



WP/06/281

# IMF Working Paper

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## Central Bank Boards Around the World: Why Does Membership Size Differ?

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and Tonny Lybek*



## **IMF Working Paper**

Monetary and Capital Markets Department

### **Central Bank Boards Around the World: Why Does Membership Size Differ?<sup>1</sup>**

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Authorized for distribution by Arne B. Petersen

December 2006

#### **Abstract**

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This paper analyzes empirically differences in the size of central bank boards across countries. Defining a board as the body that changes monetary instruments to achieve a specified target, we discuss the possible determinants of a board's size. The empirical relevance of these factors is examined using a new dataset that covers the de jure membership size of 84 central bank boards at the end of 2003. We find that larger and more heterogeneous countries, countries with stronger democratic institutions, countries with floating exchange rate regimes, and independent central banks with more staff tend to have larger boards.

JEL Classification Numbers: E52; E58; E61

Keywords: committee; council; governance; decision making; monetary policy

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<sup>1</sup> We thank the Deutsche Bundesbank, Martin Čihák, Robert Flood, Petra Gerlach, Jakob de Haan, Daniel Hardy, Chris Hunt, Alain Ize, Rodolfo Maino, Patricia Pollard, Steven Seelig, Pierre Siklos, Peter Stella, Jerome Vandenbussche, and seminar participants at the Bank of Canada, the IMF, and the Western Economic Association International meetings for helpful comments on previous drafts. Anne-Kristin Koch and Dominic Quint provided able research assistance. Berger and Nitsch thank the Fritz Thyssen Foundation for financial support.

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## I. INTRODUCTION

Monetary policy may be a “science,” but it is hardly an exact one. Given that policy decisions are surrounded by uncertainty, the way central banks exploit information and agree on decisions clearly matters for the quality and success of monetary policy. As a result, recent research has emphasized the importance of central bank organization—and in particular the size and structure of central bank boards or monetary policy committees (MPCs)—for monetary policy.<sup>3,4</sup>

The question of how many people should decide on monetary policy has recently also stirred interest on practical grounds. In Europe, the possible increase in euro area membership has triggered an intense debate on the optimal design of the decision-making process in the European Central Bank’s (ECB’s) 18-member Governing Council, in which there is at least one representative from each member country (e.g., Baldwin and others 2001; Berger, de Haan, and Inkler, 2004). As a result of this discussion, the ECB has generally limited the (future) number of voting members to 21. This, however, appears to be still a large number compared, for instance, with the Bank of England’s Monetary Policy Committee (9) or the Federal Reserve’s Federal Open Market Committee (12). Of the 82 central banks surveyed by Fry and others (2000), 55 institutions (67 percent) had policy committees with 5–10 members.<sup>5</sup>

In this paper, we aim to characterize differences in the membership size of *decision-making* bodies of central banks around the world. Since central banks often operate various boards, committees, and councils, we focus on the central bank’s implementation board (or MPC) that makes decisions on whether and when to change policy instruments to achieve a given monetary policy target. Appendix I and Lybek and Morris (2004) provide a more detailed discussion of the various functions of central bank boards.

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<sup>3</sup> To avoid confusion, we will hereinafter generally use the terms *MPC* or *central bank board*, instead of the various specific national terms describing the board, committee, council, or body in charge of deciding whether to change the monetary policy stance to achieve a specified target.

<sup>4</sup> Other features of central bank design that may have the potential to affect the quality of monetary policy decision-making include the meeting procedures (consensus decisions, voting arrangements, etc. ), whether the members are full-time employees with the central bank or part-time external members, and if there are government representative(s), if any, with voting rights or the ability to temporarily postpone decisions. These factors, although important are outside the scope of this paper.

<sup>5</sup> In some countries, like New Zealand, monetary policy decisions are solely made by the governor, sometimes based on the advice of a committee. We do not include advisory committees in our analysis since they have no formal authority. For instance, Svensson (2001) notes, in a review of Monetary Policy in New Zealand, that the governor being the single decision-maker worked well, but also that it is “too risky” and recommends a formal monetary policy committee.

In principle, the optimal size of an MPC depends on the costs and benefits.<sup>6</sup> The benefits from having more people on a board are mainly related to improvements in information processing and to ensuring that there are checks and balances owing to the different groups they represent. A larger number of board members should involve a broader range of experiences and perspectives and, hence, (ideally) be better in dealing with uncertainty and processing relevant information an argument that is loosely based on Condorcet's jury theorem.<sup>7</sup> At the same time, decision making typically becomes more difficult as board size increases. As membership size increases, different views are harder to reconcile, and discussions at board meetings are likely to become more time consuming. As a result, decisions might be delayed or require more effort, thereby weakening the effectiveness of monetary policy. Also, individual representation at the board becomes less important as MPC size increases so that the gains from diversity of skills and perspectives of members tend to become smaller for larger central bank boards. In fact, members may even have an incentive to "freeride" on the information-processing efforts of others as the number of decision makers increases.

The exact structure of the trade-off between costs and benefits determining optimal MPC size will depend on country-specific characteristics. For instance, the argument to increase board size to achieve better information processing appears to be of particular relevance when an economy is large or characterized by considerable diversity across regions and industries. Similarly, a country's political institutions may matter. For instance, in an autocratic regime, a larger MPC may provide useful insulation from political pressures.<sup>8,9</sup> In contrast, less

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<sup>6</sup> See Berger (2006) and Sibert (2006) for a detailed discussion of the costs and benefits of MPC size and reviews of the relevant literature. Many of the same issues are driving the discussions about the size of boards of corporations. Hermalin and Weisbach (2001), for instance, offers a survey of the economic literature on the size of boards of corporations. They find (pages 31–32) that: "Board composition [share of outside versus inside directors] is not related to corporate performance, while board size is negatively related to corporate performance. Both board composition and size do appear to be related to the quality of the board's decisions regarding CEO replacement, acquisitions, poison pills, and executive compensation." However, in the case of commercial corporations, the primary objective is often clearer than for central banks; in principle, it is to maximize shareholder wealth. Furthermore, central bank boards typically have a smaller role, or none at all, in the appointment of the governor and in compensation decisions than commercial boards have.

<sup>7</sup> For a brief discussion of Condorcet's jury theorem, see, for instance, Piketty (1999).

<sup>8</sup> One argument could be that large board size combined with anonymous majority voting would allow individual board members to claim to have been outvoted or otherwise dominated in the decision-making process.

<sup>9</sup> Related to size, it may in practice also make a difference if some of the MPC members are full-time employees of the central bank (i.e., "internal members") whose future careers may depend on the chairman of the MPC, typically the governor, or the members are "external" members. In the case of the former, the meeting dynamics may also be influenced by Keynes's "beauty contest factor," where these members may also be tempted to refine their own interventions in line with those they expect the chairman will favor. The special role of the chairman (see, for instance, Chappell, McGregor, and Vermilyea 2004) and the issue of internal and

(continued...)

democratic regimes may prefer a smaller board for the same reason. Finally, MPC size should also be affected by the institutional functions performed by a central bank, the type of central bank autonomy, and other elements of central bank design. If the central bank enjoys full autonomy over both policy targets and instruments, the MPC may be larger than when the central bank's autonomy is more limited. In view of the considerable cross-country variation along economic, political, and institutional dimensions, Goodfriend (2005, p. 85) argues that "the efficient size of a policy committee might vary across countries."<sup>10</sup>

In the following sections, we analyze empirically whether country-specific features help to explain differences in MPC size. Basing our research on a simple theoretical model, we illustrate the linkage between country-specific features and the size of central bank boards in more detail. We then explore the empirical association between a wide variety of country characteristics and MPC size using a new cross-country dataset that covers 84 central banks around the world at the end of 2003. Our dataset utilizes information on MPC size and other (de jure) central bank characteristics from Lybek and Morris (2004) and combines it with other macroeconomic, structural, institutional, and central bank data.

We find that board size is strongly and plausibly associated with a number of country-specific characteristics. Our results indicate, for instance, that MPC size is positively correlated with measures of country size and (population) heterogeneity, thereby providing strong empirical support for the theoretical and experimental finding that MPC size is affected by a central bank's information-processing requirements. We also find that MPC size is related to a country's political institutions, with more democratic countries having, on average, larger boards. Finally, MPC size is often associated with other central bank characteristics. Central banks that have greater formal autonomy over objectives and targets, a more complex monetary strategy, a longer history, and more staff typically have more board members who serve, on average, shorter terms.

The remainder of the paper is organized as follows. In Section II, we provide a detailed discussion of possible determinants of MPC size. Section III presents the data and the empirical results, and Section IV provides a brief conclusion.

## **II. POSSIBLE DETERMINANTS OF CENTRAL BANK BOARD SIZE**

The size of the central bank board, or the MPC, is an important feature of central bank design. It is likely to reflect costs and benefits of an increasing number of board members

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external members (see, for example, Tuladhar 2005, who provides such information on MPCs in inflation-targeting countries) are indeed important, but lie outside the scope of this paper.

<sup>10</sup> Sibert (2006, p. 1) makes a claim akin to Goodfriend's when she writes that, "[a]s a result of shirking and coordination problems, smaller committees may be better than larger ones and the optimal size for a committee is an empirical issue."

(Berger 2006; Sibert 2006) as well as the political environment in which the decision on MPC size is made. In fact, one way to picture the decision process is purely political.<sup>11</sup> For instance, the number of central bank board members could be the result of a bargaining process involving different interest groups (e.g., the financial sector, trade unions, or export industries) aiming at direct or indirect representation in the MPC, possibly with some inertia caused by path dependence.<sup>12</sup> Alternatively, the decision on MPC size could take the form of a conscious design decision of a decision-maker based on social or private preferences and subject to more or less binding political constraints. Provided the central bank independence paradigm is acknowledged, the design-scenario may be more relevant for boards that primarily make decisions on whether to change monetary policy instruments to achieve a specified target (instrument autonomy) than for policy boards that are also involved in determining the target of the central bank (target autonomy) or even deciding on its primary objective (goal autonomy), which is much more normative.<sup>13</sup> Following the more recent literature, we will organize our discussion of the determinants of central bank board size around the trade-off of some of the more obvious costs and benefits.<sup>14</sup>

### A. The Basic Trade-Off

On the *benefit side*, the most prominent argument in favor of increasing the number of MPC members is that larger MPCs could be in a better position to process, analyze, and interpret economic information—ultimately leading to better monetary policy decisions—than individuals relying mostly on their own information and judgment. Working in a notoriously uncertain macroeconomic environment, multiple MPC members are able to pool information and exploit divisions of labor in information processing.<sup>15</sup> Among others, the argument has been put forward in theoretical terms by Gerlach-Kristen (2006) and Berk and Bierut (2004); supportive experimental evidence is produced by Blinder and Morgan (2005) and

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<sup>11</sup> A case in point are the recent amendments to the central bank law of Hungary in 2004, where the balance in the monetary policy committee was changed by increasing the number of members.

<sup>12</sup> Of course, there may also be a Niskanen type of argument pointing in the same direction: if central bankers acted like the proverbial bureaucrat, they may misuse independence to maximize budget and, arguably, size—that is, an inclination to follow Parkinson’s (1957) Law. However, that may be more pronounced in cases where the MPC only comprises internal members.

<sup>13</sup> Appendix I explains the different types of autonomy and the implications it has on the decisions the governing bodies will have to make.

<sup>14</sup> See, among others, Goodfriend (2005), Berger (2006), and Sibert (2006). The forces shaping any political process relevant for the decision on MPC size may be somewhat similar in nature to the forces considered in a cost-benefit approach.

<sup>15</sup> MPC members may contribute by their differences in various ways, namely by the: (i) underlying model, meaning the underlying paradigms in which they believe; (ii) their experiences, meaning how they “estimate” the parameters in their model; (iii) the information set they use as input in their model; and not least (iv) different objective functions, which explicitly or implicitly may differ from the primary objective of the MPC.



Lombardelli et al. (2005).<sup>16</sup> Gerling et al. (2003) and Fujiki (2005) provide comprehensive surveys of the literature; Sibert (2006) and Vandenbussche (forthcoming) provide recent surveys over a related—and highly useful—social psychology literature that looks at the effects of group size on information processing and moderation.<sup>17</sup>

On the *cost side*, a plausible conjuncture is that larger MPCs will generally imply greater effort from all involved for a given decision problem. This may translate into less effective monetary policy making. The most important aspect is communication among members and the dynamics it creates. Even if the exchange of ideas at the preparatory stage of a decision were limited to a solitary statement by MPC members addressing their colleagues, larger MPCs would require more time than smaller MPCs in reaching a decision. Moreover, actual decision-making costs are likely to have a non-linear component. If MPC members regularly “sound each other out” during meetings (see, e.g., Barber 2001), the time requirement for preparing a decision will rise exponentially in the number of members (Berger 2006).<sup>18</sup> Moreover, any advantages or benefits larger MPCs might have in comparison to smaller MPCs regarding the processing of information are likely to diminish at some larger level of membership.<sup>19</sup>

The view that increasing MPC membership size may reduce the effectiveness of policy-making is also bolstered by real-world experience. The German Bundesbank, for instance, asserts that its 1992 MPC reform triggered by German unification helped to prevent an increase in MPC size which “would have greatly complicated that body’s decision-making processes” (Deutsche Bundesbank 1992, p. 50).<sup>20</sup> More recently, the ECB (2003, p. 83) has

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<sup>16</sup> Already Blinder (1998) noted that in a committee decisions tend to regress toward the mean, making it very difficult for idiosyncratic (or extreme) views to prevail. More recent contributions pointing in the same direction include Riboni and Ruge-Murcia (2006). Méon (2006), for instance, shows that (page 1) : “The volatility of the policy is smaller the smaller the volatility of members’ preferences, smaller the larger the size of the committee, and smaller than if it was chosen by a single member.” Sibert (2006), however, argues that decision-making by committee may not necessarily result in moderation.

<sup>17</sup> See, for instance, Schein (1999), for a related contribution from the business literature looking at group-based decision making.

<sup>18</sup> If there are  $n$  MPC members, the number of bilateral discussions is  $\frac{1}{2}(n^2 - n)$ . The need for preparatory communication will be especially pronounced in central bank environments given to consensus-based decision making. This includes roughly half of the more than 80 central banks surveyed by Fry and others (2000).

<sup>19</sup> Blinder and Morgan (2005) argue that small but not-too-large-groups of individuals may reach “better” decisions at speeds broadly comparable to an individual. As groups increase, however, individual members may have a stronger incentive to “freeride” on the information processing efforts of others, especially if information processing is a costly activity, which will lead to growing inefficiencies (e.g., Sibert 2006).

<sup>20</sup> Unification resulted in the addition of six new regional states. The reform effectively reduced the number of regional central bank governors in the MPC compared to the pre-unification status quo by severing the link between regional states and MPC-representation and merging regional central bank districts.

expressed the fear that the anticipated increase in the number of national central bank governors attending euro area MPC meetings after EMU enlargement “will not necessarily make deliberations easier....”

The trade-off between costs and benefits determining optimal MPC size will depend on a number of *country characteristics*. As Goodfriend (2005) has recently argued, larger and more heterogeneous currency areas may benefit from larger MPCs. This could be because of increased monitoring necessities or because a higher level of economic development gives rise to more complex monetary strategies, which may require larger decision-making bodies. Moreover, “[i]f an economy is complex, even if not particularly large geographically, then it might be useful to have the views of the key sectors represented on the policy committee” (ibid., p.85). At the same time, the costs of larger MPCs are also likely to vary with the size of the economy; the size of MPCs is less relevant for the costs of decision-making in cases where the central bank runs monetary policy for a small, open, and highly integrated economy so that there is a priori little room for independent policy making in the first place. Similarly, decision-making costs may vary with the underlying cultural consensus or democratic structure, which, in turn, could be a function of country size or heterogeneity.<sup>21</sup>

We will discuss these and other relevant economic as well as institutional and political country characteristics in somewhat greater detail below. In sum, the MPC size will reflect the trade-off between the costs and benefits along a number of dimensions—and it is likely to vary across countries. Whether the actual size is the outcome of an altruistic social planner, a political process, or an autocratic ruler, it can be useful to illustrate the aggregated pros and cons in a simple model (Box).

## **B. Determinants of Monetary Policy Committee Size**

The discussion so far suggests that, if the design of central bank boards is based on a trade-off between country-specific marginal costs and benefits and shaped by specific institutional and political factors, MPC size should be influenced by various country characteristics. In what follows, we present a number of relevant and empirically testable arguments along this line.

### **Country size and heterogeneity**

Making the argument for the empirical analysis operational, it seems safe to assume that information processing requirements are a (positive) function of diversity and country size. For economies with complex structures, a large number of board members might be

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<sup>21</sup> For instance, costs could be influenced by the nature of the decision-making process, such as the prevalence of consensus-based traditions, majority voting, or leadership style of the MPC’s president. “Group think,” the risk that one or a few charismatic persons dominate and prevent valid critical questions be addressed, may be less problematic in larger boards. A more detailed discussion can be found in Berger (2006).

### Box 1: A Simple Illustration

Assuming the number of MPC members reflects both the benefits and costs discussed above, a reduced form of the complicated political process could be illustrated by a simple and almost trivial model.<sup>1/</sup> Assume that country  $i$  maximizes welfare,  $W_i$ ,

$$W_i = B(x_i, n_i) - C(x_i, n_i), \quad (1)$$

where  $C$  measures the costs associated with MPC size,  $n_i$ , and  $B$  are the benefits. As discussed above, a plausible conjecture is that, in addition to  $n_i$ , benefits and costs depend on a vector of country-specific characteristics,  $x_i$ . Note that  $x_i$  may influence costs and benefits in a different way depending on their functional forms. While we assume these functional forms to be similar across countries, the reduced form shown above reflect country specific factors.

Reflecting the idea that, as a rule, decision making costs will be increasing in the number of decision makers in the MPC,  $C$  shall be a strictly convex function in  $n_i$ , that is,  $C_{ni} > 0$  and  $C_{ni,ni} > 0$ . As a consequence, marginal cost will be increasing in MPC size. Moreover, assume that  $B$  is increasing in  $n_i$ , perhaps because of advantages in information-processing in larger groups, but at a non-increasing rate (i.e.,  $B_{ni} > 0$  and  $B_{ni,ni} \leq 0$ ). The slope of both marginal benefits and marginal costs depends on the country characteristics  $x_i$ . Within this setup, the optimal size of the  $MPC_i$ ,  $n_i^*$ , fulfills the marginal condition

$$B_{ni}(x_i, n_i) = C_{ni}(x_i, n_i), \quad (2)$$

where our assumptions guarantee that an interior solution exists. As a consequence,  $n_i^*$  will depend on the set of country characteristics captured in  $x_i$  as well as the specific form of the underlying cost and benefit functions. Because any one element in  $x_i$  may influence MPC size through the benefit or cost side, the estimated impact could take any direction and may not necessarily be linear.<sup>2/</sup>

1/ The model ignores the complicated dynamics. One of the findings in Hermalin and Weisbach's (2001) survey of corporate boards was that (page 33): "Boards of directors are an institution that has risen *endogenously* in response to the agency problems inherent in governing any organization." Lybek and Morris (2004) suggests that the trend toward central bank independence in the 1980s, central bank transparency and accountability in the 1990s, and good central bank governance in this decade has, together with new monetary regimes like inflation targeting, changed the role of the governing bodies of central banks.

2/ For instance, assume that marginal benefits are independent of  $n_i$ , marginal costs are linear in  $n_i$ , and that  $x_i$  is a simple scalar,  $x_i$ . In this case, equation (2) would be  $b(x_i) = c n_i$ , with  $c$  being a positive constant and  $b_i$  a positive function of  $x_i$ . This implies that the optimal MPC size will be  $n_i^* = b(x_i) / c$ , which can take any form depending on the functional form of  $b(x_i)$ . For instance, if  $b(x_i)$  is concave, we should observe a concave relationship between  $x_i$  and MPC size. Ultimately, however, this is an empirical question.

particularly useful, allowing a review in detail of the (often diverse) information from various sectors and regions. Moreover, it is often larger currency areas that host a more

heterogeneous populace with diverging preferences and/or varying institutional and cultural backgrounds, possibly weighing on monetary policy.<sup>22</sup> For instance, if larger countries tend to produce more federal political structures, these structures may easily translate into the presence of regional representatives in the MPC.<sup>23</sup> Moreover, larger countries may be more independent in their monetary policy, which may make having larger MPCs more worthwhile. As a result, we would expect that measures of *country size* such as land area or population are positively correlated with MPC size. Similarly, measures of a country's cultural or political *fragmentation* may have a positive influence on the size of the MPC.

### **Development and openness**

Another group of empirically identifiable factors potentially affecting MPC size are the economy's state of development and its degree of external openness. One conjecture regarding the link between the *level of economic development* and central bank organization would be that a more elaborate monetary policy framework, including perhaps a larger MPC, could be a positive function of the average income level in a country. More specifically, larger and more developed economies may be less inclined to opt for simple monetary rules (such as a fixed exchange rate) and introduce more complex frameworks such as forward-looking inflation targeting, which may require larger MPCs to manage.<sup>24</sup> Also, countries at higher income levels and with more developed financial markets will, as a rule, have a larger supply of well-educated staff and potential MPC members. This should loosen any possible constraint imposed on MPC size at lower income levels. Furthermore, more developed and dynamic financial markets will also often result in the monetary transmission mechanism changing more frequently; hence the need for more balanced information when adjusting the monetary policy instruments.

On *openness*, Romer (1993) has argued that economies more open to international trade are more sensitive to currency fluctuations; possibly linked to idiosyncratic monetary or fiscal policy surprises, the sensitivity should lead to a more disciplined economic policy overall.

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<sup>22</sup> Of course, there are also political-economic factors that could translate heterogeneity into larger MPC size. For instance, in the absence of proper democratic institutions, a more politically diverse population might require a larger MPC to represent all relevant interest groups, possibly including external members. We return to this issue below.

<sup>23</sup> On regional representation in MPCs, see, among others, Berger and de Haan (2002), Meade and Sheets (2005), and Berger (2006).

<sup>24</sup> Another link pointing in that direction could be that more financial development means that more people depend on financial assets and hence are more vulnerable to inflation (Posen, 1995). As they demand more central bank autonomy and accountability, this could imply the establishment of larger central bank boards. In less developed countries, which typically have a younger population, the preference toward price stability may be smaller.

However, if openness was indeed making the MPC's life easier by imposing, for instance, greater discipline on fiscal policy, one could speculate that smaller MPCs are needed in more open economies. The same should hold, *ceteris paribus*, for economies characterized by a high correlation of the national business cycle with the world cycle.<sup>25</sup>

### Political institutions

A larger MPC may also have advantages for political economy reasons. Monetary policy rarely operates in a political vacuum—quite to the contrary—and the design of a central bank is likely to reflect this. For instance, as noted before, diversity in terms of language or culture may increase the attractiveness of a larger MPC, thereby allowing fuller representation of varying interests and increasing the likelihood of gaining political legitimacy. Along similar lines, more developed *democratic institutions* allow for greater diversity in opinion and preferences and, therefore, may be a factor in favor of a more sizable MPC.<sup>26</sup>

Another potentially relevant argument from political economy is related to the incentive of governments to dominate monetary policy for *fiscal* reasons. At the extreme, this can lead to fiscal determinacy of the price level, where monetary policy is forced to fully accommodate excessive fiscal behavior, including financing quasi-fiscal activities, and to allow runaway inflation to deflate the level of public debt (see, e.g., Woodford 2003). At a less drastic level, government officials may put pressure on the MPC to ease monetary policy and thereby lower the interest burden for the public finances. To insulate monetary policy from these pressures, optimal central bank design would aim for a high degree of central bank independence in the sense of Rogoff (1985). Blinder (2006) suggests that larger MPCs may be less easily swayed by government influence.<sup>27</sup> As a consequence, we might observe a positive correlation between MPC size and measures of fiscal pressure. Similarly, under the assumption that such pressures are present, MPC size may be complemented by stricter limits on central bank financing of fiscal deficits.<sup>28</sup>

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<sup>25</sup> Empirically, a high degree of openness at period  $t$  may or may not be highly correlated with measures of business cycle correlation in the past. D'Amato and Martina (2005) argue on theoretical grounds that a high degree of business cycle correlation across countries should provide incentives to decrease central bank independence. If this was correct, and larger MPCs and central bank independence were substitutes (see below), this would lead us to expect a positive correlation between a correlation measure and MPC size.

<sup>26</sup> Anecdotal evidence suggests that changing the governance structure—for instance, to better accommodate an inflation targeting regime—is often the more contentious part of amending a central bank law.

<sup>27</sup> Blinder (2006, p. 3) argues that, “[w]hen the central bank was just following orders communicated by the government, there was not much reason to have a committee on the other end of the phone. An individual governor sufficed—and also limited the phone bill.”

<sup>28</sup> Strictly speaking, the latter argument is an element of central bank design rather than the political environment (see following section). In practice, deficit financing is increasingly being alleviated by central

(continued...)

## Other central bank characteristics

Finally, if the membership size of the central bank board is part of a multidimensional process of central bank design that also involves other aspects of central bank organization, we may expect that other design choices are reflected in MPC size as well. Various aspects come to mind. For instance, with reference to the discussion above, there may be good reasons to suspect that central banks having the authority to prioritize their objectives and specify the target to pursue generally have larger MPCs. More generally, it may be the case that central banks that are more *independent* from government operate under larger MPCs.

Along similar lines, also the monetary policy strategy and the *exchange rate regime* in which a central bank operates may be relevant determinants of MPC size. In the case of a hard-pegged exchange rate, decisions on changing interest rates (in line with the anchor currency) require less deliberation and forward-looking analysis than, for example, interest rate policy in a monetary policy regime under freely floating exchange rates. As a consequence, we may expect more flexible exchange rate regimes to be associated with larger-sized MPCs.

In addition, one may argue that there is a negative association between MPC size and the envisaged average *term length* of MPC members since smaller groups require longer terms to ensure continuity.<sup>29</sup> Alternatively, larger groups can suffer a higher fluctuation frequency at the individual level without endangering the independence of the MPC from the government (which is likely to be involved in nominating new members).<sup>30</sup>

Another factor that might be relevant for MPC size is the number of central bank *staff*. A possible link between the two variables is that larger MPC size could be simply reflective of a larger number of functions performed by the central bank, which may require both more staff and a larger MPC if the MPC also performs other functions.<sup>31</sup> Similarly, if the constraints stemming from the availability of well-educated personnel (see above) also influence staff size, we should expect MPC size and the number of central bank staff to be positively correlated as well. The central bank's *operating expenditures* may be another

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bank legislation explicitly prohibiting direct or indirect central bank financing of the fiscal deficits and the financing of quasi-fiscal activities.

<sup>29</sup> Another possible link could be the so-called stabilization bias of monetary policy (e.g., Woodford 2003): if larger groups mean slower decision-making, larger MPCs could be a means to introduce optimal inertia into interest rate setting—albeit perhaps not an efficient one. See Mirzoev (2004) for an argument for lowering the meeting frequency of MPCs to achieve the same effect.

<sup>30</sup> Waller's (1989, 1992, 2002) and Waller and Walsh's (1996) contributions on the broader topic of central bank appointments and staggered contracts are relevant in this regard.

<sup>31</sup> Alternatively, there could be specialized “boards” to deal with other functions. The Reserve Bank of Australia is a case in point having a special Payment System Board.

proxy for the functions performed by the central bank. Finally, path dependencies (possibly captured by the *age* of the institution) may play a role, with younger institutions being plausibly characterized by (yet) smaller boards having more specific assignments.

### **C. Summing Up**

We have discussed a number of potential hypotheses for the observed differences in MPC size across countries—hypotheses that, in principle, are open to empirical testing. The optimal MPC size will, in principle, equate marginal benefits and marginal costs of membership size, but also reflect the institutional and political framework in which central banks operate, all of which vary across countries. Accordingly, observed MPC size may vary systematically with a number of country characteristics. In particular, we would expect that MPC size:

- increases with greater diversity and country size;
- is larger at higher levels of development, but decreases with greater openness;
- is larger in the presence of stronger democratic institutions;
- is larger in the presence of higher public debt levels;
- is larger in the presence of a floating exchange rate system; and
- interacts systematically with other elements of central bank design, including the degree of central bank independence, monetary policy strategy, staff size and operating expenditures, and the term length of MPC members.

The relationship between any of these country characteristics and the number of MPC members may well be non-linear—a possibility that the empirical approach should allow for.

## **III. EMPIRICAL ANALYSIS**

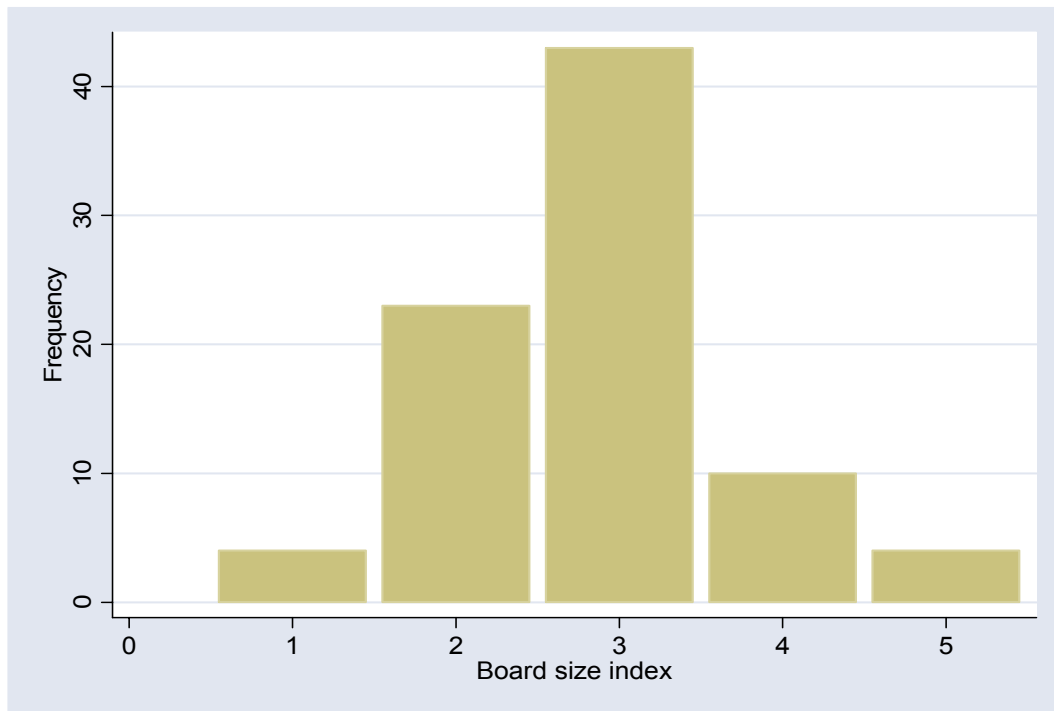
Our empirical strategy is to examine the association between MPC size and country characteristics in a very general fashion. Instead of emphasizing a particular variable or method, we use a (large) number of alternative measures and a variety of simple econometric specifications to identify possible structural correlations in the data. At the same time, this approach helps to take account of (sometimes) severe data limitations. We begin this section by describing our data, and then turn to testing the relationships between MPC size and various country characteristics, including several other features of central bank design.

### **A. Data Description**

At the heart of our data set is the MPC size data obtained from Lybek and Morris (2004). This publication surveys 101 central bank laws (covering 113 countries) at the end of 2003 and classifies the governance structure of central banks along various dimensions. Lybek and Morris distinguish between different types of central bank boards (policy boards, implementation boards, pure supervisory boards, and advisory bodies) depending on the *type*

of autonomy. We use information on the most relevant and powerful central bank board, the “implementation board,” i.e., the body that decides whether to change monetary policy instruments to achieve a specified target. Lybek and Morris have grouped MPCs into size classes of three members so that we effectively use a board size index that takes the value of one if the MPC consists of 1–3 members, the value of two if there are 4–6 members, and so on.<sup>32</sup> Figure 1 provides a histogram of our MPC size measure. The 84 countries included in our sample are listed in Appendix II.<sup>33</sup>

Figure 1. Histogram of Board Size



N = 84 / mean = 2.85 / std. dev. = 0.87

<sup>32</sup> Lybek and Morris (2004) provide no information on the precise number of MPC members. It should be noted, however, that also some central bank laws stipulate no fixed number but give a range for the number of required board members. Another qualification of the Lybek and Morris data is that they focus on boards and committees and therefore provide no information on central banks where the governor alone is responsible for decisions on how to implement the policy. Thus, de facto our smallest size category for board membership covers boards with 2–3 members.

<sup>33</sup> The main difference to the Lybek and Morris (2004) sample of 101 central bank laws is that we drop central banks that are involved in a multilateral currency union (since these central banks have either no responsibility for monetary policy or make decisions on monetary policy for a larger currency area).



It is important to note that in many cases implementation boards also perform other functions. For instance, an implementation board may also oversee the central bank, or it may make decisions regarding payment systems or banking supervision. This potentially introduces a bias against other explanatory variables in the sample. For instance, if more functions imply larger MPCs, and the allocation of additional functions is not random across the country sample, estimated coefficients may suffer from an unobserved variables bias. Ultimately, however, because we cannot directly control for it, this is an empirical issue.

Our data on country characteristics and central bank features come from a number of different sources. Most of the data on country characteristics are taken from Rose (2006), who has compiled a large and comprehensive data set of country attributes, including physical, cultural, economic, political, geographic, and social phenomena. To this data set, we add information on central bank features such as the term length of board members or the type of legal independence, the establishment year, staff size, and operational expenses of the central bank. This information is mainly obtained from Lybek and Morris (2004); other sources are the *Morgan Stanley Central Bank Directory*, Fry et al. (2000), and Ize (2006). Finally, we have compiled macroeconomic data (e.g., on a country's fiscal position) from the International Monetary Fund's *International Financial Statistics*.

We also use three different exchange rate regime classifications: the well-known de facto classifications from Levy-Yeyati and Sturzenegger (2005) and Reinhart and Rogoff (2004), and the de jure classification from the IMF (2003). Detailed sources for variables are tabulated in Appendix III. Appendix IV provides descriptive statistics.<sup>34</sup>

## B. Methodology

We now turn to the correlates of central bank board size. We estimate both simple bivariate models and models augmented with a few key controls. In particular, we estimate regressions of the form:

$$MPC = \alpha + \beta x + \gamma Y + \varepsilon$$

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<sup>34</sup> Most explanatory variables are either time-invariant or contemporaneous to MPC size. The underlying hypothesis is that the size of MPCs (as any element of central bank design) is subject to constant re-evaluation, be it through the relevant authorities or the underlying political process. If this was indeed the case, we would expect our explanatory variables to show a significant impact on MPC size. The alternative hypothesis is that MPC size is determined in a "one shot" game or design decision and not subject to change. In this case finding a significant relationship of this kind would be less likely, at least if the determinants of MPC size change over time. In practice, however, with many of the explanatory variables showing considerable inertia themselves (and the recent wave of central bank reforms having changed MPC sizes in a number of countries including, for instance, the Eurozone, the U.K., and Sweden), the distinction between both views is somewhat less sharp than what one might think. Ultimately, however, this is an empirical question.

where MPC is our ordered MPC or board size index,  $x$  is the variable of interest,  $Y$  is a set of control variables and  $\varepsilon$  is a well-behaved residual. Due to the discrete categorical nature of our dependent variable, we estimate our equation using ordered probit techniques.

### C. Bivariate Results

Tables 1–5 present the benchmark estimation results. For each variable, we report three sets of estimates. The first column records the slope coefficients obtained from simple bivariate estimation; accompanying scatter plots (for most variables) are shown in Appendix V. In column 2, we report the results of an augmented regression, adding population and per capita income as controls.<sup>35</sup> Finally, the last column presents the bivariate results with the MPC size measure transformed into a binary index that takes the value of one if the MPC comprises more than six members and zero otherwise; these results are based on standard probit estimates. In practice, it turns out that all of our key findings are robust to this transformation of board size into small and large boards; this also suggests that our results are not sensitive to outliers.<sup>36</sup> In the following, we group variables along the lines of arguments outlined in the previous section.<sup>37</sup>

Table 1 examines the linkage between (various indicators of) country size and MPC size, suggesting that larger countries tend to have larger central bank boards. The measure that is most closely related to Condorcet's jury theorem is a country's total population. Interestingly, the estimated coefficient on this variable is strongly positive and statistically highly significant, indicating that more populous countries have indeed more MPC members. Other useful proxies for country size include land area (as a measure of a country's physical extension) and the gross domestic product (as a proxy for economic mass). The results for these alternative measures of country size are basically identical to the findings for population (which is not surprising given the generally strong positive correlation between these measures).

There is also some evidence that heterogeneity is associated with larger central bank boards (Table 2). As argued in Section II, greater diversity provides good reason for the creation of larger MPCs. However, this may be more convincing in the case of policy boards than in more technical boards that determine whether to change interest rates to achieve a specified target—our MPCs. To explore this issue empirically, we examine a broad range of variables

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<sup>35</sup> We have also experimented with other sets of controls (e.g. central bank staff). The main findings were basically unaffected.

<sup>36</sup> As another test for possible non-linearities, we re-estimated all equations with squared values of the variables of interest entered; see below.

<sup>37</sup> One of the advantages of this approach is that it allows examining the robustness of the results for varying sample size.

Table 1. Characterizing MPCs: Size

	<b>Obs.</b>	<b>Bivariate ordered probit</b>	<b>Augmented ordered probit</b>	<b>Probit with binary dep. variable</b>
<b>Population</b>	84	0.009** (0.002)	0.010** (0.002)	0.02* (0.01)
<b>Area</b>	84	0.22** (0.04)	0.19** (0.07)	0.29# (0.16)
<b>Real GDP (USD)</b>	81	0.15** (0.03)	-0.13 (0.12)	2.71# (1.58)
<b>Log Real GDP (USD)</b>	81	0.20** (0.06)	0.31** (0.09)	0.23** (0.08)
<b>Real GDP (PPP)</b>	79	0.19** (0.05)	-0.07 (0.13)	2.07* (0.97)
<b>Log Real GDP (PPP)</b>	79	0.25** (0.07)	0.28* (0.12)	0.26** (0.10)

Note: Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively.

on population heterogeneity, including various measures of ethnic, linguistic, and religious diversity, indicators of the spread in income distribution and geographic location, and a country's political fragmentation as measured by the number of its first-order administrative divisions. While most of the coefficients on these variables take a positive sign, only the point estimate on the ethnolinguistic fractionalization measure is statistically different from zero, a variable that is available only for a relatively small share of the sample. Also the number of a country's administrative units is slightly (positively) correlated with central bank board size.

In comparison, there is only weak evidence that measures of a country's level of economic development or degree of openness influence MPC size, as reported in Table 3. Reviewing the results, there is only one relationship of reasonable statistical strength: landlocked countries have smaller boards. Broadly in line with this finding, we find that trade openness is consistently negatively associated with MPC size, although the coefficient is not statistically different from zero in any of the specifications. In contrast, most variables typically associated with economic and financial development and material well-being neither show the expected sign nor are they statistically significant.

The empirical results for indicators of a country's political regime tabulated in Table 4 seem to suggest that well-established democratic institutions and countries with stronger governance performance are associated with larger central bank boards. In terms of statistical significance, results appear to be somewhat mixed. In the simple bivariate specification, none of the coefficients on measures of institutional quality is statistically different from zero. Still, for some variables, the estimated coefficients at least border conventional levels of significance, an impression that is also observable from the scatter plots. Moreover, when we

Table 2. Characterizing MPCs: Heterogeneity

	Obs.	Bivariate ordered probit	Augmented ordered probit	Probit with binary dep. variable
<b>Ethnolinguistic Fractionalization</b>	50	1.12* (0.55)	1.04# (0.61)	0.97 (0.67)
<b>Ethnic Fractionalization, CH</b>	64	0.009# (0.005)	0.007 (0.006)	0.007 (0.006)
<b>Ethnic Fractionalization, ADEKW</b>	38	0.19 (0.72)	-0.40 (0.89)	0.77 (0.93)
<b>Linguistic Diversity</b>	84	0.21 (0.39)	0.21 (0.40)	0.48 (0.49)
<b>Linguistic Fractionalization</b>	80	-0.04 (0.44)	-0.21 (0.50)	-0.08 (0.55)
<b>Religious Fractionalization</b>	83	0.75 (0.53)	0.65 (0.55)	0.90 (0.63)
<b>Gini Coefficient</b>	62	-0.003 (0.012)	-0.01 (0.01)	-0.02 (0.02)
<b>Geographic Dispersion</b>	59	0.07 (0.74)	0.04 (0.70)	-0.55 (0.91)
<b>Administrative Divisions</b>	83	0.006# (0.003)	0.002 (0.002)	0.02* (0.01)

Note: Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively.

control for size and income, the estimated coefficients increase in magnitude and become statistically highly significant.

Reviewing the above results in greater detail, the standard *Polity IV* scores (democracy, autocracy, polity), which comprise composite measures of institutionalized characteristics of the political regime, are consistently linked with MPC size across specifications. Countries with open and democratic political institutions tend to have large MPCs, while countries with autocratic structures have relatively small MPCs. Similarly, *Freedom House*'s survey results on the state of civil liberties (political rights, civil rights) indicate that “free” countries (as measured by low scores) have on average more members on their central bank boards than countries with a low freedom ranking—with stronger statistical ties than the first set of variables. Finally, we experiment with several indicators, compiled by the World Bank, on various dimensions of democracy, governance, and anti-corruption (voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law). The voice and accountability measure, an indicator of the extent to which citizens of a country are able to participate in the selection of their government, is significantly positively related to MPC size in the augmented model.<sup>38</sup> Moreover, in line with the above

<sup>38</sup> The indicator summarizes a number of aspects of the political process, civil liberties, and political rights.

Table 3. Characterizing MPCs: Level of Development and Openness

	<b>Obs.</b>	<b>Bivariate ordered probit</b>	<b>Augmented ordered probit</b>	<b>Probit with binary dep. variable</b>
<b>Real GDP per capita (USD)</b>	83	-0.006 (0.015)	-0.02 (0.01)	-0.0001 (0.015)
<b>Real GDP per capita (PPP)</b>	80	0.004 (0.017)	-0.006 (0.017)	0.009 (0.018)
<b>Human Development Index</b>	61	0.48 (0.79)	1.47 (1.05)	0.56 (1.01)
<b>Urbanization</b>	84	0.003 (0.005)	0.008 (0.006)	0.38 (0.65)
<b>M3</b>	80	-0.0007 (0.0034)	0.0009 (0.0035)	0.003 (0.004)
<b>Domestic Bank Credit</b>	80	0.0003 (0.0023)	-0.002 (0.003)	-0.00002 (0.00246)
<b>Trade Openness</b>	78	-0.005 (0.003)	-0.002 (0.003)	-0.003 (0.004)
<b>Landlocked</b>	83	-0.57* (0.26)	-0.51# (0.28)	-0.45 (0.33)
<b>Business Cycle Correlation</b>	83	0.27 (0.41)	0.44 (0.38)	0.26 (0.50)

Note: Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively.

findings, the results based on the World Bank data seem to support the idea that a better quality of governance is accompanied by larger MPCs.

In addition, we find that larger government debt (in percent of GDP) is often associated with larger MPCs. Perhaps because, as Section II speculated, a larger committee is less easily swayed by government pressure for looser policy. (A related finding, discussed below, is that MPC size is positively correlated with limits on central bank financing of the fiscal deficit; see Table 5.) Note, however, that the estimate is drawn from a relatively limited sample of countries and no such relation can be found for the fiscal deficit.

Table 5 examines the association between the size of MPCs and other central bank features. We begin with several (binary) measures of central bank independence, taken from Lybek and Morris (2004) and a recent Bank of England survey among central banks (see Fry and others (2000)). Most of the legal measures taken from Lybek and Morris (2004), such as different types of legal autonomy of a central bank, are uncorrelated with the number of board

Table 4. Characterizing MPCs: Political Regime

	<b>Obs.</b>	<b>Bivariate ordered probit</b>	<b>Augmented ordered probit</b>	<b>Probit with binary dep. variable</b>
<b>Democracy</b>	76	0.05 (0.03)	0.05 (0.03)	0.06 (0.04)
<b>Autocracy</b>	76	-0.07 (0.05)	-0.07 (0.05)	-0.06 (0.05)
<b>Polity</b>	76	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)
<b>Political Rights</b>	84	-0.07 (0.06)	-0.12* (0.06)	-0.09 (0.07)
<b>Civil Rights</b>	84	-0.07 (0.08)	-0.16* (0.08)	-0.08 (0.09)
<b>Economic Freedom</b>	63	-0.10 (0.18)	0.12 (0.21)	-0.09 (0.18)
<b>Economic Security</b>	46	0.47 (0.72)	2.37* (1.17)	0.30 (1.07)
<b>Voice &amp; Accountability</b>	84	0.18 (0.16)	0.44** (0.16)	0.23 (0.18)
<b>Political Stability</b>	82	0.06 (0.13)	0.36* (0.14)	0.18 (0.16)
<b>Government Effectiveness</b>	83	0.12 (0.15)	0.62** (0.19)	0.22 (0.17)
<b>Regulatory Quality</b>	84	0.14 (0.17)	0.40* (0.19)	0.27 (0.17)
<b>Rule of Law</b>	84	0.08 (0.14)	0.71** (0.24)	0.18 (0.16)
<b>Deficit</b>	61	-0.02 (0.03)	0.02 (0.03)	0.004 (0.050)
<b>Debt</b>	50	0.009* (0.004)	0.007# (0.004)	0.011 (0.007)

Note: Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively.

members.<sup>39</sup> However, a number of results based on Fry and others (2000) independence scores, which are based on a smaller country sample, indicate that more independent central banks have relatively larger boards, supporting the logic of Blinder (2006).<sup>40</sup> Moreover, there is a positive correlation between the extent to which there are limits on central bank financing of government deficits and MPC size (at least in the augmented model).

<sup>39</sup> Note that different types of autonomy (goal autonomy, target autonomy, instrument autonomy, and limited or no autonomy) refers to the type of decisions the central bank determines, but that the quality of independence depends on a range of other factors discussed in, for instance, Lybek (1999 and 1998).

<sup>40</sup> We also tried a number of alternative measures of central bank independence that are frequently used in the literature, without much success. For most of these measures, sample size gets extremely small when member countries of the euro area (which are not covered in our analysis) are removed.

Table 5. Characterizing MPCs: Central Bank Characteristics

	<b>Obs.</b>	<b>Bivariate ordered probit</b>	<b>Augmented ordered probit</b>	<b>Probit with binary dep. variable</b>
<b>Central Bank Independence</b>	84	-0.004 (0.140)	-0.10 (0.15)	0.05 (0.18)
<b>CB Independence Score</b>	59	-0.004 (0.009)	0.02* (0.01)	0.02# (0.01)
<b>Goal Independence</b>	84	-0.26 (0.32)	-0.46 (0.28)	-0.04 (0.37)
<b>Price Stability Focus</b>	59	-0.56 (0.81)	-0.39 (1.11)	-0.05 (1.07)
<b>Target Independence</b>	84	0.17 (0.23)	0.15 (0.24)	-0.005 (0.296)
<b>Target Independence Score</b>	59	-0.33 (0.41)	-0.46 (0.44)	-0.32 (0.66)
<b>Instrument Independence</b>	84	0.13 (0.25)	0.28 (0.26)	0.23 (0.30)
<b>Instrument Independence Score</b>	59	-0.04 (0.53)	1.24** (0.42)	1.45** (0.60)
<b>Limited or No Autonomy</b>	84	-0.60# (0.32)	-0.70* (0.34)	-0.77 (0.59)
<b>Limited Central Bank Financing of Government Deficit</b>	59	-0.37 (0.57)	1.41** (0.54)	0.75 (0.75)
<b>Authority over Exchange Rate Policy</b>	84	0.06 (0.24)	0.05 (0.27)	0.14 (0.30)
<b>Goal Independence or Exchange Rate Policy Authority</b>	84	-0.16 (0.25)	-0.31 (0.25)	0.07 (0.32)
<b>Fixed Exchange Rate, RR</b>	84	0.26 (0.25)	0.43 (0.28)	0.57 (0.46)
<b>Floating Exchange Rate, RR</b>	84	0.90* (0.37)	0.57 (0.50)	7.71** (0.16)
<b>Fixed Exchange Rate, LYS</b>	84	0.04 (0.23)	0.32 (0.23)	0.22 (0.29)
<b>Floating Exchange Rate, LYS</b>	84	0.67** (0.26)	0.51# (0.27)	0.56# (0.33)
<b>Fixed Exchange Rate, IMF</b>	84	-0.45# (0.24)	-0.31 (0.27)	-0.21 (0.31)
<b>Floating Exchange Rate, IMF</b>	84	0.40# (0.23)	0.22 (0.25)	0.15 (0.29)
<b>Term Length</b>	65	-0.04 (0.08)	-0.12 (0.08)	-0.09 (0.09)
<b>Term Length in CB Law</b>	84	0.22 (0.23)	0.05 (0.24)	0.18 (0.36)
<b>Staff</b>	84	0.10** (0.03)	0.03** (0.01)	0.05* (0.02)
<b>Log Staff</b>	84	0.50** (0.09)	0.47** (0.15)	0.54** (0.16)
<b>Staff % Population</b>	84	-7.31 (8.31)	-2.04 (7.77)	-10.42 (8.64)
<b>Operating Expenditures</b>	65	0.52** (0.19)	0.32 (0.38)	3.01# (1.82)

Table 5 (concluded). Characterizing MPCs: Central Bank Characteristics

<b>Log Operating Expenditures</b>	65	0.28** (0.09)	0.41* (0.18)	0.24# (0.13)
<b>Establishment Year</b>	84	-0.0005 (0.0020)	-0.0009 (0.0021)	-0.0005 (0.0030)
<b>Establishment Year (&gt;1900)</b>	77	-0.008 (0.006)	-0.006 (0.007)	-0.006 (0.006)

Note: Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively.

While the coefficients on the dummy variables for a fixed exchange rate regime are rarely statistically significant at conventional levels, the estimated coefficients on the floating exchange rate dummies often take on a significantly positive sign, implying that countries with flexible exchange rates tend to have larger boards. A country's exchange rate regime appears to be a useful proxy for the complexity of the central bank's monetary policy strategy. Based on the most commonly used de jure and de facto exchange rate regime classifications, we have compiled binary measures for both hard-fixed and fully free-floating exchange rates (leaving the various intermediate forms of exchange rate pegs and inconclusive regimes as a control group).

It seems that members in small-sized boards tend to serve somewhat longer terms. We explore two features related to the term length of board members: the (de jure) term length in years, and whether the term length is stipulated in the central bank law. Although neither coefficient is statistically different from zero, members in small-sized boards tend to serve somewhat longer terms.<sup>41</sup>

We find a significant correlation between board size and the size of a central bank. Central banks with more staff and higher operating expenditures (and, possibly, also more functions) have larger MPCs, while recently established central banks often have smaller boards, although only the former relations are significant at conventional statistical levels. However, there seems not to be a systematic relationship between measures of the age of a central bank as an institution and MPC size (Table 5).

#### D. Nonlinear Specification

In most cases, the scatter plots collected in Appendix V suggest that linear models capture the correlation between MPC size and its possible determinants reasonably well. Still, to allow for possible non-linearities, we also estimate our ordered probit models with quadratic terms. Table 6 presents the results.

<sup>41</sup> Our measure of term length for MPC members from Lybek and Morris (2004) is highly positively correlated with equivalent information for central bank governors that is reported in the *Morgan Stanley Central Bank Directory*.



Table 6. Quadratic Results

Variable	Coefficient 1	Std. dev.	Coefficient 2	Std. dev.
Population	0.018**	(0.007)	-0.00004#	(0.00002)
Area	0.172	(0.139)	0.005	(0.012)
Real GDP (USD)	0.459	(0.362)	-0.033	(0.035)
Real GDP (PPP)	0.850#	(0.443)	-0.069	(0.042)
Ethnolinguistic Fractionalization	-0.218	(2.228)	1.538	(2.566)
Ethnic Fractionalization, CH	-0.010	(0.021)	0.0002	(0.0002)
Ethnic Fractionalization, ADEKW	-0.666	(2.733)	1.036	(3.197)
Linguistic Diversity	-4.954	(1.605)	0.818	(1.772)
Linguistic Fractionalization	-1.484	(1.609)	1.712	(1.876)
Religious Fractionalization	-2.340	(2.030)	3.652	(2.364)
Gini Coefficient	0.031	(0.071)	-0.0004	(0.0008)
Geographic Dispersion	0.311	(3.785)	-0.205	(3.494)
Administrative Divisions	0.024*	(0.011)	-0.0001*	(0.00005)
Real GDP per capita (USD)	0.030	(0.038)	-0.001	(0.002)
Real GDP per capita (PPP)	0.043	(0.042)	-0.001	(0.002)
Human Development Index	1.027	(7.154)	-0.411	(5.479)
Urbanization	0.026	(0.020)	-0.0002	(0.0002)
M3	0.005	(0.010)	-0.00003	(0.00005)
Domestic Bank Credit	-0.005	(0.006)	0.00002	(0.00002)
Trade Openness	-0.016#	(0.008)	0.00005	(0.00003)
Business Cycle Correlation	0.526	(0.416)	-0.931	(1.322)
Democracy	0.083	(0.136)	-0.003	(0.014)
Autocracy	-0.155	(0.130)	0.011	(0.016)
Polity	0.033	(0.024)	-0.00009	(0.0041)
Political Rights	0.096	(0.287)	-0.023	(0.038)
Civil Rights	0.553	(0.411)	-0.086	(0.054)
Economic Freedom	0.427	(1.969)	-0.040	(0.150)
Economic Security	4.039*	(2.004)	-3.713#	(2.029)
Voice & Accountability	0.196	(0.154)	-0.255	(0.165)
Political Stability	0.014	(0.140)	-0.185	(0.127)
Government Effectiveness	0.330*	(0.140)	-0.307*	(0.128)
Regulatory Quality	0.138	(0.173)	-0.252#	(0.136)
Rule of Law	0.399**	(0.145)	-0.408**	(0.146)
Deficit	-0.017	(0.024)	0.004	(0.004)
Debt	0.029**	(0.011)	-0.0002*	(0.00007)
Central Bank Independence	1.251	(0.650)	-0.233	(0.126)
CB Independence Score	0.072	(0.045)	-0.0004	(0.0003)
Price Stability Focus	1.272	(2.055)	-0.579	(1.760)
Target Independence Score	3.192*	(1.242)	-3.087*	(1.275)
Instrument Independence Score	2.212	(1.861)	-0.786	(1.646)
Lim. CB Financing of Gov't Deficit	7.912#	(4.505)	-5.437#	(3.177)
Term Length	-0.590**	(0.204)	0.040**	(0.012)
Staff	0.131**	(0.043)	-0.001#	(0.0005)
Staff % Population	-1.902	(21.51)	-73.4	(208.7)
Staff % Population	-1.902	(21.51)	-73.4	(208.7)
Operating Expenditures	1.909#	(1.000)	-0.0004#	(0.0003)

Notes: The table reports the results of an ordered probit regression of the following equation:

$MPC = \alpha + \beta x + \gamma x^2 + \varepsilon$ , where  $\beta$  is coefficient 1 and  $\gamma$  is coefficient 2. Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively. Evaluation calculates  $\beta x + \gamma x^2$  based on the estimated coefficients and the mean of the respective variables—excluding those non-significant.

Almost all variables that show a significant non-linear effect on MPC size were also relevant determinants of MPC size in the linear specification. That is, they produced significant coefficients in at least one of the specifications reported in Tables 1–5. One exception to this rule is term length (see Appendix VI), a variable we will return to in the multivariate setting. Another is the target independence score, which reinforces the bivariate findings for other indicators of central bank independence. Other variables, in contrast, lose their significance in the non-linear model, such as real GDP and ethnolinguistic fractionalization.

Moreover, for the majority of variables for which we find a significant non-linear component, we observe a concave relationship with MPC size.<sup>42</sup> This holds for population, administrative divisions, economic security, government effectiveness, rule of law, debt, and the number of central bank staff. These results suggest that in these cases, the marginal benefits associated with increasing MPC size are declining in the relevant country characteristic. For instance, a given increase in population size seems to have a smaller impact on MPC size at lower population levels.

The results for term length, however, deviate from these two general findings. The term length of board members is significantly associated with MPC size only in the non-linear specification. Also, the relationship is convex rather than concave. As illustrated in Appendix VI, board members typically tend to have longer legislated terms in both relatively large and relatively small MPCs.

## **E. Multivariate Results**

Next, we aim to explain cross-country differences in MPC size by combining various explanatory variables. Our aim is twofold. First, we are interested in exploring the robustness of our empirical findings, after controlling for the effect of other factors on MPC size. Second, we are interested in the empirical fit of the specification; that is, the extent to which we are able to explain the variation in MPC size in our sample.

Our empirical approach is essentially guided by data availability, and it is constrained by possible multicollinearity. More specifically, we select from each group of determinants suggested in the literature a representative variable that has a particularly strong bivariate correlation with central bank board size and is available for a large share of the sample. To this baseline specification, we then add other variables of intrinsic interest.

The results indicate that country size, a democratic political regime, and a large number of central bank staff are associated with larger MPCs, while landlocked and/or richer countries tend to have smaller boards. Table 7 reports the results. The first column jointly includes a measure of country size (population), level of economic and financial development (real per

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<sup>42</sup> Using the ordered probit coefficients can be misleading in this respect, but we find very similar results based on the OLS models. Results are not shown.

capita income), openness (landlockedness), political regime (voice and accountability), and central bank size (staff; we obtain similar results for operating expenditures) to explain the size of the board. Compared with the bivariate results, all variables (except for landlockedness) remain economically relevant and statistically highly significant. Moreover, our estimation results are derived from a still large sample of 83 observations. While the significance levels of individual variables later vary with the set of regressors (and sample size), the coefficient estimates generally turn out to be reasonably robust.

Table 7. Empirical Determinants of MPC Size

<b>Population</b>	0.744** (0.254)		0.533 (0.325)	0.730 (0.456)	0.599* (0.263)	0.874** (0.278)	0.908* (0.435)	1.540** (0.394)
<b>Area</b>		0.186* (0.081)						
<b>Real GDP per capita (USD)</b>	-0.431* (0.175)	-0.463** (0.175)	-0.473* (0.200)	-0.593** (0.227)	-0.389* (0.174)	-0.608** (0.185)	-0.697** (0.236)	-0.378 (0.244)
<b>Landlocked</b>	-0.428 (0.280)	-0.485# (0.283)	-0.563# (0.294)	-0.990** (0.368)	-0.433 (0.279)	-0.544# (0.320)	-0.842** (0.320)	-0.931** (0.415)
<b>Voice &amp; Accountability</b>	0.425** (0.156)	0.382* (0.166)	0.386* (0.177)	0.395* (0.158)	0.375* (0.154)	0.707** (0.212)	0.429* (0.179)	0.497** (0.253)
<b>Staff</b>	0.385** (0.131)	0.709 (0.464)	0.444** (0.169)	0.376# (0.217)	0.410** (0.120)	0.360** (0.087)	0.345# (0.200)	0.765 (0.508)
<b>Trade Openness</b>			-0.004 (0.003)					
<b>Business Cycle Correlation</b>			0.573 (0.447)					
<b>CB Independence Score</b>				0.020* (0.009)				
<b>Float'g Exchange Rate, LYS</b>					0.482# (0.284)			
<b>Term Length</b>						-0.457# (0.271)		
<b>Term Length Squared</b>						0.022 (0.016)		
<b>Lim. CB Financing of Gov't Def.</b>							1.109# (0.601)	
<b>Ethnolinguistic Fractionalization</b>								1.485* (0.618)
<b>Number Observations</b>	83	83	78	53	83	64	53	50
<b>Count R2</b>	0.542	0.530	0.551	0.604	0.530	0.563	0.604	0.580
<b>Pseudo-R2</b>	0.334	0.568	0.368	0.492	0.356	0.477	0.469	0.431

Notes: Ordered probit regression. Dependent variable is board size index. Pseudo-R<sup>2</sup> is the McKelvey and Zavoina R<sup>2</sup>. Standard errors are in parentheses. \*\*, \* and # denote significant at the 0.01, 0.05 and 0.10 level, respectively.

Adding alternative controlling factors yields additional insights. In column two, we experiment with an alternative control for country size, replacing population with land area. This modification, however, has little effect on the overall results, though the empirical fit appears to be somewhat stronger for some  $R^2$ -measures. In the remaining columns, we then report results testing for the effect of other variables of theoretical interest on MPC size. The most notable results are found for overall central bank independence and ethnolinguistic fractionalization; the coefficients take on the expected sign and are statistically highly significant. Also the exchange rate regime and the degree to which there are limits to central bank financing of government debt play at least a marginally significant role in explaining MPC size in a multivariate framework.<sup>43</sup> In all cases, the results in Table 7 confirm the direction of the bivariate relationship reported earlier. Openness and the correlation of the national with the world business cycle, in contrast, are not significantly related to MPC size in the multivariate framework.

Statistically, the overall fit of the multivariate models is encouraging. Pseudo- $R^2$  values (as measured by the McKelvey and Zavoina method) are between 0.3 and 0.6. An alternative measure, the Count  $R^2$ , is generally higher in the 0.5 to 0.6 range, indicating that we explain a considerable share of the variation in MPC size across countries.<sup>44</sup>

#### IV. CONCLUSIONS

Recent research emphasizes the importance of central bank design for the success of monetary policy. One of the features that have received particular interest is the membership size of the central bank's decision-making body—that is, how many people should decide whether to take measures to achieve a specified monetary policy target?

From a theoretical point of view, the optimal size of an MPC depends on the costs and benefits. On the benefit side, larger MPCs promise improvements in information processing along the lines of Condorcet's jury theorem. At the same time, decision making typically becomes more difficult and time consuming as the number of MPC members increases. Also, members may have a stronger incentive to "freeride" on the information-processing efforts of others in larger MPCs. Other factors influencing the optimal size of MPCs include political forces: both the fact that large MPC size may increase its ability to resist political pressures as well as the fact that the size will reflect the political balance of power. Finally, if central bank designers take a holistic view of central bank organization, other parameters of central bank design, such as the term length of MPC members, may be systematically related to MPC size as well. Since factors affecting optimal board size are likely to differ across

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<sup>43</sup> Government debt, which played a role in the bivariate setup, does not show a significant influence on MPC size in the multivariate model.

<sup>44</sup> As a robustness check, we also performed (unreported) OLS regressions. While the coefficient estimates were qualitatively unchanged, the adjusted  $R^2$  values were typically on the upper end of that range.

countries (e.g., the information-processing requirement might vary with the size and diversity of the economy), it seems reasonable to assume also that “the efficient size of a policy committee might vary across countries” (Goodfriend 2005, p. 85).

Around the world, central bank boards do, indeed come, in different sizes. Although New Zealand, for instance, the governor alone is responsible for policymaking, the European Central Bank (ECB) Governing Council currently comprises 18 members.<sup>45</sup> Moreover, the pending increase in euro area membership has triggered a preemptive ECB reform that generally limits the overall number of voting members to 21. This, however, still seems to be a relatively large number compared with the membership size of other central bank decision-making bodies such as the U.S. Federal Reserve’s Federal Open Market Committee. The average MPC in our sample of central banks has 7–9 members.

In this paper, we characterize differences in the structure of central bank governance based on a dataset that covers the (de jure) membership size of 84 central bank boards around the world at the end of 2003 that make decisions on whether to increase or decrease interest rates to achieve a specified target.<sup>46</sup> We find that board size is indeed significantly and plausibly correlated to various country and central bank characteristics. For instance, MPC size tends to increase with country size and population heterogeneity, thereby providing empirical support for the notion that central bank board size is affected by information-processing requirements. There is also evidence that MPC size is correlated to political institutions, with more democratic countries, where citizens participate more strongly in the selection of their governments, having, on average, larger boards. For some variables, we find a hump-shaped effect on MPC size.

Finally, although the size of the central bank’s policy committee has been the focus of much debate recently, there are indications that it should not be viewed as independent of other features of central bank design. MPC size is often associated with other central bank characteristics. For instance, central banks tend to have larger MPCs if they have more staff or higher operational expenditure. More importantly, countries with floating exchange rate regimes, which typically have more complicated monetary policy frameworks, also seem to have larger boards. Along similar lines, we find that more independent central banks often have larger MPCs. Furthermore, there is a negative relation between MPC size and the length of terms served by MPC members (at least at shorter term lengths). Viewed in conjunction

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<sup>45</sup> However, in New Zealand the governor sets the target in agreement with the minister of finance, while in the ECB, the Governing Council also determines the target but both bodies determine whether monetary policy instruments have to be changed to achieve the target.

<sup>46</sup> In a companion paper, Berger and Nitsch (2006), we examine the effect of various features of MPC design on the outcome of monetary policy.

with the results discussed previously, this suggests that the institutional setup of central banks may indeed be tailored to reflect country-specific factors.

## APPENDIXES

### I. DIFFERENT TYPES OF AUTONOMY AND MONETARY POLICY DECISIONS

	Management Day-to-day operations	Implementa- tion decisions	Policy decisions		Oversight: Supervision of the bank
			Determine the target	Prioritizing the goals	
<b>Limited autonomy</b>	X				X
<b>Instrument autonomy</b>	X	X			X
<b>Target autonomy</b>	X	X	X		X
<b>Goal autonomy</b>	X	X	X	X	X
<b>Function typically entrusted to:</b>	- Manage- ment board, - Governor, or - General manager	- <b>MPC</b> , - Management board, or - Governor	- Policy board, - <b>MPC</b> , - Management board, or - Governor		- Supervisory board, or - Governing board

Source: Based on Lybek and Morris (2004).

Lybek and Morris (2004) distinguish between four types of central bank autonomy, which have consequences for the authority and thus the accountability of the central bank and the role of the board.

*Goal autonomy* means that the central bank has the authority to prioritize among competing objectives stipulated in the central bank law.

*Target autonomy* means that the central bank has the authority to specify the target to achieve a stipulated primary objective in the central bank law.

*Instrument autonomy* means that a target is determined by the government—ideally in consultation with the central bank—but that the bank has adequate autonomy and authority to achieve this target as it sees best fit.

*Limited autonomy* means that the central bank basically functions as a government agency, since both the target and its implementation are strongly influenced by government directions.

The *policy board* determines the priorities of the objectives in the case of goal autonomy and the target for monetary policy in the case of both goal and target autonomy.

Actual monetary policy decision-making—when to increase or decrease interest rates to achieve the target, which is the main focus of our investigation—takes place in an *implementation board*, or sometimes called a monetary policy committee (MCP).

The *management* is responsibility for the day-to-day operations, i.e., implementing the implementation decisions. This responsibility may solely lie with a management board, the governor, or a general manager.

A *supervisory board* is responsible for overseeing the central bank, both its policies and financial conditions.

In addition, central bank governing bodies are occasionally advised by *advisory boards/committees* which, however, have no formal authority.

## II. COUNTRIES IN THE SAMPLE

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Angola	Namibia
Argentina	Nepal
Armenia	Nicaragua
Australia	Nigeria
Bahamas, The	Norway
Bahrain	Oman
Barbados	Pakistan
Bolivia	Paraguay
Bosnia and Herzegovina	Peru
Botswana	Philippines
Brazil	Poland
Bulgaria	Qatar
Cambodia	Romania
Canada	Russian Federation
Cape Verde	Rwanda
Chile	Serbia and Montenegro
Colombia	Sierra Leone
Croatia	Singapore
Cyprus	Slovenia
Czech Republic	South Africa
El Salvador	Sudan
Estonia	Sweden
Fiji	Switzerland
Georgia	Tajikistan
Guatemala	Tanzania
Honduras	Trinidad and Tobago
Hungary	Tunisia
Iceland	Turkey
Jamaica	Turkmenistan
Japan	Ukraine
Jordan	United Arab Emirates
Kazakhstan	United Kingdom
Kenya	United States
Korea, Rep. of	Uzbekistan
Kuwait	Venezuela, República Bolivariana de
Kyrgyz Republic	Yemen, Rep. of
Lao PDR	Zambia
Latvia	
Lesotho	
Liberia	
Lithuania	
Macedonia, FYR of	
Madagascar	
Malawi	
Malaysia	
Moldova	
Mozambique	

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### III. DEFINITIONS AND SOURCES OF VARIABLES

<b>Variable</b>	<b>Description</b>	<b>Source</b>
<b>MPC</b>	Board size index; implementation board	Lybek and Morris
<b>Population</b>	Total population	Rose
<b>Area</b>	Land area	Rose
<b>Real GDP (USD)</b>	Real GDP in US dollar	Rose
<b>Real GDP (PPP)</b>	Real GDP in PPP terms	Rose
<b>Ethnolinguistic Fractionalization</b>	Ethnolinguistic Fractionalization, Mauro	Rose
<b>Ethnic Fractionalization, CH</b>	Ethnic Fractionalization, Collier & Hoeffler	Rose
<b>Ethnic Fractionalization, ADEKW</b>	Ethnic Fractionalization, Alesina et al.	Rose
<b>Linguistic Diversity</b>	Linguistic Diversity, Ethnologue	Rose
<b>Linguistic Fractionalization</b>	Linguistic Fractionalization, Alesina et al.	Rose
<b>Religious Fractionalization</b>	Religious Fractionalization, Collier & Hoeffler	Rose
<b>Gini Coefficient</b>	Gini Coefficient, CIA World Factbook	Rose
<b>Geographic Dispersion</b>	Geographic Dispersion, Collier & Hoeffler	Rose
<b>Administrative Divisions</b>	Number of first-order administrative divisions	CIA World Factbook
<b>Real GDP per capita (USD)</b>	Real GDP per capita in US dollar, WDI	Rose
<b>Real GDP per capita (PPP)</b>	Real GDP per capita in PPP terms, WDI	Rose
<b>Human Development Index</b>	Human development index, UNDP	Rose
<b>Urbanization</b>	Urban population/Total population, WDI	Rose
<b>M3</b>	M3/GDP, WDI	Rose
<b>Domestic Bank Credit</b>	Domestic bank credit/GDP, WDI	Rose
<b>Trade Openness</b>	(Exports+Imports)/GDP, WDI	Rose
<b>Landlocked</b>	Dummy =1 if country is landlocked	Rose
<b>Business Cycle Correlation</b>	Correlation with world GDP, 20-year average	IFS
<b>Democracy</b>	Democracy index, Polity IV (10 = democratic)	Rose
<b>Autocracy</b>	Autocracy index, Polity IV (10 = autocratic)	Rose
<b>Polity</b>	Polity index, Polity IV (-10 = autocratic; 10 = democratic)	Rose
<b>Political Rights</b>	Political rights index, Freedom House	Rose
<b>Civil Rights</b>	Civil rights index, Freedom House	Rose
<b>Economic Freedom</b>	Freedom status, Freedom House	Rose
<b>Economic Security</b>	Economic security index, ILO	Rose
<b>Voice &amp; Accountability</b>	Voice & Accountability, World Bank	Rose
<b>Political Stability</b>	Political Stability, World Bank	Rose
<b>Government Effectiveness</b>	Government Effectiveness, World Bank	Rose
<b>Regulatory Quality</b>	Regulatory Quality, World Bank	Rose
<b>Rule of Law</b>	Rule of Law, World Bank	Rose

<b>Deficit</b>	Overall budget balance/GDP, 10-year average	WDI
<b>Debt</b>	Central government debt/GDP, 20-year average	WDI
<b>Central Bank Independence</b>	Summary index (goal = 1; target = 2; instrument = 3; other = 4)	Lybek and Morris
<b>CB Independence Score</b>	Independence score (0 = low; 100 = high)	Fry et al. (BoE)
<b>Goal Independence</b>	Dummy = 1 if CB has goal independence	Lybek and Morris
<b>Price Stability Focus</b>	Statutory/legal objectives focus on price stability? (0 = weak; 1 = strong)	Fry et al. (BoE)
<b>Target Independence</b>	Dummy = 1 if CB has target independence	Lybek and Morris
<b>Target Independence Score</b>	Independence score (0 = low; 1 = high)	Fry et al. (BoE)
<b>Instrument Independence</b>	Dummy = 1 if CB has instrument independence	Lybek and Morris
<b>Instrument Independence Score</b>	Independence score (0 = low; 1 = high)	Fry et al. (BoE)
<b>Limited or No Autonomy</b>	Dummy = 1 if CB has goal independence	Lybek and Morris
<b>Limited Central Bank Financing of Government Deficit</b>	Independence score (0 = low; 1 = high)	Fry et al. (BoE)
<b>Authority over Exchange Rate Policy</b>	Dummy = 1 if CB has authority over exchange rate policy	Lybek and Morris
<b>Goal Independence or Exchange Rate Policy Authority</b>	Dummy = 1 if CB has either goal independence or authority over exchange rate policy	Lybek and Morris
<b>Fixed Exchange Rate, RR</b>	Dummy = 1 if fixed exchange rate regime	Reinhart and Rogoff
<b>Floating Exchange Rate, RR</b>	Dummy = 1 if floating exchange rate regime	Reinhart and Rogoff
<b>Fixed Exchange Rate, LYS</b>	Dummy = 1 if fixed exchange rate regime	Levy-Y. & Sturzenegger
<b>Floating Exchange Rate, LYS</b>	Dummy = 1 if floating exchange rate regime	Levy-Y. & Sturzenegger
<b>Fixed Exchange Rate, IMF</b>	Dummy = 1 if fixed exchange rate regime	IMF
<b>Floating Exchange Rate, IMF</b>	Dummy = 1 if floating exchange rate regime	IMF
<b>Term Length</b>	Term length of board members (de jure)	Lybek and Morris
<b>Term Length in CB Law</b>	Dummy = 1 if term length stipulated in central bank law	Lybek and Morris
<b>Staff</b>	Staff number	Central Bank Directory
<b>Staff % Population</b>	Staff/Population	Central Bank Directory & Rose
<b>Operating Expenditures</b>	Operating expenditures	Ize
<b>Establishment Year</b>	Establishment year	Central Bank Directory

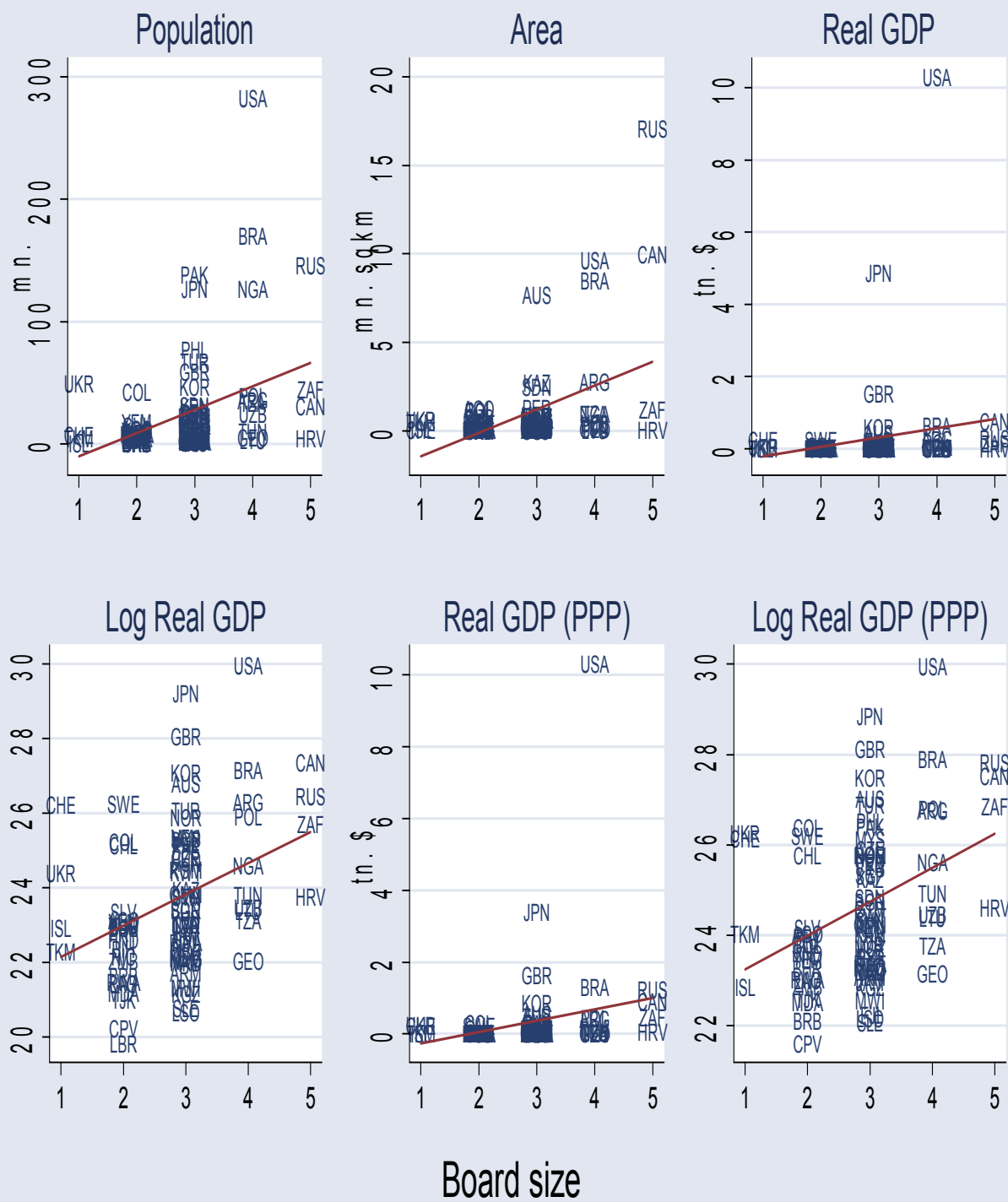
#### IV. DESCRIPTIVE STATISTICS

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
MPC	84	2.85	0.87	1	5
Population	98	37.44	132.02	0.27	1262.65
Area	98	0.997	2.588	0.0004	17.075
Real GDP (USD)	95	0.313	1.194	0.0004	10.300
Real GDP (PPP)	93	0.430	1.308	0.002	10.300
Ethnolinguistic Fractionalization	62	0.38	0.29	0.00	0.93
Ethnic Fractionalization, CH	77	36.92	27.70	0.00	93.00
Ethnic Fractionalization, ADEKW	47	0.42	0.25	0.01	0.86
Linguistic Diversity	98	0.43	0.29	0.003	0.99
Linguistic Fractionalization	94	0.37	0.27	0.002	0.90
Religious Fractionalization	97	0.46	0.23	0.002	0.86
Gini Coefficient	74	40.00	10.83	24.40	70.00
Geographic Dispersion	72	0.63	0.18	0.19	0.97
Administrative Divisions	97	22.65	29.35	0	195
Real GDP per capita (USD)	94	10.02	9.53	0.46	35.13
Real GDP per capita (PPP)	97	7.48	10.09	0.13	39.32
Human Development Index	74	0.74	0.17	.34	0.95
Urbanization	98	59.10	22.60	6.15	100.00
M3	85	48.80	38.26	8.17	193.41
Domestic Bank Credit	94	65.14	57.20	3.83	317.22
Trade Openness	91	83.14	38.08	20.18	228.88
Landlocked	98	0.21	0.41	0	1
Business Cycle Correlation	97	0.18	0.31	-0.49	0.80
Democracy	90	6.03	3.78	0	10
Autocracy	90	1.68	2.83	0	10
Polity	90	4.36	6.36	-10	10
Political Rights	98	3.18	2.09	1	7
Civil Rights	98	3.36	1.69	1	7
Economic Freedom	76	6.65	0.96	4.66	8.56
Economic Security	58	0.52	0.23	0.05	0.98
Voice & Accountability	98	0.14	0.92	-1.75	1.64
Political Stability	96	0.17	0.98	-2.38	1.73
Government Effectiveness	97	0.23	1.04	-1.58	2.48
Regulatory Quality	98	0.25	0.91	-2.14	2.27
Rule of Law	98	0.25	1.07	-1.52	2.22
Deficit	82	-2.90	3.34	-13.65	10.85
Debt	76	49.23	35.76	0	189.53
Central Bank Independence	98	2.67	0.83	1	4
CB Independence Score	93	73.5	16.2	24	98
Goal Independence	98	0.16	0.37	0	1
Price Stability Focus	93	0.76	0.20	0	1
Target Independence	98	0.42	0.50	0	1
Target Independence Score	93	0.58	0.31	0	1
Instrument Independence	98	0.35	0.48	0	1
Instrument Independence Score	93	0.82	0.29	0	1

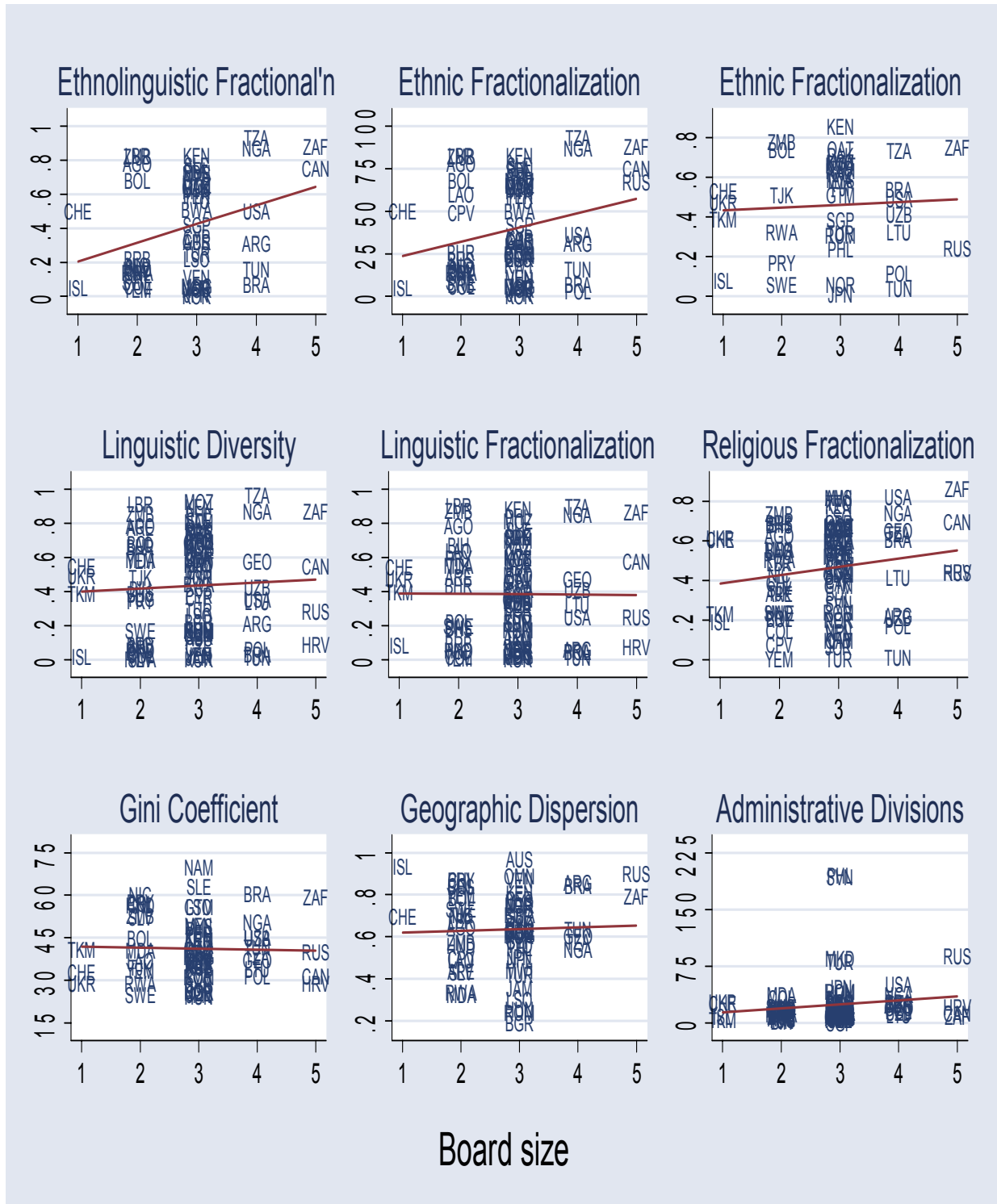
<b>Limited or No Autonomy</b>	98	0.07	0.26	0	1
<b>Limited Central Bank Financing of Government Deficit</b>	93	0.76	0.27	0	1
<b>Authority over Exchange Rate Policy</b>	98	0.09	0.29	0	1
<b>Goal Indep. or Exch. Rate Policy Auth.</b>	98	0.33	0.47	0	1
<b>Fixed Exchange Rate, RR</b>	98	0.22	0.42	0	1
<b>Floating Exchange Rate, RR</b>	98	0.06	0.24	0	1
<b>Fixed Exchange Rate, LYS</b>	98	0.45	0.50	0	1
<b>Floating Exchange Rate, LYS</b>	98	0.30	0.46	0	1
<b>Fixed Exchange Rate, IMF</b>	98	0.37	0.48	0	1
<b>Floating Exchange Rate, IMF</b>	98	0.53	0.50	0	1
<b>Term Length</b>	70	5.19	1.97	3	14
<b>Term Length in CB Law</b>	98	0.84	0.37	0	1
<b>Staff</b>	89	4.04	18.03	0.10	150.00
<b>Staff % Population</b>	89	0.01	0.01	0.002	0.09
<b>Operating Expenditures</b>	99	0.243	0.567	0.004	3.626
<b>Establishment Year</b>	98	1939	59.33	1668	1997

## V. SCATTER PLOTS

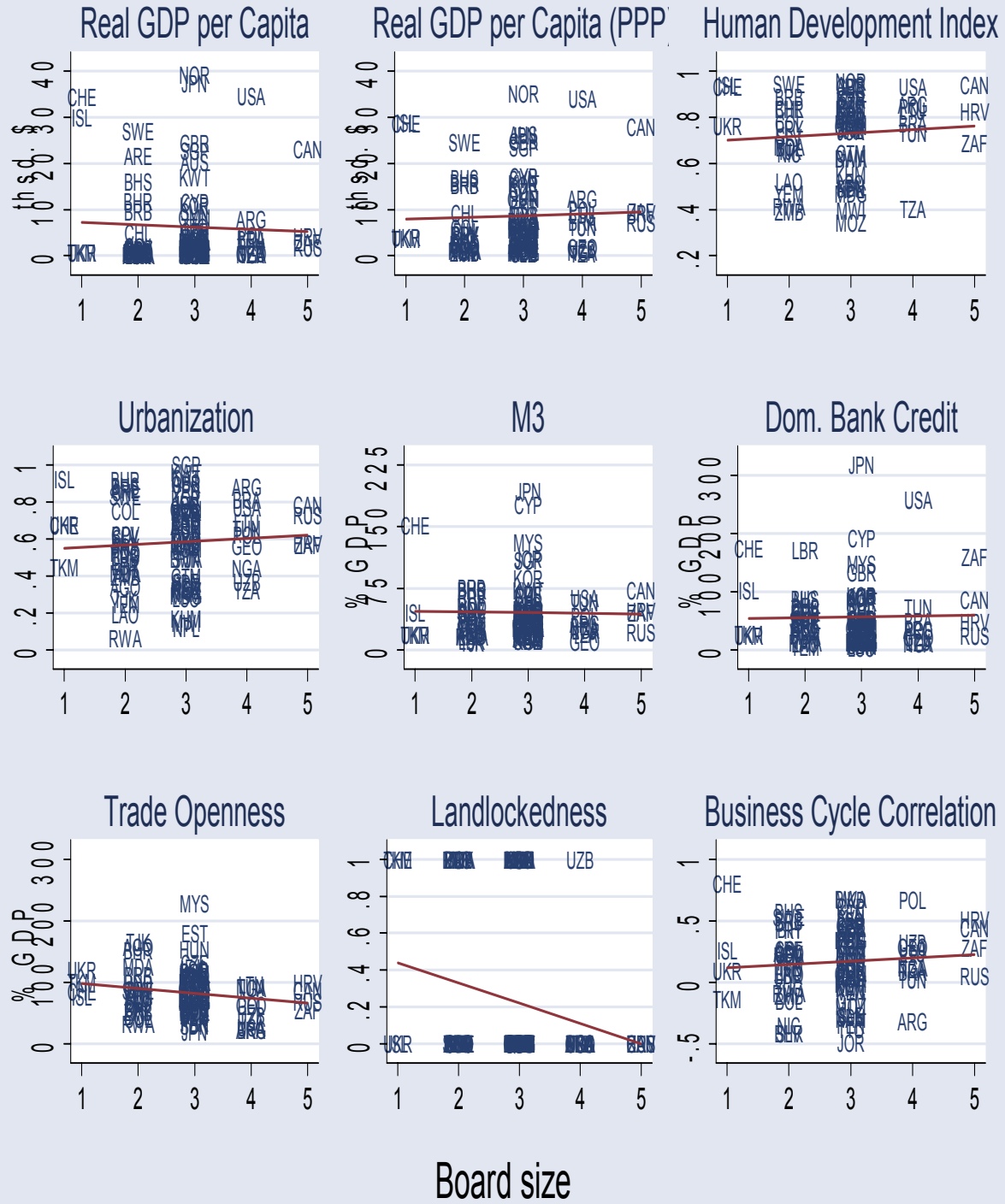
Panel A1: Size



Panel A2: Heterogeneity



**Panel B: Level of Development and Openness**



**Panel C: Political Regime**



Board size

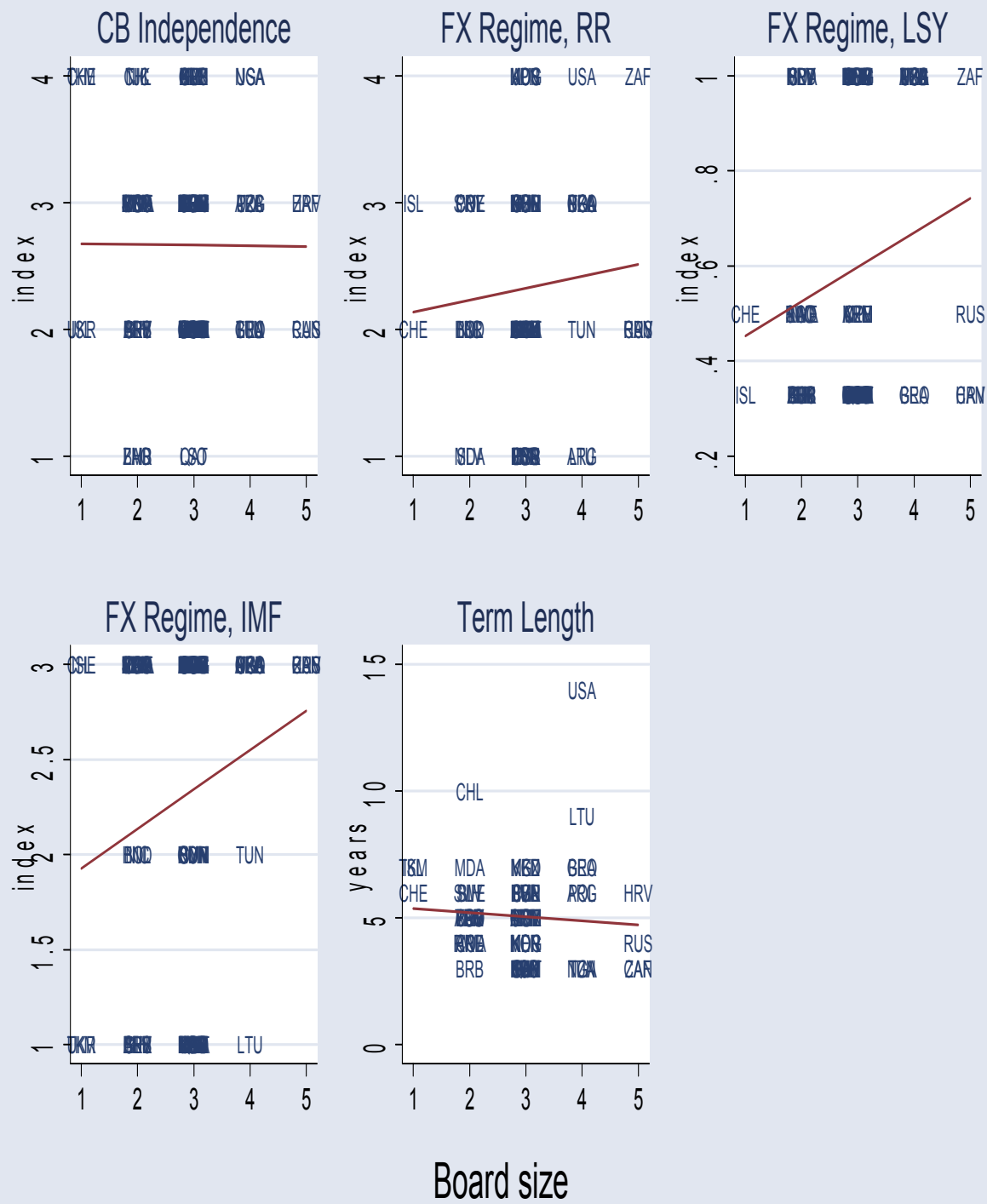


**Panel C (concluded): Political Regime**



Board size

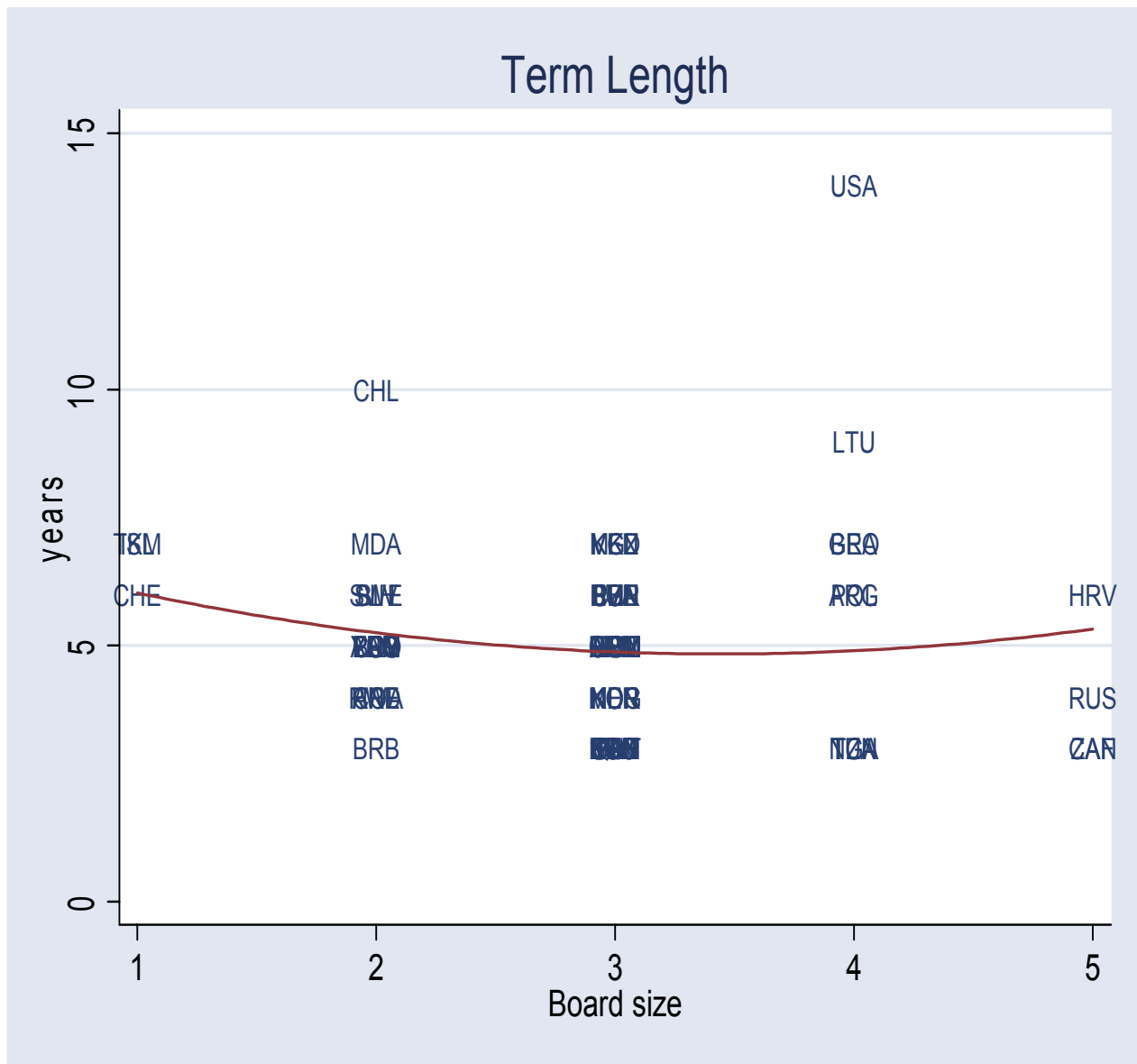
**Panel D: Central Bank Characteristics**



**Panel D (concluded): Central Bank Characteristics**



## VI: BOARD SIZE AND TERM LENGTH



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