_1} - \sigma_{\varepsilon_1}^2 - \lambda^2 \sigma_{\theta_1}^2$. The RHS is always non-positive and the inequality always holds because $\sigma_{\varepsilon_1}^2 > 0$ and $\varphi_{\varepsilon_1, \theta_1} \leq 1$.

which is always fulfilled if the welfare costs associated with economic volatility exceed the volatility of preferences in country 1 or the correlation between preference and economic shocks in country 1 is non-positive, i.e. if $\varphi_{\varepsilon_1,\theta_1} \leq 0$.

To ensure that $\alpha^* < 1$, we need that

$$\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1} < \frac{1}{2-\chi}\sigma_{\varepsilon_1}^2 + \frac{(1-\chi)\lambda}{2-\chi}\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right),$$

which is likely to be fulfilled unless the "political-economic" covariance between preference and economic shocks within country 1, the LHS of the inequality, takes on extreme values that dominate the RHS, which unambiguously increases in the sum of the variances of the economic shocks in countries 1 and 2 *and* the preference shock in country 1. Note that this inequality, too, will always be fulfilled for non-positive values of $\varphi_{\varepsilon_1,\theta_1}$.

We conclude that an interior solution with $0 < \alpha^* < 1$ is more likely the smaller the coefficient of correlation (with a negative correlation always implying an interior solution) and the larger the welfare costs of economic volatility in the currency union.

**Conditions for $\alpha^* \gtrless \chi$**

We find:

$$(3.21) \quad \alpha^* \gtrless \chi \Leftrightarrow \chi\left(\sigma_{\varepsilon_1}^2 - \lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1}\right) \lessgtr (1-\chi)\sigma_{\varepsilon_2}^2.$$

**Comparative Statics**

Taking the derivative of optimal representation (3.20) with regard to preference volatility yields

$$\frac{\partial \alpha^*}{\partial \sigma_{\varepsilon_1}} \gtrless 0 \Leftarrow \varphi_{\varepsilon_1,\theta_1} \gtrless \frac{2\sigma_{\varepsilon_1}}{(2-\chi)\lambda\sigma_{\theta_1}}.$$

Moreover, note that if preference shocks are symmetrical or more volatile than economic shocks in welfare terms, i.e. $\sigma_{\varepsilon_1} \geq \lambda\sigma_{\theta_1}$, the optimal voting weight will always decrease as the preferences become less stable.

**Proof:** Define $\Gamma = \sigma^2_{\varepsilon_2} + \chi\lambda^2(\sigma^2_{\theta_1} + \sigma^2_{\theta_2}) - \chi\lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1}$ and $\Delta = \sigma^2_{\varepsilon_1} + \sigma^2_{\varepsilon_2} + \lambda^2(\sigma^2_{\theta_1} + \sigma^2_{\theta_2}) - 2\lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1}$ so that $\alpha^* = \Gamma/\Delta$. Then, taking the derivative of Equation (3.20) with regard to $\sigma_{\varepsilon_1}$, one finds that

$$\frac{\partial\alpha^*}{\partial\sigma_{\varepsilon_1}} \overset{>}{\underset{<}{}} 0 \Leftrightarrow -\Delta\left(\lambda\chi\varphi_{\varepsilon_1,\theta_1}\sigma_{\theta_1}\right) - 2\Gamma\left(\sigma_{\varepsilon_1} - \lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\theta_1}\right) \overset{>}{\underset{<}{}} 0 .$$

In an interior solution: $0 < \alpha^* < 1$ and, thus, $0 < \Gamma < \Delta$. This leads to the sufficient condition noted above. Note that $0 < \chi < 1$ implies $2\sigma_{\varepsilon_1}/(2-\chi)/\sigma_{\theta_1} > 1$ when $\lambda\sigma_{\theta_1} \geq \sigma_{\varepsilon_1}$.

$\square$

Taking the derivative of optimal representation with regard to **economic volatility** gives

$$\frac{\partial\alpha^*}{\partial\sigma_{\theta_1}} \overset{>}{\underset{<}{}} 0 \Leftarrow \varphi_{\varepsilon_1,\theta_1} \overset{>}{\underset{<}{}} \frac{2(1-\chi)\lambda\sigma_{\theta_1}}{(2-\chi)\sigma_{\varepsilon_1}} .$$

**Proof:** Define $\Gamma = \sigma^2_{\varepsilon_2} + \chi\lambda^2(\sigma^2_{\theta_1} + \sigma^2_{\theta_2}) - \chi\lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1}$ and $\Delta = \sigma^2_{\varepsilon_1} + \sigma^2_{\varepsilon_2} + \lambda^2(\sigma^2_{\theta_1} + \sigma^2_{\theta_2}) - 2\lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\sigma_{\theta_1}$ so that $\alpha^* = \Gamma/\Delta$. Taking the derivative of Equation (3.20) with regard to $\sigma_{\varepsilon_1}$, one finds that

$$\frac{\partial\alpha^*}{\partial\sigma_{\theta_1}} \overset{>}{\underset{<}{}} 0 \Leftrightarrow \Delta\left(2\sigma_{\theta_1}\chi\lambda^2 - \chi\lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\right) - 2\Gamma\left(\lambda^2\sigma_{\theta_1} - \lambda\varphi_{\varepsilon_1,\theta_1}\sigma_{\varepsilon_1}\right) \overset{>}{\underset{<}{}} 0 .$$

In an interior solution: $0 < \alpha^* < 1$ and, thus, $0 < \Gamma < \Delta$. This implies the sufficient condition stated in the Result. This scenario is especially plausible if the initial level of economic volatility (in welfare terms) is small compared to preference volatility.[24] $\square$

The RHS of the last inequality unambiguously increases in $\sigma^2_{\varepsilon_2}$, $\sigma^2_{\theta_1}$, and $\sigma^2_{\theta_2}$.

### Appendix 3.5 (Comparative statics with relative-weight uncertainty)

On the one hand, an increase in economic volatility strengthens the economic argument underlying the calculation of $\alpha^*_\lambda$, suggesting higher representation for initially under-represented countries. On the other, a higher $\sigma_{\theta_1}$ decreases $\alpha^*_{P\lambda}$, which tends to reduce $\alpha^*_\lambda$. This latter effect always dominates. To see this, note the partial derivative

---

[24] The proof suggests that a necessary condition for $\partial\alpha^*/\partial\sigma_{\theta_1}$ to be positive is that $\lambda\sigma_{\theta_1} < \sigma_{\varepsilon_1}$. Note that $\partial\alpha^*/\partial\sigma_{\theta_1}$ is always negative if $\lambda\sigma_{\theta_1}$ is already very large compared to $\sigma_{\varepsilon_1}$ in the sense $\lambda\sigma_{\theta_1}/\sigma_{\varepsilon_1} > (2-\chi)/2(1-\chi)$.

(3.22) $\quad \dfrac{\partial \alpha_\lambda^*}{\partial \sigma_{\theta_1}} \gtrless 0 \Leftrightarrow \chi \sigma_{\theta_1}^2 \sigma_{\varepsilon_1}^2 \gtrless (1-\chi)\sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2 + \chi \sigma_{\varepsilon_1}^2 \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) + \dfrac{1}{\lambda^2}\sigma_{\theta_2}^2 \sigma_{\varepsilon_1}^2 \sigma_{\varepsilon_2}^2$

The term $\chi \sigma_{\theta_1}^2 \sigma_{\varepsilon_1}^2 \gtrless (1-\chi)\sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2$ in (3.22) represents the condition for over- and under-representation in (3.13). That is, in principle, under-representation works toward a positive impact of $\sigma_{\theta_1}$ on optimal representation just as in the baseline model with preference uncertainty regarding the inflation target. However, the additional terms $\chi \sigma_{\varepsilon_1}^2 \left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) + \dfrac{1}{\lambda^2}\sigma_{\theta_2}^2 \sigma_{\varepsilon_1}^2 \sigma_{\varepsilon_2}^2$ on the RHS inequality in (3.22) will always over-compensate that effect. This can be shown by rearranging (3.22):

$$\frac{\partial \alpha_\lambda^*}{\partial \sigma_{\theta_1}} = -(1-\chi)\lambda^2 \sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2 - \chi \lambda^2 \sigma_{\theta_2}^2 \sigma_{\varepsilon_1}^2 - \sigma_{\theta_2}^2 \sigma_{\varepsilon_1}^2 \sigma_{\varepsilon_2}^2 < 0 \cdot$$

In the case of under-representation, we have $\alpha_{P\lambda}^* < \alpha_\lambda^* < \chi$. In contrast to the result of the baseline model where $\alpha^*$ approaches $\chi$ as $\sigma_{\theta_1}$ rises when a country was initially under-represented, here, the distance between $\alpha_\lambda^*$ and $\chi$ grows. However, for plausible parameter values $\alpha_\lambda^*$ does not approach $\alpha_{P\lambda}^*$, either as this moves down even further with $\sigma_{\theta_1}$ increasing. Technically we need

$$\left| \frac{\partial \alpha_{\lambda_P}^*}{\partial \sigma_{\theta_1}} \right| > \left| \frac{\partial \alpha_\lambda^*}{\partial \sigma_{\theta_1}} \right|,$$

which is true if

$$\frac{2\sigma_{\theta_1}\sigma_{\varepsilon_1}^2 \sigma_{\varepsilon_2}^2}{\left(\sigma_{\theta_1}^2 \sigma_{\varepsilon_1}^2 + \sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2\right)} > \frac{(1-\chi)\lambda^2 \sigma_{\varepsilon_2}^2 + \chi \lambda^2 \sigma_{\theta_1}^2 + \sigma_{\varepsilon_1}^2 \sigma_{\varepsilon_2}^2}{\left(\lambda^2\left(\sigma_{\theta_1}^2 + \sigma_{\theta_2}^2\right) + \sigma_{\theta_1}^2 \sigma_{\varepsilon_1}^2 + \sigma_{\theta_2}^2 \sigma_{\varepsilon_2}^2\right)}$$

Again, this is fulfilled for plausible parameter values (numerical results available on request).

# 4. On the Prudential Regulation of Multinational Banks in Europe – Who Should Be in Charge?

**Abstract**

Up to now prudential banking regulation in the European Union (EU) stays mainly in the national domain, with both, the home and the host country being involved in regulating multinational banks. Taking the national orientation as given, this paper analyzes the effects of different distributions of regulatory powers among EU member states. To do so, a simple model is presented which allows comparing two alternative regulatory regimes where full responsibility for prudential banking regulation is assigned to either the home or the host country. The model predicts that home country regulation will imply higher welfare at the union level if member states are sufficiently similar in their reaction to macroeconomic shocks, if competition in the European banking sector is stiff, if the difference in regulatory efficiency between domestic and foreign regulators is small, and if the overall financial stability in the EU is high.

## 4.1 Introduction

The European Union (EU) pursues a strategy of promoting cross-border integration in banking (see, for instance, the White Paper on Financial Services Policy 2005-2010). In 2005, the average share of total banking assets that was controlled by foreign banks was roughly 26%, with parent banks headquartered in other EU member states accounting for about 70% of this Figure (ECB, 2006). It is hoped that cross border integration will boost competition and efficiency in the European banking sector. However, the impact of foreign ownership on financial stability is far from being clear. On the one hand, representations abroad create an additional channel for cross-border contagion since the parent bank may get into financial distress when its entity abroad is hit by an adverse shock. Hence, there is the risk of 'contagion through intragroup linkages' (Schinasi and Teixeira, 2006). The current cross-border contagion effects are a case in point. On the other hand, investments abroad may help to diversify risks and thereby contribute to financial stability.[1] Some authors argue that this stability-enhancing effect may decline as EU economies further integrate and national shocks are more likely transmitted across borders, for instance via trade linkages (Gulde and Wolf, 2006). The latest turmoils in international banking markets, again, stressed the need for a sound European regulatory framework that allows exploiting the potential efficiency gains from integration while, at the same time, helps restraining the risk for financial stability (Calzolari and Loranth, 2003).

Despite the growing relevance of foreign ownership in Europe, banking regulation remains mainly a national task.[2] Regulatory standards are neither set by a European decision-making body nor is there a central supervisory authority that controls compliance with the rules.[3] As a result, although several arrangements for co-operation and co-ordination exist and member countries agreed upon minimum standards, such as the Bank of International Settlements standards of the Basle Accords, regulatory standards still vary across the EU (Padoa-Schioppa,

---

[1] Fecht and Grüner (2005) analyze this trade-off in a model with contagion via the interbank market.

[2] For a detailed description of the current regulatory arrangements, see, for instance, Gulde and Wolf (2005).

[3] Grünbichler and Darlap (2004) point out that the distinction between regulation (rule-setting) and supervision (enforcement) may be difficult in practice since supervisors "are assigned with rule-making powers for refining legislation" (p.2). This paper focuses on regulation. In the model presented below, there is no explicit role for supervision since it abstracts from enforcement problems, i.e. banks comply with the rules set by regulators.

2003).[4] With regard to foreign representations, there is a crucial distinction between foreign branches and subsidiaries (Calzolari and Loranth, 2003). Foreign subsidiaries are legally independent from – but majority owned by – the parent bank. They are separately licensed by the host country and are thus subject to the host country's regulation. On the contrary, foreign branches are integral parts of the parent bank and as such regulated by the home country. Hence, currently the home and the host country are involved in regulating multinational banks (MNB) in the EU, depending on the form of foreign representations.

A number of potential drawbacks of the current European regulatory framework are discussed in the literature, including externalities, regulatory competition, and information issues.[5]

**Externalities**. If national regulators are merely concerned with financial stability in their jurisdictions, they may not take into account the adverse consequences of bank failures for other countries. Consequently, national regulators may fail to internalize positive externalities stemming from their decisions, probably resulting in 'under-regulation' (Dell'Ariccia and Marquez, 2006). This problem should become more severe the more integrated banking markets are because the risk of spillover effects increases (Vives, 2001).

**Regulatory competition**. One may argue that the competition between different regulatory authorities will force regulators to perform their tasks as effectively and efficiently as possible. However, the desire to attract investments may drive national regulators to be loose, possibly implying a 'race to the bottom' (Weinberg, 2002).

**Information**. Among others, Gulde and Wolf (2005) stress the need of proximity between regulators and banks for efficient regulation. If local expertise is needed for appropriately processing information, the home regulator may not be in the position to

---

[4] For instance, the definition of tier one capital varies across countries and thus the de facto capital adequacy requirements (Prati and Schinasi 1999). Similarly, as reported by Huizinga (2004), deposit insurance schemes differ materially across EU countries.

[5] The other area that received a great deal of attention recently is crisis management. For instance, the ECB's potential role as a lender of last resort (Schinasi and Teixeira, 2006, Berger and Hefeker, 2006) or the question of cost-sharing once a troubled MNB has to be bailed out are discussed (see, for instance, Vives, 2001, Dermine, 2005). However, issues regarding ex-post regulation are not subject of this paper.

implement those rules that are best suited for foreign markets. Although rules for information exchange exist 'soft information' may be difficult to exchange and, as Holthausen and Rønde (2004) argue, national regulators may not have the incentives to reveal all relevant information if national interests diverge.

These and other potential shortcomings arising from the national orientation have triggered a lively debate on whether the current regulatory framework in the EU is adequate to preserve financial stability. In particular, the question of who should be in charge of regulating foreign activities of MNBs has attracted a lot of attention recently (see, for instance, Gulde and Wolf, 2005, Calzolari and Loranth, 2003, Schoenmaker and Oosterloo, 2004, Veron, 2007). From a normative perspective, most economists agree that ultimately, i.e. with further integrating EU banking markets, a centralized solution to banking regulation should be established, at least for pan-European banks.[6] Centralization should alleviate the problems of externalities and regulatory competition. However, (full) centralization could also worsen the information problems due to a lack of proximity between regulators and banks. To cope with information problems a 'European System of Financial Supervisors' is proposed where the European System of Central Banks could serve as a role model with regard to task sharing between the centre and the nation states (Schoenmaker and Oosterloo, 2004, Gulde and Wolf, 2005).

Despite the broad consensus on the potential benefits of centralization, from a positive point of view, there is little hope that this *first best solution* could be established any time soon due to the reluctance of national governments to render competences (see, for instance, Favero *et al.*, 2000 and Schüler, 2003). Therefore, a *second best solution* 'continues to be based on national competence' (Vesala, 2005, p.100). Then, the question arises, who should be in charge of regulating MNBs' foreign activities. Provided that banking regulation indeed stays mainly a national task, Schoenmaker and Oosterloo (2004) discuss two principle alternatives to the current regulatory framework with regard to the distribution of responsibility between the home and the host country. Different to the current framework consisting of a mixture of

---

[6] Some authors propose a 'two-tier approach' where pan-European banks should be regulated at the EU level while the respective nation state should keep regulatory responsibility for purely national active banks (Veron, 2007, Grünbichler and Darlap, 2004).

home and host country regulation, full responsibility could be assigned to one of the two, irrespective of the form of representation.[7]

This paper compares the two alternative regulatory regimes, home and host country regulation, in terms of EU welfare. The model presented below derives the optimal second best regime choice from an EU perspective. In the model, national regulators aim at attracting MNBs and at providing financial stability. However, they only take into account welfare in their own jurisdiction and thereby disregard externalities on other countries when setting the regulatory standards. In principle, both regimes have their specific strengths and weaknesses. Home country regulation, on the one hand, implies stricter regulation on average. The reason is that host country regulation enables MNBs to pursue international regulatory arbitrage, causing a tendency for national regulators to race to the bottom. On the contrary, MNBs' chances to pursue regulatory arbitrage are smaller under home country regulation as, in this case, banks cannot escape easily from the rules set by their domestic regulator. Under host country regulation, on the other hand, national regulators take into account specific country characteristics more strongly because they hold regulatory responsibility for all banking units doing business in their country. As a consequence, rules are more differentiated among countries, with less stable countries implementing stricter regulation. The model shows how the optimal regime choice will generally depend on the relative importance of these advantages. In particular, home country regulation will be more likely the optimal choice if (i) countries are similar in their reaction to macroeconomic shocks, (ii) the competition in the European banking sector is stiff, (iii) the difference in efficiency between foreign and domestic regulators is small, and (iv) the overall financial stability in the EU is high.

The remainder of the paper is organized as follows. The next Section gives a brief background on the sources of systemic risk and the objectives and instruments of prudential banking regulation. Section 4.3 relates this paper to the literature. The model is presented in Section 4.4 where equilibrium regulation is derived for both, home and host country regulation. Afterwards, the EU welfare implications of both alternative regulatory regimes are analyzed. Section 4.5 gives some concluding remarks.

---

[7] Alternatively, as argued by White (1994), the home country regulatory authority could demand a subsidiary-structure when a foreign MNB establishes a representation in the domestic market.

## 4.2 Systemic Risk and Prudential Banking Regulation

The main objective of prudential banking regulation, beside the protection of depositors, is to ensure financial stability which is often referred to as limiting 'systemic risk' (Crockett, 2000).[8] De Bandt and Hartmann (2000) distinguish two different sources of systemic risk. First, the failure of a single bank, caused by an idiosyncratic (institution-specific) shock may trigger a domino-effect, causing other banks to fail and eventually resulting in a systemic crisis. This contagion can take place via different channels (see Schoenmaker and Oosterloo, 2005), for instance, via the interbank market as analyzed by Freixas *et al.* (2000) and Rochet and Tirole (1996). The second source of systemic risk are non-diversifiable, macroeconomic events like asset price shocks, recessions or exchange rate shocks (systematic risk), initially affecting a large subset of banks or even the whole banking sector (Rochet, 2004). This paper focuses on the latter source, since it is widely acknowledged that macroeconomic turbulences play an important role when explaining major banking crises (see Demirgüc-Kunt and Detragiache, 1998, 2005, D'Amato *et al.*, 1997, Gonzalez-Hermosillo, 1999, Caprio and Klingebiel, 1997, Rochet, 2004).[9] For the EU, De Nicolo and Tieman (2005) find that systemic risk in the banking sector increased due to grown synchronization of real activity.[10]

There are several channels through which macroeconomic shocks may adversely affect the solvency of banks. A bank will become insolvent if the value of liabilities exceeds the value of assets. Hence, insolvency can stem from adverse shocks to both sides of the balance sheet. On the liability side, risks for banks' solvency mainly originate from one of the core functions of banking: maturity transformation. Banks typically 'borrow short and lend long'. Consequently, when there are shocks to the cost of refinancing, for instance short term interest rate shocks, it may be impossible for banks to adjust their rate of return on assets timely. For the same reason, banks may be unable to adjust their asset portfolio properly in case of sudden withdrawals of deposits and are thus prone to bank runs (Bryant, 1980, Diamond and Dybvig, 1983).

---

[8] Note that both objectives are somewhat interrelated, especially when there is the danger of bank runs.

[9] Of course, since not all banks fail during a banking crisis, also bank-specific factors play a role. Nevertheless, individual bank failures are often triggered by macroeconomic turbulences (Caprio and Kliengbiel, 1997).

[10] On the synchronization of real activity in the EU see also Artis *et al.* (2004).

This paper focuses on one particular channel located on the asset side of the balance sheet, namely the credit risk. If an adverse macroeconomic shock hits the economy, an increasing part of debtors may fail to meet their obligations.[11] Therefore, the share of non-performing loans will rise, decreasing banks' assets and – if the shock and the rate of default are large enough – lead to insolvency (Kearns, 2004). Empirically, Pesola (2005) shows that adverse macro shocks indeed have a strong impact on banks' loan losses. In addition, Gonzalez-Hermosillo (1999) finds that the ratio of non-performing loans to total assets plays a key role in explaining banking crises.

What can prudential regulation do to reduce systemic risk? Since systematic risk – by definition – cannot be diversified and hence eliminated completely, prudential regulation will aim at limiting the exposure of banks to aggregate risk and thereby reduce the overall vulnerability of banks to macroeconomic disturbances (Summer, 2003). Limiting the amount of (aggregate) risk banks are taking may especially be important, since – as widely discussed in the literature – banks tend to take an amount of risk that exceeds the pareto optimal level. Banks' excessive risk-taking mainly arises from two features inherent in the banking business, namely the existence of moral hazard and negative externalities.

Moral hazard stems from limited liability of shareholders together with asymmetric information between banks and their depositors. Due to limited liability shareholders may be able to gain at the expense of depositors when taking on risky investments (see, for instance, Merton, 1977, Furlong and Keeley, 1989, Keeley, 1990). Of course, this is not a unique feature of the banking sector but as Gavin and Hausmann (1998, p.3) phrase it: "The incentive problems that make banks 'special' ultimately stem from the fact that they are leveraged; when managing their investments they are putting other people's money at risk." Moral hazard should not occur if depositors were able to perfectly monitor the behavior of banks at no cost. In this case, depositors could impose market discipline by withdrawing deposits or demanding higher interest rates (Calomiris, 1999). However, depositors' monitoring efforts may be limited since acquiring information on banks' risk-taking is a difficult and costly task.[12] Moreover, it is

---

[11] This is what we observed during the start of the subprime crises where moderate interest rate changes had an enormous negative impact on aggregate mortgage repayments.

[12] Again, there are characteristics that make banks 'special'. First, as Caprio and Klingebiel (1997) argue, most bank products include a promise for future payments which makes it difficult to access banks' risk-

often argued that the implementation of deposit insurance schemes removes the incentive for monitoring even further, thereby worsening the problem of moral hazard (Kane, 1989, Freixas and Rochet, 1997, Mishkin, 2000). Therefore, one could argue that the introduction of deposit insurance schemes shifted risk in banking from the liability side to the asset side of the balance sheet, including increased credit risk.

The second reason for banks' excessive risk-taking is the existence of negative externalities. These are arguably stronger in banking than in other sectors (Freixas and Santomero, 2005) due to strong linkages via the interbank market and the possibility of 'psychological spillovers'. When deciding on the degree of risk of their investments, individual banks do not internalize these negative externalities, i.e. do not take into account the impact of a potential failure on other institutions, the real economy, and possibly – in case of a banking crisis – the payment system as a whole.

Regulators have multiple instruments at their disposal that can reduce banks' risk-taking and thereby potentially limit the vulnerability of banks to macroeconomic shocks, for instance, investment restrictions or capital adequacy requirements. The latter do not only provide a buffer for banks' solvency, but also alleviate the moral hazard problem sketched above by extending shareholders liability (Bhattacharya *et al.*, 1998, Mishkin, 2000). Moreover, regulators may intend to limit the degree of competition in the banking sector to reduce banks' risk-taking. It is hoped that the monopoly rents implied by lower competition encourage banks to take less risky investments (Keeley, 1990).

Following Dell'Ariccia and Marquez (2001), this paper takes a short form approach by abstracting from different regulatory instruments. Instead, the model presented below assumes that regulators can choose the overall level of regulation and implement it by combining various different instruments. In the model, stricter regulation directly reduces the vulnerability of banks to macroeconomic shocks. Hence, the level of regulation, captured by one 'regulatory variable' can be best thought of as constraints on bank behavior that effectively limit banks' risk-taking. In general, some investments will be more sensitive to

taking properly. Second, individual creditors of banks, i.e. depositors, are relatively small and widely dispersed compared to non-financial firms (Matutes and Vives, 2000).

macroeconomic shocks than others. In the case of credit risk, the likelihood of initially good loans turning bad due to an adverse macro shock will typically differ with the characteristics of borrowers. Small firms, for instance, are more likely to fail in case of a severe recession – implying loan default for the bank – than established large companies.[13]

## 4.3 Related Literature

There is a large literature that discusses the adequacy of the current European framework for banking regulation in the light of increasing cross-border integration.[14] The present paper most closely relates to two particular strands that take the national orientation of banking regulation as their starting point. One studies the ex post regulation of MNBs, mainly focusing on information exchange between national supervisors/regulators. Holthausen and Rønde (2004) examine the cooperation between the home and the host country supervisor of a branch-organized MNB. In their model, national supervisors exclusively aim at maximizing national welfare, disregarding cross-border externalities. Therefore, the host supervisor may lack the incentives to provide the true information on the financial health of the foreign branch which is assumed to be unobservable for the home supervisor. As a consequence, the first best closure policy will not be achieved if national interests diverge. In a similar vein, Calzolari and Loranth (2004) compare the effects of the representation form (foreign branch or subsidiary) of a MNB on its ex post regulation. The authors stress that the different liability structure implied by branches and subsidiaries may be a crucial aspect for the outcome of the regulatory process.

Another line of papers stresses the ex ante regulation of MNBs (Dalen and Olsen, 2003, Dell'Arriccia and Marquez, 2001, 2006). Dalen and Olsen (2003) analyze the implications of different representation forms of MNBs on their prudential regulation. In particular, the authors compare branch- and subsidiary-organized MNBs when national regulators act

---

[13] In principle, this idea is also reflected in the 'first pillar' of the Basle Accords where the amount of capital banks are required to hold is a function of their risk weighted assets. Reversely, if banks are endowed with a fixed amount of capital, the Basle Accords determine the maximum level of risk on banks' asset side.

[14] For surveys see, for instance, Vives (2001), Dermine (2005), Schüler (2003), Gulde and Wolf (2005), (2006), Calzolari and Loranth (2003).

cooperatively and non-cooperatively. Taking the mixture of home (branches) and host country regulation (subsidiaries) as given, Dalen and Olsen (2003) explore, among other things, the factors that influence the organizational choice of MNBs. In the model by Dell'Arriccia and Marquez (2001), national regulators disregard spillover effects and thus fail to internalize the positive externalities induced by stricter regulatory standards. Beside financial stability, regulators are concerned with the competitiveness of their domestic banking sectors, resulting in a tendency to race to the bottom. In principle, a similar effect is also inherent in the model presented in the next Section. However, Dell'Arriccia and Marquez (2001) do not compare the welfare effects of different regulatory regimes as their model is only consistent with branch-organized MNBs (or home country regulation). Instead, the authors focus on the incentives of national regulators to merge into a supranational regulatory authority. According to their model, the likelihood of a merger increases in the degree of financial integration since cross-border externalities gain importance when banking markets integrate.

## 4.4 The Model

Consider an even number of multinational banks, $n$, operating in two countries $h = A, B$.[15] Each MNB is headquartered in one country and carries out business in the other country, i.e. lends to foreign customers, via a foreign representation (branch or subsidiary). The same fraction of banks, $n/2$, is headquartered in each country. MNBs are risk-neutral and decide on their loan supply in the two countries in order to maximize expected profits.[16] Since this paper focuses on the risk on the asset side of banks' balance sheets, namely the credit risk, funding is taken out of the picture by assuming a fixed balance sheet total per bank of $2/n$ which is invested in risky loans completely. This specification ensures that an increase of $n$ directly implies stiffer competition since the aggregate balance sheet total of the banking sector is constant and independent of $n$.[17]

---

[15] Since there is no endogenous market entry in the model, one can think of $n$ as the exogenous number of banks that received a licence.

[16] See Santomero (1984) for a justification of the risk-neutrality assumption of banks.

[17] This simplification is made for the sake of simplicity. It has important implications. Nevertheless, as will be discussed in Section 4.4.3 in detail, the results should be more general than they might seem at first glance.

In each country, there is a regulator that sets the level of regulatory standards to maximize national welfare, disregarding welfare of the other country. The term 'regulator' is used in a broad sense and can be the government or a national regulatory authority. The sphere of responsibility of national regulators depends on the regulatory regime. In the case of home country regulation, regulators set the rules for all banks headquartered in their country, including their representations abroad. In contrast, under host country regulation, the rules set by a national regulator apply for all banking units doing business within his jurisdiction.

Regulation has two effects. First, stricter rules effectively limit banks' risk-taking and thereby lower the default rate of banks' borrowers in case of an adverse shock. That is, stricter regulation moderates the impact of macroeconomic shocks on banks' returns. Second, regulation is costly for banks. Although, ceteris paribus, banks will prefer a lower default rate, there are costs associated with stricter regulation. In principle, these costs can include direct costs, like those associated with the implementation of sophisticated risk management systems and indirect costs, possibly stemming from investment restrictions or capital adequacy requirements. The net effect of stricter regulation on expected profits is negative, implying the usual assumption that higher expected returns come at the cost of greater risk (volatility). Since MNBs are risk-neutral they always prefer loose regulation and try to escape strict regulatory standards if possible, i.e. try to pursue international regulatory arbitrage.[18] This assumption is in line with the empirical literature that studies international investment decisions of banks. Miller and Parkhe (1998) find that US banks' investments are negatively influenced by the stringency of capital requirements in the host country. In a similar vein, Focarelli and Pozzolo (2005) show that lower regulatory restrictions in a country increase the presence of foreign subsidiaries.

Figure 4.1 depicts the sequence of events. At stage $t_0$, the EU chooses the regulatory regime, home or host country regulation. At $t_1$ national regulators decide simultaneously on the level of regulation, taking into account the reaction of banks. At stage $t_2$, MNBs decide on their loan supply simultaneously. Finally, at $t_3$ a macroeconomic shock hits both economies, affecting banks' ex post rates of return. Hence, the model comprises two Nash games, one

---

[18] Jones (2000) discusses several ways how banks can restructure their portfolios to lower regulatory capital requirements in a national context.

between regulators at stage $t_1$ and one between MNBs at $t_2$. In addition, there is a Stackelberg game between regulators and banks.
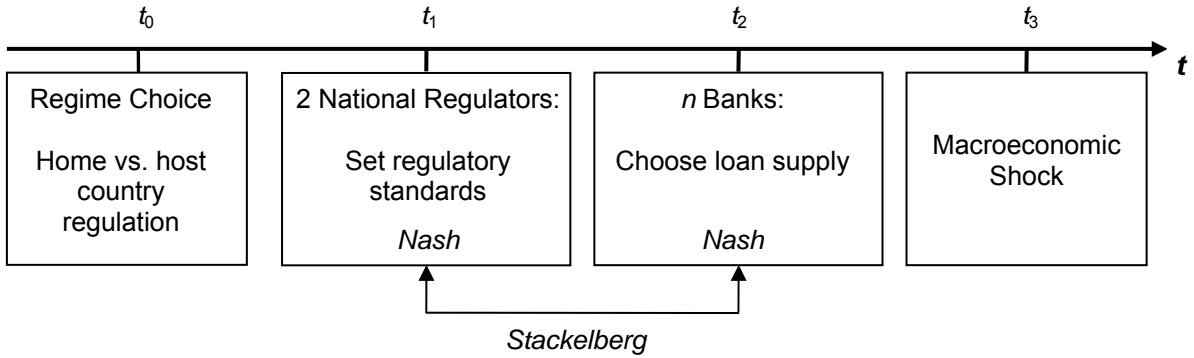


**Figure 4.1.** *Sequence of Events*

In what follows, first the optimization problems of national regulators and MNBs will be analyzed if foreign representations are regulated by the host country. Then, the same exercise is done for the case of home country regulation. Finally, the welfare implications for the EU of the two alternative regulatory regimes are compared.

### 4.4.1 Host country regulation

The model is solved by proceeding backwards, i.e., before turning to the regulators' decisions, banks' optimization problems are analyzed.

### 4.4.1.1 Banks

Profits of a representative bank $i$ ($m$), headquartered in country $A$ ($B$), $\pi_i$ ($\pi_m$), are given by:

$$(4.1) \quad \pi_i = \sum_{h=A,B} x_i^h r_h - C\left(x_i^h\right) \qquad \pi_m = \sum_{h=A,B} x_m^h r_h - C\left(x_m^h\right)$$

The first term in the profit functions represents revenues, the second term costs. Revenues equal the loan supply of $i$ ($m$) in country $h$, $x_i^h$ ($x_m^h$), times the ex post rate of return achieved in $h$, $r_h$. The ex post rate of return does not only depend on the interest rate charged on loans but also on macroeconomic conditions:

$$(4.2) \quad r_h = a - x^h + \mu_{host}^h \theta \, .$$

The first term, $a - x^h$, represents the downward-sloping inverse credit demand function in country $h$, with $x^h$ denoting the total credit volume in $h$. Slope and axis intercept of credit demand functions are assumed to be identical in both countries. The second term in (4.2) expresses the influence of macroeconomic conditions on the ex post rate of return, with $\theta$ being a macroeconomic shock with zero mean and known positive variance $\sigma^2_\theta$. If an adverse shock hits the economy ($\theta < 0$), the default rate will rise, thereby decreasing the ex post rate of return and banks' profits.[19] As $\theta$ is modeled as a shock common to both economies, one can interpret $\theta$ as an external shock like, for instance, an exchange rate shock. However, the default rate of debtors and hence the intensity with which banks' ex post rates of return are affected by the shock may vary across countries ($\mu^h_{host}$).[20] Empirically, Kose $et\ al.$ (2003) find that the co-movement of European business cycles is to a large extent driven by a common 'world component' (see also Artis $et\ al.$, 2004).[21]

Cost functions of MNBs $i$ and $m$ are given by

$$(4.3) \qquad \sum_{h=A,B} C\left(x_i^h\right) = cx_i + \sum_{h=A,B} x_i^h k_h \qquad\qquad \sum_{h=A,B} C\left(x_m^h\right) = cx_m + \sum_{h=A,B} x_m^h k_h$$

where $c$ represents the weighted average cost of capital which, without loss of generality, is normalized to zero in both countries. The policy instrument of the regulator in $h$ is the overall level of regulation, $0 \leq k_h \leq 1$. Stricter regulation, i.e. a higher $k_h$, increases banks' marginal costs linearly. Here, stricter regulation creates additional direct costs. Alternatively, as discussed above, regulation could imply indirect costs which could be modelled as forgone chances of profit in banks' rate of return without changing the results. Finally, note that the way $k_h$ enters the cost function here is only consistent with host country regulation since all banking units are regulated by the host country, no matter where the bank is headquartered.

MNBs maximize expected profits by choosing loan supply in both countries, taking the behavior of other banks as given. Expected profits of representative banks $i$ and $m$ equal:

---

[19] In 'normal times', i.e. when $\theta = 0$, there is some average, positive rate of default which leaves room for a rising ex post rate of return once a positive shock occurs ($\theta > 0$).

[20] The specific form of $\mu^h_{host}$ will be discussed below when regulators' decisions are analyzed. In the optimization problem of banks it can be neglected since banks are risk-neutral and $E(\theta) = 0$.

[21] Note that – due to the static nature of the model – this specification is also consistent with national shocks as long as they are transmitted across borders. Thus, alternatively, $\theta$ could be interpreted as the common component of both countries' business cycles.

$$E\left(\pi_i\right) = \sum_{h=A,B} \left[ x_i^h E\left(r_h\right) - C\left(x_i^h\right) \right] \qquad E\left(\pi_m\right) = \sum_{h=A,B} \left[ x_m^h E\left(r_h\right) - C\left(x_m^h\right) \right],$$

$$\text{with } E\left(r_h\right) = a - \sum_{i=1}^{n/2} x_i^h - \sum_{m=n/2+1}^{n} x_m^h$$

since total loan supply in $h$ by banks headquartered in $A$ and $B$, respectively, is $\sum_{i=1}^{n/2} x_i^h$ and

$\sum_{m=n/2+1}^{n} x_m^h$. Maximizing $E(\pi_i)$ $(E(\pi_m))$ with respect to $x_i^A$ $(x_m^A)$ and solving reaction functions

yields loan supply in Nash equilibrium (see Appendix 4.1):

$$x_i^A = x_m^A = \frac{1}{n} + \frac{\left(k_B - k_A\right)}{2\left(n+1\right)} \qquad x_i^B = x_m^B = \frac{1}{n} - \frac{\left(k_B - k_A\right)}{2\left(n+1\right)}$$

Banks' individual loan supply is independent of residence since all banks acting in one market are equally regulated and thus share the same cost function. Individual banks react to the relative strictness of regulation, set in $t_1$. Relatively loose regulation in a country increases loan supply there and reduces loan supply in the other country. Aggregating individual banks' loan supply yields the total credit volume in countries $A$ and $B$:

$$(4.4) \qquad x^A = \frac{n}{2}\left(x_i^A + x_m^A\right) = 1 + \frac{n\left(k_B - k_A\right)}{2\left(n+1\right)} \qquad x^B = \frac{n}{2}\left(x_i^B + x_m^B\right) = 1 - \frac{n\left(k_B - k_A\right)}{2\left(n+1\right)}$$

### 4.4.1.2 Regulators

Acting as national benevolent social planners, regulators in each country choose the overall level of regulation, $k_h$, in order to ensure financial stability in their jurisdiction, disregarding financial stability in the other country. Stricter rules indeed increase financial stability by limiting the risk in banks' credit portfolios. However, in addition to the private costs for banks [cf. Equation (4.3)], regulation also implies social costs (Briault, 2003). It is often argued that regulation works like a tax on the banking business (Jordan, 1994, Huizinga, 2004) which implies the usual distortions induced by taxation, including 'regulatory arbitrage' (Jones, 2000). Probably most important, regulation may limit banks' ability to perform their primary task of financial intermediation. In this respect, Gavin and Hausmann (1998, p.6) argue that regulation may "[…] reduce the efficiency with which domestic savings are channeled into the productive, and inherently risky, investments required for economic growth." Hence, when deciding on the regulatory standards, regulators face a trade-off. While, on the one hand,

stricter regulation increases financial stability, on the other hand, it limits banks' ability to perform their primary task and may therefore harm the growth potential of the economy. The model captures this trade-off by assuming the following social welfare function for $h$:[22]

$$(4.5) \qquad W^h = (1-\gamma) x^h - \gamma \left[ x^h \cdot Var(r_h) \right].$$

The first term in the welfare function is total credit volume in $h$ ($x^h$) which serves as an indicator for banks' ability to channel savings into investments. An alternative way to justify $x^h$ in the welfare function is that an increase in the credit volume is associated with a higher consumer surplus in country $h$. The second term in the welfare function is the variance of the ex post rate of return in $h$ times the credit volume, $x^h \cdot Var(r^h)$, capturing financial instability. Of course, the choice of an indicator for financial instability is somewhat arbitrary. There are many alternatives based on some measure of volatility that could be used. Probably the most obvious alternative is the variance of revenues. This, however, would look very similar to the specification here, except that the size of the credit volume would enter quadratically. This would complicate the algebra considerably without changing the underlying trade-off, qualitatively. Finally, both countries place the same relative weight on financial (in-) stability $0 \le \gamma \le 1$ which can be interpreted as a measure of risk aversion.

Before moving on, the specific impact of the macro shock on banks' ex post rates of return ($r_h = a - x^h + \mu^h_{host}\theta$) shall be discussed. In particular, the following assumptions on $\mu^h_{host}$ are imposed. First, it is assumed that $\mu^h_{host}$ is a decreasing function of the level of regulation, implying a weaker impact of $\theta$ on $r_h$ with stricter rules. Second, $\mu^h_{host}$ allows for differences in the 'efficiency of regulation'. A specific set of rules may be more or less suitable for different countries. In line with the discussion above, it is assumed that regulators are more efficient in regulating banking units doing business in their domestic market. Third, it is assumed that $\mu^h_{host}$ is strictly positive. This ensures that it is impossible for regulators to isolate the ex post rate of return completely from macroeconomic conditions, reflecting the idea that almost every loan involves some risk of default, especially in the presence of severe adverse macroeconomic shocks. Finally, $\mu^h_{host}$ allows countries to differ in their exposure to the macro

---

[22] This social welfare function is very similar to the regulators' objective function in Dell'Arrichia and Marquez (2001). However, in their model the opposing force that limits regulation is the aggregate profit of domestic banks. The authors argue that regulators care about bank shareholders' well-being to justify this assumption.

shock and thus in their degree of financial stability. If the same shock hits both economies and countries vary in their composition of GDP, this should result in diverging default rates of debtors (and thus in diverging ex post rates of return), even if both countries implemented the same regulatory standards.[23] The following functional form captures these assumptions:

$$\mu_{\text{host}}^h = \left(b_h - \phi_D k_h\right)^{\frac{1}{2}} > 0$$

The regulation-independent, country specific exposure to the shock is denoted by $b_h > 1$. The parameter $0 < \phi_D \leq 1$ affects the marginal impact of regulation on financial stability and is thus a measure of regulatory efficiency of domestic regulators. A variation of $\phi_D$ changes the relation of marginal costs and benefits of regulation: a higher $\phi_D$ implies that an increase of regulation has a stronger positive impact on financial stability at given costs.[24] Under host country regulation, both regulators are solely responsible for regulating banking units doing business within their domestic markets and are assumed to be equally efficient. For simplicity, stricter regulation lowers the variance of the ex post rates of return [see Equation (4.2)] linearly as $\text{Var}(r_h) = (b_h - \phi_D k_h)\sigma^2_\theta$.

Regulators choose $k_A$ and $k_B$ to maximize national welfare, taking the behavior of the other regulator as given and taking into account MNBs reactions. Welfare under host country regulation equals $W^h = (1 - \gamma)x^h - \gamma[\ x^h \cdot (b_h - \phi_D k_h)\ \sigma^2_\theta]$ with $x^h$ given by Equation (4.4). Maximizing $W^h$ with respect to $k_h$ for both countries yields the following reaction functions of regulators (see Appendix 4.2):

$$k_A\left(k_B\right) = \frac{n+1}{n} + \frac{1}{2\phi_D}b_A - \frac{\left(1-\gamma\right)}{2\gamma\phi_D\sigma^2_\theta} + \frac{1}{2}k_B \qquad k_B\left(k_A\right) = \frac{n+1}{n} + \frac{1}{2\phi_D}b_B - \frac{\left(1-\gamma\right)}{2\gamma\phi_D\sigma^2_\theta} + \frac{1}{2}k_A$$

Solving reaction functions yields the levels of regulation in Nash equilibrium:

$$(4.6a) \quad k_A = \begin{cases} 0 & \text{for} \quad \gamma \leq \underline{\gamma}_A^{\text{crit.}} \\ \dfrac{2(n+1)}{n} + \dfrac{2b_A + b_B}{3\phi_D} - \dfrac{\left(1-\gamma\right)}{\gamma\phi_D\sigma^2_\theta} & \text{for} \quad \underline{\gamma}_A^{\text{crit.}} < \gamma < \overline{\gamma}_A^{\text{crit.}} \\ 1 & \text{for} \quad \gamma \geq \overline{\gamma}_A^{\text{crit.}} \end{cases}$$

---

[23] When the shock is interpreted as reflecting the common component of national business cycles, the impact of $\theta$ on both countries should be more similar if the common component gets more important. This may be interpreted as increased economic integration.

[24] Equivalently, $\phi_D$ could be modeled in the cost function of banks in Equation (4.3).

$$(4.6b) \quad k_B = \begin{cases} 0 & \text{for} \quad \gamma \leq \underline{\gamma}_B^{\text{crit.}} \\ \dfrac{2(n+1)}{n} + \dfrac{2b_B + b_A}{3\phi_D} - \dfrac{(1-\gamma)}{\gamma\phi_D\sigma_\theta^2} & \text{for} \quad \underline{\gamma}_B^{\text{crit.}} < \gamma < \overline{\gamma}_B^{\text{crit.}} \\ 1 & \text{for} \quad \gamma \geq \overline{\gamma}_B^{\text{crit.}} \end{cases}$$

with $\underline{\gamma}_A^{\text{crit.}} \equiv \left(1 + \phi_D\sigma_\theta^2\left[\dfrac{2(n+1)}{n} + \dfrac{2b_A + b_B}{3\phi_D}\right]\right)^{-1}$, $\overline{\gamma}_A^{\text{crit.}} \equiv \left(1 + \phi_D\sigma_\theta^2\left[\dfrac{n+2}{n} + \dfrac{2b_A + b_B}{3\phi_D}\right]\right)^{-1}$

and $\underline{\gamma}_B^{\text{crit.}} \equiv \left(1 + \phi_D\sigma_\theta^2\left[\dfrac{2(n+1)}{n} + \dfrac{2b_B + b_A}{3\phi_D}\right]\right)^{-1}$, $\overline{\gamma}_B^{\text{crit.}} \equiv \left(1 + \phi_D\sigma_\theta^2\left[\dfrac{n+2}{n} + \dfrac{2b_B + b_A}{3\phi_D}\right]\right)^{-1}$

(Appendix 4.3). If $\gamma$ falls short of certain thresholds $\left(\underline{\gamma}_A^{\text{crit.}}, \underline{\gamma}_B^{\text{crit.}}\right)$ regulators will choose minimum regulation as they place a low relative weight on financial stability. Reversely, if $\gamma$ exceeds $\overline{\gamma}_A^{\text{crit.}}, \overline{\gamma}_B^{\text{crit.}}$ maximum regulation will be implemented. In what follows, I will focus on the case of a simultaneous interior solution ($0 < k_A, k_B < 1$) as, in this case, the mutual influence of regulators' decisions appears to the full extent. Appendix 4.4 proofs that such an interior solution exists if $3\phi_D > |b_B - b_A|$.[25] Figure 4.2 illustrates this relationship for the case of country $B$ being relatively instable $\left(b_B > b_A\right)$. In this case, it holds that $\underline{\gamma}_A^{\text{crit.}} > \underline{\gamma}_B^{\text{crit.}}$ and $\overline{\gamma}_A^{\text{crit.}} > \overline{\gamma}_B^{\text{crit.}}$.
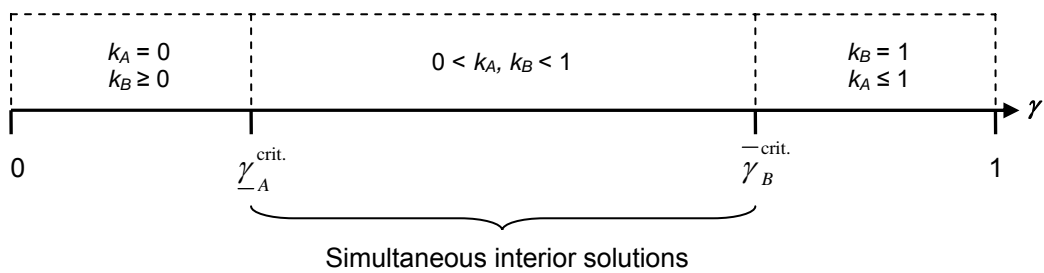


**Figure 4.2.** *Interior Solutions*
*B* is relatively instable

Equilibrium regulation [cf. Equations (4.6)] mirrors the basic trade-off regulators face. Stricter regulation increases financial stability in a country but, at the same time, the credit volume is reduced. Variations of parameters change the relation of costs and benefits of regulation and

---

[25] Throughout the remainder of the paper this condition is assumed to hold.

thus the underlying trade-off. Not surprisingly, country $A$'s regulator increases the level of regulation, $k_A$, with higher risk aversion ($\gamma$), greater variance of the macro shock ($\sigma^2_\theta$) and the own country's exposure to the shock ($b_A$). Interestingly, although regulators do not care about financial stability in the other country, $B$'s exposure to the macro shock increases regulation in $A$, too. The reason is that a high exposure in $B$ increases the level of regulation there. All else equal, this will raise the credit volume in country $A$ since it is the relative strictness of regulation that is crucial for loan supply. This, in turn, lowers regulator $A$'s costs of increased regulation, resulting in stricter rules in country $A$. Finally, note that the relative instable country will implement stricter rules. If, for instance, country $B$ is relatively instable ($b_B > b_A$), this will result in stricter regulation in $B$ since $(k_B - k_A) = (b_B - b_A)/3\phi_D > 0$.

### 4.4.2 Home country regulation

Going through the same steps as before, equilibrium regulation will be derived in the case of home country regulation.

### 4.4.2.1 Banks

Here, all MNBs are solely regulated by their home country regulator, no matter where the business is conducted. Therefore banks $i$ and $m$, headquartered in $A$ and $B$, operate with the following cost functions:[26]

$$\sum_{h=A,B} C\left(x_i^h\right) = \sum_{h=A,B} x_i^h k_A, \qquad\qquad \sum_{h=A,B} C\left(x_m^h\right) = \sum_{h=A,B} x_m^h k_B.$$

Maximizing expected profits,

$$E\left(\pi_i\right) = \sum_{h=A,B} x_i^h E\left(r_h\right) - C\left(x_i^h\right), \qquad E\left(\pi_m\right) = \sum_{h=A,B} x_m^h E\left(r_h\right) - C\left(x_m^h\right)$$

and taking into account Equation (4.2) yields individual banks' loan supply:

$$x_i^A = x_i^B = 1/n, \qquad x_m^A = x_m^B = 1/n.$$

Since $x^h = (n/2) x_i^h + (n/2) x_m^h$, the total credit volume in $A$ and $B$ equals:

$$(4.7) \quad x^A = x^B = 1$$

Each MNB supplies the same amount of loans in both countries. The reason is that expected rates of return are similar across countries and, under home country regulation, MNBs cannot

---

[26] These cost functions are also consistent with banks doing cross-border business from their domestic offices.

escape from stricter regulation. This mirrors Dalen and Olsen's (2003, p. 3) finding that internationalization by branching "removes the regulatory competition phenomena induced by subsidiaries."

### 4.4.2.2 Regulators

In each country, both, the domestic and the foreign regulator set the rules only for a fraction of banking units. Therefore, the impact of the macroeconomic shock on the rate of return in one country does not only depend on the regulatory standards set in this country but also on those set in the other country. The model captures this circumstance by assuming the following $\mu^h_{\text{home}}$:

$$\mu^A_{\text{home}} = \left( b_A - \frac{n}{2} x_i^A \phi_D k_A - \frac{n}{2} x_m^A \phi_F k_B \right)^{\frac{1}{2}} \qquad \mu^B_{\text{home}} = \left( b_B - \frac{n}{2} x_i^B \phi_F k_A - \frac{n}{2} x_m^B \phi_D k_B \right)^{\frac{1}{2}}$$

$\mu^A_{\text{home}}$ resembles $\mu^A_{\text{host}}$[27] except that, under home country regulation, the rules set by regulator $A$ ($k_A$) only apply for the fraction of loans supplied by banks headquartered in $A$, $(n/2)x_i^A$. For these banks the regulatory efficiency is $\phi_D$ since it is regulator $A$'s domestic credit market. Conversely, the credit volume controlled by MNBs headquartered in $B$, $(n/2)x_m^A$, is regulated by $B$'s regulator ($k_B$). Since $B$ is the 'foreign regulator' who is assumed to be less efficient, the regulatory efficiency is $\phi_F$, with $\phi_F < \phi_D$. Finally, the regulation-independent, country-specific exposures to the shock ($b_h$) are not affected by the regulatory regime. This specification implies for the variances of the ex post rates of return:

$$(4.8) \quad Var\left( r_A \right) = \left[ b_A - \frac{1}{2} \phi_D k_A - \frac{1}{2} \phi_F k_B \right] \sigma_\theta^2 \qquad Var\left( r_B \right) = \left[ b_B - \frac{1}{2} \phi_F k_A - \frac{1}{2} \phi_D k_B \right] \sigma_\theta^2$$

Regulators maximize social welfare [see Equation (4.5)] which, in case of home country regulation, equals $W^h = \left(1-\gamma\right) x^h - \gamma x^h \cdot \left[ b_h - \frac{1}{2} \phi_D k_h - \frac{1}{2} \phi_F k_{\neq h} \right] \sigma_\theta^2$. Since the total credit volume ($x^h$) is independent of the level of regulation, social welfare functions are maximized for:

$$(4.9) \quad k_h = 1.$$

---

[27] The same is true for $\mu^B_{\text{home}}$.

Under home country regulation, maximum regulation will be implemented since stricter rules are not associated with higher costs for regulators. This extreme result is due to the assumption of a fixed balance sheet total which will be discussed now.

### 4.4.3 Discussion

In this Section, the assumption of a fixed balance sheet total of the aggregate banking sector will be discussed. The most important and evident implication of this assumption is that banks' loan supply does not depend on the strictness of rules under home country regulation [Equation (4.7)]. As a consequence, maximum regulation is implemented in both countries [Equation (4.9)] as stricter regulation does not come at higher costs for national regulators. The question arises whether this assumption drives the basic mechanisms of the model or if the principle results regarding the welfare effects of both regimes would remain qualitatively similar if this assumption was relaxed. In this regard, one result is of special importance, namely that regulation is stricter under home country regulation on average. It is interesting to see whether this result would still hold if aggregate loan supply was flexible.

If banks could vary their total loan supply by raising additional funds, they would indeed react to changes in regulation. In this case, implementing stricter rules would be associated with a positive cost for regulators which, in turn, would prevent maximum regulation under home country regulation. In this case, however, although regulators would not implement maximum regulation, regulatory standards should still be stricter under home country regulation on average. The reason is international regulatory arbitrage which is facilitated under host country regulation. Consequently, under this regime, not only domestic banks will react to changes in regulation but also foreign banks doing business in the domestic market. In contrast, international regulatory arbitrage is hampered if the home country is in charge of regulating foreign activities of MNBs (Dalen and Olsen, 2003). Therefore, both regulators have stronger incentives to lower regulatory standards under host country regulation, possibly resulting in a race to the bottom. As a result, average regulation should still be stricter under home country regulation if banks' balance sheet total was flexible, indicating that the results are more general than they might seem at first glance.

A minor implication of the assumption concerns host country regulation. In the model with a fixed balance sheet total, a decrease in regulation increases loan supply in a country and reduces loan supply in the other country by the same amount [Equation (4.4)]. This 1:1 relationship is not crucial for the results but it is important that investments in both countries are somewhat competing. This is a prerequisite for regulators' tendency to race to the bottom. However, investments would still be competing – under a flexible aggregate loan supply – if the costs of funding would – at some point – exceed the additional expected returns.

### 4.4.4 Welfare Analysis

After equilibrium regulation is described under both regimes, the welfare implications for the EU from choosing either arrangement can be analyzed. To do so, it is assumed that EU welfare is given by the sum of individual countries' welfare functions:

$$(4.10) \quad W^{EU} = \sum_{h=A,B} W^h = \sum_{h=A,B} (1-\gamma) \cdot x^h - \gamma \left[ x^h \cdot Var(r_h) \right]$$

In the case of host country regulation, EU welfare equals

$$(4.11) \quad W_{\text{host}}^{EU} = (1-\gamma)\left(x^A + x^B\right) - \gamma \left[ x^A \cdot \left(b_A - \phi_D k_A\right) + x^B \cdot \left(b_B - \phi_D k_B\right) \right] \sigma_\theta^2,$$

where $k_A$ and $k_B$ are the equilibrium values of regulation [Equation (4.6)] and $x^A$ and $x^B$ the credit volumes in equilibrium [Equation (4.4)]. Accordingly, using Equations (4.7), (4.8), and (4.9) yields EU welfare under home country regulation:

$$(4.12) \quad W_{\text{home}}^{EU} = (1-\gamma)\left(x^A + x^B\right) - \gamma \left[ b_A + b_B - \phi_D - \phi_F \right] \sigma_\theta^2$$

From a comparison of Equations (4.11) and (4.12) the following proposition can be derived.

**Proposition 4.1:** At the union level, host country regulation implies higher welfare than home country regulation if:

$$(4.13) \quad \gamma > \left(1 + \left[ \frac{b_A + b_B}{2} + \frac{(3n+4)\phi_D - n\phi_F}{2n} + \frac{n\left(b_B - b_A\right)^2}{18(n+1)\phi_D} \right] \sigma_\theta^2 \right)^{-1} \equiv \gamma_{\text{host}}^{\text{crit.}}.$$

**Proof**: See Appendix 4.5.

Although home country regulation leads to stricter regulation on average, host country regulation may imply higher welfare at the union level. This perhaps surprising finding stems

from two principle advantages of host country regulation. First, national regulators react more sensitive to country differences in financial (in-)stability because the benefits from increased regulation, i.e. financial stability, solely arise in the regulator's domestic market. In contrast, under home country regulation, stricter regulation also raises financial stability in the foreign banking market which is not a benefit from the domestic regulator's perspective who only cares about national welfare. This leads to stricter regulation in the relatively instable country, implying a smaller credit volume there and thereby higher welfare at the union level. Second, in the case of host country regulation, every banking unit is regulated by the domestic regulator who, by assumption, is better able to do so than his foreign counterpart. On the other hand, the basic disadvantage of host country regulation rests on MNBs' possibility to pursue international regulatory arbitrage, inducing an incentive for regulators to race to the bottom which results in lower average levels of regulation.

A variation of parameters changes the relative importance of advantages and disadvantages of both regulatory regimes and thus affects the optimal choice. Regarding the degree of risk aversion the following result can be derived as inequality (4.13) is more likely fulfilled for a higher $\gamma$.

> **Result 4.1:** Host country regulation will more likely be the optimal choice for the EU if the degree of risk aversion is high.

The degree of risk aversion affects regulators' relative costs and benefits from implementing stricter rules. Specifically, a higher $\gamma$ increases the costs of lowering regulation in order to increase the credit volume. This reduces the importance of the relative disadvantage of host country regulation. If $\gamma$ exceeds a certain threshold $\left(0 < \gamma_{host}^{crit.} < 1\right)$ the advantages always outweigh the drawbacks and host country regulation should be implemented.[28]

---

[28] Appendix 4.6 derives the conditions for $\underline{\gamma}_A^{crit.}, \underline{\gamma}_B^{crit.} < \gamma_{host}^{crit.} < \overline{\gamma}_A^{crit.}, \overline{\gamma}_B^{crit.}$. If this condition does not hold in the case of simultaneous interior solutions ($0 < k_A, k_B < 1$), one institution will always be optimal. If, for instance, $\gamma_{host}^{crit.} < \underline{\gamma}_A^{crit.}, \underline{\gamma}_B^{crit.}$ it always holds that $\gamma_{host}^{crit.} < \gamma$ and host country regulation is optimal.

Note that Result 4.1 generalizes to the cases where both countries implement maximum or minimum regulation, i.e. choose corner solutions. It is straightforward that home country regulation will always be optimal from an EU perspective if $k_A$, $k_B = 0$ under host country regulation $\left( \gamma \leq \underline{\gamma}_A^{crit.}, \underline{\gamma}_B^{crit.} \right)$. On the contrary, for $\gamma \geq \overline{\gamma}_A^{crit.}, \overline{\gamma}_B^{crit.}$ ($k_A$, $k_B = 1$) host country regulation unambiguously implies higher welfare at the EU level.[29]

Examining how country differences in the reaction to macroeconomic shocks affect the optimal regime choice, yields the following result as inequality (4.13) will be more likely fulfilled if $(b_B - b_A)^2$ increases $\left( \partial \gamma_{\text{host}}^{crit.} \middle/ \partial (b_A - b_B)^2 < 0 \right)$.

**Result 4.2:** If countries become more similar in their reaction to macroeconomic shocks, home country regulation is more likely the optimal choice for the EU.

The more similar countries are in their exposure to the macro shock, the less important is a strong differentiation in regulatory standards. Hence, the principle advantage of host country regulation gets relatively less important, making home country regulation more likely the favorable choice. In line with the discussion above, a more similar reaction to macroeconomic shocks may also be interpreted as increased economic integration. If the model allowed for country-specific shocks, an increase in the coefficient of correlation would work quite similar to a decrease of $(b_B - b_A)^2$. For instance, the extreme case of a coefficient of correlation of one together with identical variances of country-specific shocks coincides with the case of $b_A = b_B$. Having analyzed country differences in financial stability, it is worthwhile to examine the impact of a change in the overall degree of financial stability in the union, for given country differences.

**Result 4.3:** Increased financial stability in the EU favors home country regulation.

Higher financial stability – expressed by either a lower variance of the macroeconomic shock or a smaller sum of country specific exposures to the shock ($b_A + b_B$) increases $\gamma_{\text{host}}^{crit.}$, making

---

[29] This can be seen by inserting the respective $k_h$'s into $W_{\text{host}}^{EU}$ and comparing it with (4.12).

inequality (4.13) less likely to be fulfilled. Therefore, increased financial stability favors home country regulation. Although greater financial stability raises welfare under both regimes, home country regulation gets relatively more attractive. The reason is that this welfare-enhancing effect is partially contradicted under host country regulation by a change in regulators' incentives. If financial stability increases, it will be less costly for regulators to lower regulatory standards in order to increase the credit volume, implying looser regulatory standards under host country regulation. Therefore, home country regulation gets relatively more attractive if financial stability in the union increases.

Turning to regulatory efficiency, the following result can be derived.

**Result 4.4:** If the difference of regulatory efficiency between domestic and foreign regulators increases, host country regulation will become relatively more attractive.

Since $\phi_D > \phi_F$, an increasing difference in regulatory efficiency can stem from both, a decline in efficiency of foreign regulators or a rise in efficiency of domestic regulators. Both effects make (4.13) more likely fulfilled and favor host country regulation.[30] A lower $\phi_F$ reduces welfare under home country regulation but leaves welfare under host country regulation unchanged. In contrast, a higher $\phi_D$ increases welfare under both regimes. However the effect is weaker under home country regulation as, in this case, a fraction of banking units is regulated by the foreign regulator. This result should not come as a surprise as the efficiency edge of domestic regulators constitutes one of the principle advantages of host country regulation.

Finally, the impact of the degree of competition in the union's banking sector on the favorable regime choice will be analyzed. In the model, banks' risk-taking is not affected by $n$. In fact, banks always take the maximum risk permitted by the regulator since this implies the highest expected returns. Therefore, the argument of diminishing monopoly rents that trigger excessive risk-taking, mentioned above, does not apply here. Nevertheless, the degree of competition has an effect on the favorable regime choice as $\partial \gamma_{host}^{crit.} / \partial n > 0$ for $|b_B - b_A| < 3\phi_D$.

---

[30] Differentiating (4.13) implies this finding as $\partial \gamma_{host}^{crit.} / \partial \phi_F > 0$ and $\partial \gamma_{host}^{crit.} / \partial \phi_D < 0$ if $|b_B - b_A| < 3\phi_D$.

**Result 4.5:** Stiffer competition in the banking sector favors home country regulation.

Under home country regulation, the union's welfare is not affected by the degree of competition [see Equation (4.12)] whereas welfare decreases under host country regulation [Equation (4.11)], making home country regulation relatively more attractive. This perhaps surprising result stems from the impact of competition on aggregate loan supply in one market. If competition is stiff, aggregate loan supply in one country will react more sensitive to changes in marginal costs, i.e. the regulation variable. This increases regulators' incentives for lowering $k_h$ to increase the credit volumes in their domestic banking markets. Figure 4.3 illustrates the impact of competition on national regulators' incentives for two extreme cases of the degree of competition, a monopoly ($n = 1$) and perfect competition ($n \to \infty$). Consider first a high level of regulation, $k_0$. A monopolist will choose the loan supply equal to $x_0^M$ where marginal revenues (MR) intersect with marginal costs (MC). Under perfect competition, equilibrium loan supply will equal $x_0^*$ where the MC-curve intersects with the inverse credit demand function, $r(x)$.
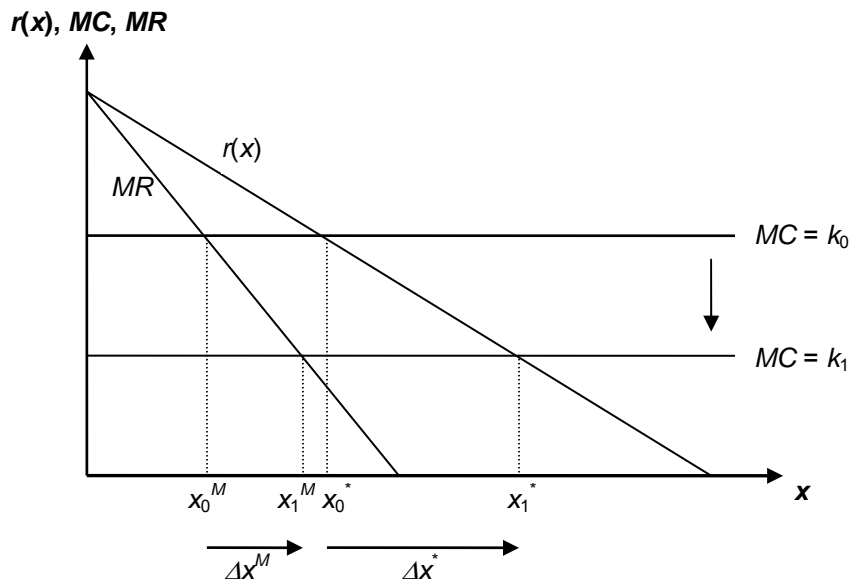


**Figure 4.3.** *Loan Supply for Different Degrees of Competition*

A reduction in the level of regulation (to $k_1$) increases equilibrium loan supply in both cases. However, the rise under perfect competition, $\Delta x^*$, exceeds the increase in the case of a monopoly, $\Delta x^M$. Hence, the gains in terms of increased credit volume and thus the incentives to lower regulation will be higher for regulators if competition is intense. This implies lower levels of regulation when competition is stiff which is associated with lower welfare under host country regulation.

## 4.5 Concluding Remarks

In the EU, prudential banking regulation is mainly a national task, with both, the home and the host country being involved in regulating MNBs, depending on the form of foreign representations. The ongoing cross-border integration in the European banking sector has triggered a lively debate on the adequacy of the current regulatory framework. From a normative perspective, there are strong arguments in favor of a centralized solution to banking regulation. However, from a positive point of view, there is reason to believe that full centralization is political infeasible at the moment. The present work adds to the discussion on how to organize prudential banking regulation in the EU, given that the first best centralized solution can not be implemented. The paper compares two different regulatory regimes where either the home or the host country is assigned with full responsibility of regulating foreign owned banking units, independent of the form of representation.

A simple model is presented which derives the optimal second best regulatory regime from an EU perspective. In the model, national regulators aim at attracting MNBs and at providing financial stability but disregard welfare in other countries. The optimal regime choice for the EU will generally depend on the relative importance of the specific strengths and weaknesses of either arrangement. Host country regulation enables MNBs to pursue international regulatory arbitrage, inducing a tendency for regulators to race to the bottom. As a result, regulatory standards are looser on average compared to home country regulation where international regulatory arbitrage is hampered. However, under host country regulation, national regulators take into account specific country characteristics more strongly because they hold regulatory responsibility for all banking units doing business in their jurisdiction. As

a consequence, rules are more differentiated in line with specific country needs. The model predicts that home country regulation will be more likely the better regulatory regime for the EU if (i) countries are sufficiently similar in their reaction to macroeconomic shocks, (ii) the overall financial stability in the union is high, (iii) the difference in regulatory efficiency between domestic and foreign regulators is relatively small, and (iv) competition in the European banking sector is stiff. Overall, the EU strategy of promoting increased integration together with strong competition in the banking sector is – according to the model – only consistent with home country regulation. Therefore, with further economic integration, home country regulation will be the favorable regulatory regime for the EU, as long as centralization of prudential banking regulation cannot be established.

# References

Artis, M., Krolzig, H.-M. and J. Toro (2004) *The European Business Cycle,* Oxford Economic Papers, 56, 1–44

Bhattacharya, S., Boot, A. W. and A. Thakor (1998) *The Economics of Bank Regulation,* Journal of Money, Credit and Banking, 30 (4), 745-70.

Berger, H. and C. Hefeker (2006) *Does Financial Integration Make Banks Act more Prudential? Regulation, Foreign Owned Banks, and the Lender-of-Last Resort,* HWWA Discussion Paper 339

Briault, C. (2003) *The Cost of Financial Regulation,* Speech at the ZEW/AEI Conference on Regulation and Supervision of Financial Markets and Institutions in the EU, Mannheim

Bryant, J. (1980) *A Model of Reserves, Bank Runs, and Deposit Insurance,* Journal of Banking and Finance, 4, 335-44

Calomiris, C. (1999) *Building an Incentive-compatible Safety Net,* Journal of Banking and Finance, 23 (10), 1499-1519

Calzolari, G. and G. Loranth (2003) *On the Regulation of Multinational Banks,* in: *Antitrust, Regulation and Competition,* M. Baldassarri and L Lambertini (Eds.), Palgrave, 265

Calzolari, G. and G. Loranth (2004) *Regulation of Multinational Banks: A Theoretical Inquiry,* CEPR Discussion Paper 4232

Caprio, G. and D. Klingebiel (1997) *Bank Insolvency: Bad Luck, Bad Policy, or bad Banking?* Paper presented at the 1996 Annual Bank Conference on Development Economics, World Bank Economic Review, January 1997

Crockett, A. (2000) *Marrying the Micro- and Macro-Prudential Dimensions of Financial Stability,* Speech at the Eleventh International Conference of Banking Supervisors, Basel

Dalen, D. M. and T. E. Olsen (2003) *Regulatory Competition and Multi-National Banking,* CES-IFO Working Paper 971

D'Amato, L., Grubisic, E. and A. Powell (1997) *Contagion, Bank Fundamentals or Macroeconomic Shock? An Empirical Analysis of the Argentine 1995 Banking Problems,* BCRA Working Paper 2

De Bandt, O. and P. Hartmann (2000) *Systemic Risk: A Survey,* ECB Working Paper 35

Dell'Ariccia, G. and R. Marquez (2001) *Competition Among Regulators,* IMF Working Paper 73

Dell'Ariccia, G. and R. Marquez (2006) *Competition Among Regulators and Credit Market Integration,* Journal of Financial Economics, 79, 401-30

De Nicolo, G. and A. Tieman (2005) *Economic Integration and Financial Stability: A European Perspective,* mimeo

Demirgüç-Kunt, A. and E. Detragiache (1998), *The Determinants of Banking Crises in Developing and Developed Countries,* IMF Staff Papers 45 (1)

Demirgüc-Kunt, A. and E. Detragiache (2005), *Cross-Country Empirical Studies of Systemic Bank Distress: A Survey,* National Institute Economic Review 192

Dermine, J. (2005) *European Banking Integration: Don't Put the Cart before the Horse,* Financial Markets, Institutions & Instruments 15 (2), 57

Diamond, D. W. and P. H. Dybvig (1983) *Bank Runs, Deposit Insurance, and Liquidity,* Journal of Political Economy 91, 401-19

ECB (2006) *EU Banking Structures,* October 2006, Frankfurt.

Favero, C., Freixas, X., Persson, T. and C. Wyplosz (2000) *One Money, Many Countries – Monitoring the European Central Bank No. 2,* CEPR London

Fecht, F. and H. P. Grüner (2005) *Financial Integration and System Risk,* Deutsche Bundesbank Discussion Paper 2 (11)

Focarelli, D. and F. Pozzolo (2005) *Where Do Banks Expand Abroad? An Empirical Analysis,* Journal of Business, 78, 2435-64

Freixas, X. and J. C. Rochet (1997) *The Microeconomics of Banking,* Cambridge: MIT Press

Freixas, X., B. Parigi, and J. C. Rochet (2000) *Systemic Risk, Interbank Relations and Liquidity Provision by the Central Bank,* Journal of Money, Credit and Banking 3(2), 611-38

Freixas, X. and A. M. Santomero (2005) *An Overall Perspective on Banking Regulation,* University Pompeu Fabra, Economics and Business Working Paper 664

Furlong, F.T. and M. C. Keeley (1989) *Capital Regulation and Bank Risk-taking: A Note,* Journal of Banking and Finance 13, 883-91

Gavin, M. and R. Hausmann (1998) *The Roots of Banking Crises: The Macroeconomic Context,* Inter-American Development Bank Working Paper 318

Gonzalez-Hermosillo, B. (1999) *Determinants of Ex-ante Banking System Distress: A Macro – Micro Empirical Exploration of Some Recent Episodes,* IMF Working Paper 99/33

Grünbichler, A. and P. Darlap (2004) *Integration of EU Financial Markets Supervision: Harmonisation or Unification?* Journal of Financial Regulation and Compliance 12 (1), 36-44

Gulde, A.-M. and H. Wolf (2005) *Financial Stability Arrangements in Europe: A Review,* in: A Constitutional Treaty for an Enlarged Europe: Institutional and Economic Implications for Economic and Monetary Union, Proceedings of OeNB Workshops, No. 4, 50-67

Gulde, A.-M. and H. Wolf (2006) *Challenges to Effective Financial Supervision in the EU,* Manuscript, June 2006

Holthausen, C. and T. Rønde (2004) *Cooperation in International Banking Supervision,* ECB Working Paper 316

Huizinga, H. (2004) *The Taxation of Banking in an Integrating Europe,* International Tax and Public Finance, 11, 551-68

Jones, D. (2000) *Emerging Problems with the Basel Capital Accord: Regulatory Capital Arbitrage and Related Issues,* Journal of Banking & Finance 24, 35-58

Jordan, J.L. (1994) *A Market Approach to Banking Regulation,* Cato Journal, 13 (3), 315-32

Kane, E. (1989) *The S&L Insurance Mess: How Did It Happen?* Urban Institute Press, Washington

Kearns, A. (2004) *Loan Losses and the Macroeconomy: A Framework for Stress Testing Credit Institutions' Financial Well-Being,* Central Bank and Financial Services Authority of Ireland, Financial Stability Report 2004

Keeley, M. C. (1990) *Deposit Insurance, Risk, and Market Power in Banking,* American Economic Review 80 (5), 1183-1200

Kose, M. A., Otrok, C. and C. H. Whiteman (2003) *International Business Cycles: World, Region, and Country-Specific Factors,* American Economic Review, 93(4), 1216-39

Matutes, C. and X. Vives (2000) *Imperfect Competition, Risk Taking and Regulation in Banking,* European Economic Review 44, 1-34

Merton, R. C. (1977) *An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees,* Journal of Banking and Finance 1, 3-11

Miller, S. R. and A. Parkhe (1998) *Patterns in the Expansion of U.S. Banks' Foreign Operations,* Journal of International Business Studies, 29, 359-90

Mishkin, F. S. (2000) *Prudential Supervision: What is Important and what are the Issues?* NBER Working Paper 7926

Padoa-Schioppa, T. (2003) *Central Banks and Financial Stability, Exploring the Land in Between,* in: The Transformation of the European Financial System, Gaspar, V., Hartman, P. and O. Slejpen (eds.), 270-310, 2nd ECB Conference, Frankfurt 2003

Pesola, J. (2005) *Banking Fragility and Distress: An Econometric Study of Macroeconomic Determinants,* Bank of Finland Research Discussion Papers 13/2005

Prati, A. and G. Schinasi (1999) *Financial Stability in European Economic and Monetary Union,* Princeton Studies in International Finance, Princeton University, New Jersey

Rochet, J.-C. and J. Tirole (1996) *Interbank Lending and Systemic Risk,* Journal of Money, Credit and Banking 28(4), 733-62

Rochet, J.-C. (2004) *Macroeconomic Shocks and Banking Supervision,* Journal of Financial Stability, 1(1), 93-110

Santomero, A. (1984) *Modeling the Banking Firm: A Survey,* Journal of Money, Credit and Banking, 16(4), 576-602

Schinasi, G. J. and P. G. Teixeira (2006) *The Lender of Last Resort European Single Financial Market,* IMF Working Paper 127

Schoenmaker, D. and S. Oosterloo (2004) *Cross-Border Issues in European Financial Supervision,* Prepared for the Bank of Finland Conference "The Structure of Financial Regulation" 2-3 September 2004, Helsinki

Schoenmaker, D. and S. Oosterloo (2005) *Financial Supervision in an Integrating Europe: Measuring Cross-Border Externalities,* International Finance 8(1), 1-27

Schüler, M. (2003) *How Do Banking Supervisors Deal with Europe-Wide Systemic Risk?* ZEW Discussion Paper 03

Summer, M. (2003) *Banking Regulation and Systemic Risk,* Open Economies Review 14, 43-70

Veron, N. (2007) *Is Europe Ready for a Major Banking Crisis?* Bruegel Policy Brief 03/2007

Vesala, J. (2005) *Which Model for Prudential Supervision in the EU? Comments on Daniele Nouy, "Ensuring Financial Stability through Supervisory Cooperation"* 33rd Economics Conference 2005, Oesterreichische Nationalbank

Vives, X. (2001) *Restructuring Financial Regulation in the European Monetary Union,* Journal of Financial Services Research 19(1), 57-82

Weinberg, J. A. (2002) *Competition Among Bank Regulators,* Federal Reserve Bank of Richmond Economic Quarterly 88(4), 19-36

White, L. J. (1994) *On the International Harmonization of Bank Regulation,* Oxford Review of Economic Policy 10(4), 94-105

## Appendices

**Appendix 4.1 (Equilibrium loan supply under host country regulation)**

Expected profits of MNB $i$ are given by

$$E(\pi_i) = \sum_{h=A,B} \left[ x_i^h E(r_h) - C(x_i^h) \right]$$

with $\quad \sum_{h=A,B} C(x_i^h) = \sum_{h=A,B} x_i^h k_h \quad$ and $\quad E(r_h) = a - x_i^h - \sum_{j=1, j\neq i}^{n/2} x_j^h - \sum_{m=n/2+1}^{n} x_m^h.$

After using the symmetry assumption, the expected rate of return in $h$ becomes

$$E(r_h) = a - x_i^h - \left(\frac{n}{2} - 1\right) x_j^h - \frac{n}{2} x_m^h.$$

Maximizing $E(\pi_i)$ with respect to $x_i^A$, after substituting $x_i^B = 2/n - x_i^A$ and using the fact that in equilibrium $x_i^A = x_j^A$, yields the following reaction function of MNB $i$:

$$x_i^A\left(x_m^A\right) = \frac{2(n+1)}{n(n+2)} + \frac{(k_B - k_A)}{(n+2)} - \frac{n}{(n+2)} x_m^A.$$

Since host country regulation implies a similar regulation for all banks, it holds that $x_i^A = x_m^A$ in equilibrium. Hence loan supply of $i$ and $m$ in $A$ equals

$$x_i^A = \frac{1}{n} + \frac{(k_B - k_A)}{2(n+1)} = x_m^A.$$

Similarly, since $x_i^B = 2/n - x_i^A$, loan supply of $i$ and $m$ in $B$ equals

$$x_i^B = \frac{1}{n} - \frac{(k_B - k_A)}{2(n+1)} = x_m^B.$$

**Appendix 4.2 (Equilibrium regulation under host country regulation)**

Regulator $A$ maximizes $W^A = (1 - \gamma)x^A - \gamma\,[x^A(b_A - \phi_D k_A)\sigma_\theta^2]$ over $k_A$.

$$\frac{\partial W^A}{\partial k_A} = -(1-\gamma)\frac{n}{2(n+1)} - \gamma\left[\frac{-n}{2(n+1)}(b_A - \phi_D k_A) - \phi_D\left(1 + \frac{n(k_B - k_A)}{2(n+1)}\right)\right]\sigma_\theta^2 \overset{!}{=} 0$$

$$\Leftrightarrow \quad k_A(k_B) = \frac{n+1}{n} + \frac{1}{2\phi_D}b_A - \frac{(1-\gamma)}{2\gamma\phi_D\sigma_\theta^2} + \frac{1}{2}k_B$$

Similarly, $B$'s reaction function is given by $k_B(k_A) = \frac{n+1}{n} + \frac{1}{2\phi_D}b_B - \frac{(1-\gamma)}{2\gamma\phi_D\sigma_\theta^2} + \frac{1}{2}k_A.$

**Appendix 4.3 (Interior solutions)**

An interior solution for country $A$ requires $k_A > 0$ and $k_A < 1$:

$$k_A = \frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D} - \frac{(1-\gamma)}{\gamma\phi_D\sigma_\theta^2} > 0 \quad \Leftrightarrow \quad \gamma\phi_D\sigma_\theta^2\left(\frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D}\right) > (1-\gamma)$$

$$\Leftrightarrow \quad \gamma > \left(1 + \phi_D\sigma_\theta^2\left[\frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1} \equiv \underline{\gamma}_A^{crit.}$$

$$k_A = \frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D} - \frac{(1-\gamma)}{\gamma\phi_D\sigma_\theta^2} < 1 \quad \Leftrightarrow \quad \gamma\phi_D\sigma_\theta^2\left(\frac{n+2}{n} + \frac{2b_A + b_B}{3\phi_D}\right) < (1-\gamma)$$

$$\Leftrightarrow \quad \gamma < \left(1 + \phi_D\sigma_\theta^2\left[\frac{n+2}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1} \equiv \overline{\gamma}_A^{crit.}$$

Similarly, $0 < k_B < 1$ requires:

$$k_B = \frac{2(n+1)}{n} + \frac{2b_B + b_A}{3\phi_D} - \frac{(1-\gamma)}{\gamma\phi_D\sigma_\theta^2} > 0 \quad \Leftrightarrow \quad \gamma > \left(1 + \phi_D\sigma_\theta^2\left[\frac{2(n+1)}{n} + \frac{(2b_B + b_A)}{3\phi_D}\right]\right)^{-1} \equiv \underline{\gamma}_B^{crit.}$$

$$k_B = \frac{2(n+1)}{n} + \frac{2b_B + b_A}{3\phi_D} - \frac{(1-\gamma)}{\gamma\phi_D\sigma_\theta^2} \leq 1 \quad \Leftrightarrow \quad \gamma < \left(1 + \phi_D\sigma_\theta^2\left[\frac{n+2}{n} + \frac{2b_B + b_A}{3\phi_D}\right]\right)^{-1} \equiv \overline{\gamma}_B^{crit.}$$

**Appendix 4.4 (Proof of the existance of simultenous interior solutions)**

A simultaneous interior solution requires $\underline{\gamma}_A^{crit.}, \underline{\gamma}_B^{crit.} < \gamma < \overline{\gamma}_A^{crit.}, \overline{\gamma}_B^{crit.}$. To proof that a $\gamma$ exists for that $0 < k_A, k_B < 1$ it has to be shown that $\underline{\gamma}_A^{crit.} < \overline{\gamma}_A^{crit.}$, $\underline{\gamma}_B^{crit.} < \overline{\gamma}_B^{crit.}$, $\underline{\gamma}_B^{crit.} < \overline{\gamma}_A^{crit.}$, and $\underline{\gamma}_A^{crit.} < \overline{\gamma}_B^{crit.}$. The conditions $\underline{\gamma}_A^{crit.} < \overline{\gamma}_A^{crit.}$ and $\underline{\gamma}_B^{crit.} < \overline{\gamma}_B^{crit.}$ are always fulfilled since:

$$\underline{\gamma}_A^{crit.} < \overline{\gamma}_A^{crit.} \quad \Leftrightarrow \quad \left(1 + \phi_D\sigma_\theta^2\left[\frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1} < \left(1 + \phi_D\sigma_\theta^2\left[\frac{n+2}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1}$$

$$\Leftrightarrow \quad \frac{n+2}{n} + \frac{2b_A + b_B}{3\phi_D} < \frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D}$$

$$\Leftrightarrow \quad 0 < n$$

$$\underline{\gamma}_B^{crit.} < \overline{\gamma}_B^{crit.} \quad \Leftrightarrow \quad \left(1 + \phi_D \sigma_\theta^2 \left[\frac{2(n+1)}{n} + \frac{2b_B + b_A}{3\phi_D}\right]\right)^{-1} < \left(1 + \phi_D \sigma_\theta^2 \left[\frac{n+2}{n} + \frac{2b_B + b_A}{3\phi_D}\right]\right)^{-1}$$

$$\Leftrightarrow \quad \frac{n+2}{n} + \frac{2b_B + b_A}{3\phi_D} < \frac{2(n+1)}{n} + \frac{2b_B + b_A}{3\phi_D} \quad .$$

$$\Leftrightarrow \quad 0 < n$$

In addition, $\underline{\gamma}_B^{crit.} < \overline{\gamma}_A^{crit.}$ and $\underline{\gamma}_A^{crit.} < \overline{\gamma}_B^{crit.}$ requires:

$$\underline{\gamma}_B^{crit.} < \overline{\gamma}_A^{crit.} \quad \Leftrightarrow \quad \left(1 + \phi_D \sigma_\theta^2 \left[\frac{2(n+1)}{n} + \frac{2b_B + b_A}{3\phi_D}\right]\right)^{-1} < \left(1 + \phi_D \sigma_\theta^2 \left[\frac{n+2}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1}$$

$$\Leftrightarrow \quad \frac{2(n+1)}{n} + \frac{2b_B + b_A}{3\phi_D} > \frac{n+2}{n} + \frac{2b_A + b_B}{3\phi_D}$$

$$\Leftrightarrow \quad 3\phi_D > b_A - b_B$$

$$\underline{\gamma}_A^{crit.} < \overline{\gamma}_B^{crit.} \quad \Leftrightarrow \quad \left(1 + \phi_D \sigma_\theta^2 \left[\frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1} < \left(1 + \phi_D \sigma_\theta^2 \left[\frac{n+2}{n} + \frac{2b_B + b_A}{3\phi_D}\right]\right)^{-1}$$

$$\Leftrightarrow \quad \frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D} > \frac{n+2}{n} + \frac{2b_B + b_A}{3\phi_D}$$

$$\Leftrightarrow \quad 3\phi_D > b_B - b_A$$

Both conditions are simultaneously fulfilled for $3\phi_D > |b_B - b_A|$.

**Appendix 4.5 (Proof of Proposition 4.1)**

According to (4.11) and (4.12) $W_{host}^{EU} > W_{home}^{EU}$ if:

$$(1-\gamma)(x^A + x^B) - \gamma\left[x^A \cdot (b_A - \phi_D k_A) + x^B \cdot (b_B - \phi_D k_B)\right]\sigma_\theta^2 > 2(1-\gamma) - \gamma[b_A + b_B - \phi_D - \phi_F]\sigma_\theta^2$$

$$\Leftrightarrow \quad \left[x^A \cdot (b_A - \phi_D k_A) + x^B \cdot (b_B - \phi_D k_B)\right] < \left[b_A + b_B - \phi_D - \phi_F\right].$$

After taking into account equilibrium loan supply [Equation (4.4)], this inequality becomes:

$$\left[\left(1 + \frac{n(k_B - k_A)}{2(n+1)}\right) \cdot (b_A - \phi_D k_A) + \left(1 - \frac{n(k_B - k_A)}{2(n+1)}\right) \cdot (b_B - \phi_D k_B)\right] < \left[b_A + b_B - \phi_D - \phi_F\right]$$

$$\Leftrightarrow \quad -\phi_D(k_A + k_B) - \frac{n(k_B - k_A)}{2(n+1)}(b_B - b_A) + \frac{n(k_B - k_A)^2}{2(n+1)}\phi_D < -\left[\phi_D + \phi_F\right] ,$$

and, after inserting equilibrium regulation under host country regulation [Equation (4.6)]:

$$\Leftrightarrow \qquad -\frac{4(n+1)\phi_D}{n} - (b_A + b_B) + \frac{2(1-\gamma)}{\gamma\sigma_\theta^2} - \frac{n(b_B - b_A)^2}{6\phi_D(n+1)} + \frac{n(b_B - b_A)^2}{18(n+1)\phi_D} < -[\phi_D + \phi_F]$$

$$\Leftrightarrow \qquad \gamma > \left(1 + \left[\frac{(b_A + b_B)}{2} + \frac{(3n+4)\phi_D - n\phi_F}{2n} + \frac{n(b_B - b_A)^2}{18(n+1)\phi_D}\right]\sigma_\theta^2\right)^{-1} \equiv \gamma_{host}^{crit.}$$

**Appendix 4.6 (Conditions for $\underline{\gamma}_A^{crit.}, \underline{\gamma}_B^{crit.} < \gamma_{host}^{crit.} < \overline{\gamma}_A^{crit.}, \overline{\gamma}_B^{crit.}$)**

Consider the case of $b_B > b_A$, implying $\underline{\gamma}_B^{crit.} < \underline{\gamma}_A^{crit.}$ and $\overline{\gamma}_B^{crit.} < \overline{\gamma}_A^{crit.}$.[31] In this case, a sufficient condition for $\underline{\gamma}_A^{crit.}, \underline{\gamma}_B^{crit.} < \gamma_{host}^{crit.} < \overline{\gamma}_A^{crit.}, \overline{\gamma}_B^{crit.}$ is $\underline{\gamma}_A^{crit.} < \gamma_{host}^{crit.} < \overline{\gamma}_B^{crit.}$. It holds that $\gamma_{host}^{crit.} > \underline{\gamma}_A^{crit.}$ if

$$\left(1 + \left[\frac{(b_A + b_B)}{2} + \frac{(3n+4)\phi_D - n\phi_F}{2n} + \frac{n(b_B - b_A)^2}{18(n+1)\phi_D}\right]\sigma_\theta^2\right)^{-1} > \left(1 + \phi_D\sigma_\theta^2\left[\frac{2(n+1)}{n} + \frac{2b_A + b_B}{3\phi_D}\right]\right)^{-1}$$

$$\Leftrightarrow \qquad (b_B - b_A)^2 < \frac{9(n+1)}{n}\phi_D\left[\phi_D + \phi_F - \frac{(b_B - b_A)}{3}\right] \equiv \kappa$$

Similarly, it holds that $\gamma_{host}^{crit.} < \overline{\gamma}_B^{crit.}$, if

$$\left(1 + \left[\frac{(b_A + b_B)}{2} + \frac{(3n+4)\phi_D - n\phi_F}{2n} + \frac{n(b_B - b_A)^2}{18(n+1)\phi_D}\right]\sigma_\theta^2\right)^{-1} < \left(1 + \phi_D\sigma_\theta^2\left[\frac{n+2}{n} + \frac{2b_B + b_A}{3\phi_D}\right]\right)^{-1}$$

$$\Leftrightarrow \qquad (b_B - b_A)^2 > \frac{9(n+1)}{n}\phi_D\left[\phi_F - \phi_D + \frac{(b_B - b_A)}{3}\right] \equiv \lambda$$

Both conditions can only be fulfilled simultaneously if $\lambda < \kappa$. This is always the case since $|b_B - b_A| < 3\phi_D$.

---

[31] Due to symmetry these conditions can be derived analogously for $b_A > b_B$ which will not be done here.

# Acknowledgements

# Deutsche Kurzzusammenfassung

Die neue politische Ökonomie gibt die traditionelle Annahme auf, dass sich politische Entscheidungsträger stets als wohlwollende soziale Planer verhalten. Vielmehr wird unterstellt, dass Politiker – zumindest teilweise – von Eigeninteressen geleitet werden und damit Ziele verfolgen, welche denen der Gesellschaft zuwider laufen können. Im Rahmen dieser Arbeit werden die Konzepte der politischen Ökonomie auf die Bereiche Zentralbankunabhängigkeit einerseits und Bankenregulierung andererseits angewandt. Die Arbeit besteht aus drei Papieren, welche im Folgenden kurz zusammengefasst werden.

## Political Determinants of Central Bank Independence

Aus normativer Perspektive herrscht weitestgehend Einigkeit darüber, dass eine unabhängige Zentralbank positive Wohlfahrtseffekte mit sich bringt. Dennoch variiert der Grad der Zentralbankunabhängigkeit stark zwischen verschiedenen Ländern. In diesem Papier wird gezeigt, welche Faktoren Regierungen dazu veranlassen können, unterschiedliche Grade von Zentralbankunabhängigkeit zu wählen. Dabei existieren zwei zentrale, gegenläufige Effekte. Einerseits erhöht eine unabhängige Zentralbank die Kosten für eine Politikänderung durch Nachfolgeregierungen, andererseits reduziert ein hoher Grad von Zentralbankunabhängigkeit die Möglichkeiten politischer Einflussnahme auf die gegenwärtige Geldpolitik.

**How Should Large and Small Countries Be Represented in a Currency Union?[1]**

Die Europäische Zentralbank (EZB) wurde von den Mitgliedsstaaten der Währungsunion ausdrücklich damit beauftragt, eine Europäische Perspektive bei der Durchführung der Geldpolitik einzunehmen. Die geldpolitischen Entscheidungen werden allerdings mehrheitlich von den nationalen Notenbankpräsidenten getroffen, da diese die Mehrheit im geldpolitischen Entscheidungsgremium der EZB, dem EZB-Rat, stellen. Werden diese von den Mitgliedsstaaten entsandten Vertreter – zumindest teilweise – von nationalen Interessen geleitet, so könnte die Europäische Perspektive der Geldpolitik gefährdet sein. In diesem Papier werden die optimalen Stimmgewichte einzelner Mitgliedsstaaten im EZB-Rat bestimmt, welche die Verzerrungen der Geldpolitik minimieren.

**On the Regulation of Multinational Banks in Europe – Who Should Be in Charge?**

Während die Europäische Integration im Bankensektor voranschreitet, verbleibt die Verantwortung für die Bankenregulierung weitestgehend bei den Mitgliedsstaaten der Europäischen Union (EU). Dieses Papier vergleicht die Wohlfahrtseffekte zweier unterschiedlicher Regulierungsregime für die EU: Heimatland- und Gastlandprinzip. Welches der beiden Regime aus Europäischer Sicht vorzuziehen ist, hängt von einer Vielzahl von Faktoren ab, wie etwa dem Grad der wirtschaftlichen Integration oder der Wettbewerbsintensität im Europäischen Bankensektor.

---

[1] Dieser Teil der Arbeit entstand in Zusammenarbeit mit Helge Berger.