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Too Many Cooks?
Committees in Monetary Policy*

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Abstract
How many people should decide about monetary policy? In this paper, we take an empirical perspective on this issue, analyzing the relationship between the number of monetary policy decision-makers and monetary policy outcomes. Using a new data set that characterizes central bank monetary policy committees (MPCs) in more than 30 countries from 1960 through 2006, we find a U-shaped relationship between MPC size and inflation; our results suggest that the lowest level of inflation is reached at MPCs with intermediate size of about five to nine members. Similar results are obtained for inflation variability. Other MPC characteristics also matter for monetary policy outcomes, though to a smaller degree. For instance, the membership composition of the MPC as well as the frequency of MPC membership turnover appear to affect economic variables.

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1. Introduction

The number of people who decide about monetary policy varies considerably across countries. At one extreme, decisions are made by a single person; examples where the governor alone is responsible for monetary policy include the Bank of Israel and the Reserve Bank of New Zealand. At the other extreme, central banks operate large monetary policy committees (MPCs) that comprise more than a dozen members.[1] A prominent example is the Governing Council of the European Central Bank which currently consists of 22 voting members. Similarly, in the U.S. Federal Open Market Committee, 19 members are participating in policy discussions, out of which 12 hold voting rights. Fry, Julius, Mahadeva, Roger, and Sterne (2000) report that 8 (of 82 surveyed) central banks have monetary policy boards with more than 10 members.

The number of monetary policy decision-makers, while generally persistent, also changes over time. In Brazil, for instance, the central bank reform of the late 1980s effectively reduced MPC size from a maximum of 26 members to 9 members. In the U.K., in contrast, the 1997 reform act took monetary policy decisions out of the hands of the governor and into the hands of a nine member MPC. In Germany, the Bundesbank MPC had initially 10 members, which changed to 18 members in the late 1950s and was cut back again, after German reunification, to 17 members in 1992.[2]

With MPCs varying across countries and time, a growing literature aims to quantify their optimal membership size as an important feature of central bank design. While there is a broad consensus that committees make better decisions than individuals, there is much less agreement on how large a committee should be.[3] Theory suggests that the marginal benefits of MPC size become smaller, and the marginal costs of decision-making become larger, as MPC size increases. The magnitude of these offsetting forces, however, is likely to depend on a variety of factors, possibly including various national characteristics. As a result,

[1] We use the term MPC in the broadest possible sense, describing the board, council, or committee (etc.) making actual monetary policy decisions.
[2] The Bundesbank reform of 1992 prevented a significant increase in the number of voting governors in its Central Bank Council ('Zentralbankrat') due to German unification. Before the reform, each federal state had a representative in the Council, and without reform, membership would have exceeded 22 – a number that, according to the Bundesbank, "would have greatly complicated that body's decision-making processes" (Deutsche Bundesbank 1992, p. 50).
[3] For surveys of the literature, see, among others, Gerling, Grüner, Kiel and Schulte (2005), Fujiki (2005), Sibert (2006), Vandenbussche (2006), Berger (2006), and Maier (2007).

Goodfriend (2005, p. 85) argues that the "efficient size of a policy committee might vary across countries".

In this paper, we take an empirical perspective on this question. More specifically, we examine to what extent the economic outcomes of monetary policy are possibly associated with the number of monetary policy decision-makers. To that end, we have compiled a new data set of the de jure and de facto membership size of MPCs, creating an unbalanced panel that covers, on a yearly basis, more than 30 countries from 1960 through 2006. In addition, since our measure of de facto membership is derived from the names, positions, and membership dates of MPC members, we were able to compute the annual turnover rate of MPC membership. Finally, we gathered information on whether the MPC comprises industry representatives, regional delegates, or government representatives. In our empirical analysis, we use all these measures to examine the effects of MPC design on inflation (and other economic outcomes), after controlling for economic and institutional factors.

To preview our main results, we find a U-shaped relationship between MPC size and inflation. More precisely, inflation tends to fall as the number of MPC members increases from low levels, but this effect becomes smaller and eventually turns positive at high levels of MPCs membership. Taken at face value, our estimates imply that inflation reaches a minimum at medium-sized MPCs with about five to nine members, holding constant all other factors. Similar results are obtained for inflation variability. In addition, there is evidence that other features of MPC design, such as membership turnover rates and the membership composition of MPCs, also shape economic outcomes. Finally, we find that MPC size affects the effectiveness of monetary targeting regimes, as defined by Fatas, Mihov and Rose (2007).

The remainder of the paper is organized as follows. In Section 2, we review the relevant literature. Section 3 describes our empirical methodology and the data. The heart of our paper is Section 4 which presents the empirical results. Section 5 provides a brief conclusion.

2. Related Literature

A sizable literature deals with the merits of smaller or larger MPCs from an applied theoretical and institutional perspective. Blinder (1998) and Gerlach-Kristen (2006), for

example, argue that, when it comes to the efficiency of monetary policy making, 'bigger may be better' because a more numerous MPC will process information on the state of the economy more effectively than an individual; in a group, information is pooled, there may be even cooperation in information processing, and extreme decisions are likely to be avoided.[4] Blinder and Morgan (2005) and Lombardelli, Proudman, and Talbot (2005) provide supporting evidence based on experimental research.

The gains from larger MPCs, however, may not be linear, and, more importantly, they may come at a cost. For instance, the large literature on decision making in groups surveyed in Sibert (2006) suggests that the advantages in information processing are likely to diminish as MPC size increases because members may have an incentive to 'free-ride' on the efforts of others. Berger (2002, 2006) argues that in larger committees members will spend considerably more time 'sounding each other out' bilaterally before or during meetings so that decision-making costs are growing (possibly exponentially) in MPC membership.[5] In summary, however, the weight of these arguments will, at least to some degree, also depend on the traditions of decision-making prevailing in a particular MPC.[6]

Another set of papers takes a more empirical approach on the design of MPCs. Berger, Nitsch, and Lybek (2008) analyze differences in the size of MPCs in a cross-section sample of 84 countries. Examining a large number of possible determinants of MPC size, they 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 MPCs; see also Erhart and Vasquez-Paz (2007).[7] Erhart, Lehment, and

[4] See also the discussion in Blinder (1998), Berk and Beirut (2004), and Riboni and Ruge-Murcia (2006).
[5] The governor of the Bank of England, Mervyn King (UK House of Commons, 2007, p. 29), has recently defended the membership size of nine members in the MPC of the Bank of England by arguing: "I do think that more than nine would run the risk of making the process much less effective because a conversation among the nine is a key part of it and to have many more people would run the risk, as I think happens in somewhat larger councils that set policy, that some people have more say than others; there may be inner deliberations that take place because a very large body is simply too big to have a sensible discussion."
[6] Decision-making traditions are often 'soft' in nature and, while an interesting subject of study, do not as readily lend themselves to measurement and quantitative analysis as does MPC size. While MPC statutes regularly detail voting rules, their interpretation and enforcement tends to vary across countries and time. For instance, members of the ECB's Governing Council often stress that monetary policy decisions are taken by consensus despite the fact that its statutes foresee decisions based on specific majority voting rules. Of course, such traditions or interpretations of decision making rules can also change over time. Another hard-to-measure and time variant characteristic of MPC decision making is the amount of leadership provided by the MPC chairperson. Some of these and related issues are discussed in greater detail in, among others, von Hagen and Brückner (2001), Gersbach and Pachl (2004), Gerlach-Kristen (2006), and Blinder and Morgan (2007). For a recent review of issues in MPC design, see Blinder (2007).
[7] These findings are essentially positive in nature. To give them normative content, one must assume that observed MPC sizes are the outcome of optimal central bank design decisions and argue that larger and more

Vasquez-Paz (2007) examine differences in the volatility of inflation for MPCs with more or less than five members. Based on cross-country evidence for 75 countries, they argue that inflation volatility is higher in (the small subset of) countries with MPC sizes below five.[8]

More broadly, our paper is also close in spirit to the large literature that has empirically examined the effects of institutional features of central banking on monetary policy and policy outcomes. Some of these papers focus on features of central bank design. Examples include Cukierman, Webb, and Neyapti (1992), Campillo and Miron (1997) and de Haan and Kooi (2000) on central bank independence, Fatas, Mihov, and Rose (2007) on monetary policy transparency, and Göhlmann and Vaubel (2007) on the personal background of central bankers. Other papers analyze the role of monetary policy strategies such as inflation targeting or exchange rate regime choice; see, for instance, Mishkin and Schmidt-Hebbel (2007) and Levy-Yeyati and Sturzenegger (2001, 2003).

Finally, there are close parallels to recent work in corporate finance on the effects of board size (and other board characteristics) on corporate performance. In an early empirical contribution, Yermack (1996) finds an inverse relationship between firm market value and the size of the board of directors for a sample of large U.S. industrial corporations; Eisenberg, Sundgren, and Wells (1998) provide complementary evidence for small Finnish firms. Most recently, de Andres and Vallelado (2008) have examined board characteristics and firm performance in the banking industry. They find an inverted U-shaped relationship between the number of board directors and the firm market-to-book value ratio. Hermalin and Weisbach (2003) provide an excellent survey of issues discussed in this literature.

3. Methodology and Data

Our main goal is to explore the link between the membership size of a central bank's monetary policy decision-making body and monetary policy outcomes, in particular the level of inflation. Price stability or low inflation is often the most prominent target of central bank policy around the world; see Fry, Julius, Mahadeva, Roger, and Sterne (2000) for a survey.

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heterogeneous currency areas should indeed have larger MPCs. Erhart and Vasquez-Paz (2007) provide an interesting attempt in that direction.

[8] In their sample, eight out of 75 countries have MPCs with less than five members. Most of these countries are small in size.

However, we also explore other measures of potential interest such as output growth. As noted before, this empirical analysis has the potential to inform the debate on the optimal size of MPCs, adding to insights derived from theoretical and experimental research.

To examine the effect of committee size on monetary policy outcomes, we apply various empirical techniques. First, we conduct a simple event-study analysis that explores the effects of variations in committee size over time. The results are informative but somewhat limited by the small number of sizable MPC size changes in our sample; most variation in MPC size occurs de facto at a scale of one to two members (e.g., due to extended vacancies). Therefore, in a second step, we make systematic use of the panel nature of our data, looking at the effects of MPC size on policy outcomes across time and countries.

Our panel approach follows previous work that examines the effect of central bank characteristics on inflation; examples include Fatas, Mihov, and Rose (2007) and Acemoglu, Johnson, Querubin, and Robinson (2008). More specifically, we estimate equations of the form:

$$\Pi_{c,t+1} = \alpha + \beta_1 \, \text{MPCsize}_{c,t} + \beta_2 \, \text{MPCsize}^2_{c,t} + \Sigma_i \gamma_i \, X_{c,t} + \delta_c + \omega_t + \varepsilon_{c,t} , \qquad (1)$$

where $\Pi_{c,t+1}$ denotes the inflation rate of country c at time t+1, MPCsize is the membership size of the central bank's monetary policy committee, X is a set of other features that may (potentially) affect inflation, and δ_c and ω_t stand for a full set of country and time fixed effects, respectively. To account for any serial correlation in the disturbance $\varepsilon_{c,t}$, standard errors are corrected for clustering at the country level.

The relevant data are obtained from various sources. At the heart of our data set is a new (unbalanced) panel that covers the identities of MPC members for 33 central banks from 1960 to 2006. The countries are listed in Appendix 1. The data set is constructed in a three-step procedure. First, we identify the central bank's monetary policy decision-making body, the MPC. This information is typically available from the central bank law but, where necessary, we cross-checked the information with central bank officials. In most cases, the committee that runs a central bank's day-to-day operations also takes de jure responsibilities for

monetary policy decision-making.[9] Second, we extract all relevant information describing the MPC from the central bank law. Features that are frequently defined in the law include the membership size and the composition of the decision-making body, the frequency of meetings, voting rules and majorities, and specific requirements on individual members (e.g., nationality, educational background). For instance, apart from de jure MPC size, we compile information on the number of voting and non-voting members and the presence of industry, regional, or government representatives in the committee. Finally, using a variety of sources such as annual reports and other forms of central bank communication, we identify individual MPC members and their positions. Since we have, based on this data, information on the entry and exit dates of individuals, we also construct measures of de facto MPC size and MPC membership turnover (as well as a more conventional measure of central bank governor turnover).

Other institutional and economic data used in the empirical analysis are obtained from standard sources. Our main dependent variable, inflation, is taken from the International Monetary Fund's International Financial Statistics. In the empirical implementation, we transform the raw inflation data (defined as the annual percentage change in the consumer price index) into normalized inflation, $\Pi_{c,t} = \text{Inflation}_{c,t} / (1 + \text{Inflation}_{c,t})$.[10] Other sources include the Penn World Table and the World Bank's World Development Indicators. For data on central bank design, we turn to Acemoglu, Johnson, Querubin, and Robinson (2008) for information on central bank independence and rely on Fatas, Mihov, and Rose (2007) for data on the presence of de jure monetary policy targets and whether a particular target was met in practice. A data appendix provides a detailed list of the variables used in the empirical analysis and a description of the sources.

[9] We ignore any informal or semi-official arrangements in the preparation of monetary policy decisions (e.g., when the governor or the board holds consultations before taking decisions) mostly because this type of arrangements may be easily changed on an ad hoc basis and is, in the end, very hard to document.

[10] This transformation helps to minimize the effects of outliers (i.e., countries that experienced extremely high rates of inflation); see Acemoglu, Johnson, Querubin and Robinson (2008) for a recent application. Temple (1998) highlights the role of extreme and influential observations in this literature.

4. Empirical Results

4.1 Descriptive Statistics

We begin by describing our data on MPC membership size in more detail. Figure 1 portrays the evolution of de facto MPC size over time. The figure graphs the average membership size for the full sample and, since the number of central banks with available MPC data varies across years, also for different groups of countries for which we have membership size data covering similar periods. The averages are based on the full membership size of committees (i.e., including non-voting MPC members) since, on a practical level, all MPC members are likely to contribute to MPC decisions. However, all of our empirical results are robust to using only voting members.

There are a number of notable observations. First, average MPC size is fairly persistent. While there are some short-term fluctuations due to temporary vacancies or minor adjustments in MPC design, there are very few radical changes in average committee size; the number of monetary policy decision-makers in central bank committees consistently averages between six and eight members since the late 1950s. A notable exception is Brazil where the size (and composition) of the monetary policy committee has fluctuated widely.

Second, to the extent that there is change over time, it appears that MPCs are converging in membership size. While the countries in Figure 1 are grouped according to data availability (and, thus, more or less randomly), it is interesting to note that the group of countries with initially small MPCs (labeled ‘5 countries’) experienced on average an increase in membership size; this group of countries includes the Bank of England which has newly established an MPC in 1997. In contrast, groups with relatively large MPCs have tended to reduce membership size.

Third, the average MPC size of central banks in European countries that later joined the euro area (labeled as ‘9 countries’ in Figure 1) appears to have been, on average, disproportionately large. Especially in small open economies such as Austria, Belgium, Ireland and Portugal, the decision-making bodies were relatively large, often comprising more than 10 members.

In sum, there is interestingly little evidence that single-governor MPCs have been historically the dominant organizational form of monetary policy decision-making. Blinder (2004, p. 3) claims that, until recently, the "[o]ne-man rule used to be the norm [to conduct monetary policy]." In our sample, however, one-person MPCs are the exception rather than the rule. Part of the explanation for this discrepancy in perception may be that some of the multiple-member MPCs have been dominated, at times, by influential chairpersons, creating the impression of a 'one-man rule'.[11]

4.2 Event Study

Next, we examine episodes of major change in MPC membership size in greater detail. In particular, we identify episodes when the de facto size of a MPC has increased or decreased by more than two members in a given year.[12] Taking an event study approach, we then analyze (in univariate fashion) the dynamic behavior of variable(s) of interest before and after that change.

Figure 2 graphs the size of committees before and after major MPC size changes. There are five episodes of large and rapid decreases in committee size in our sample and three episodes of enlargement. During those adjustments, committee size changed by, on average, six members. Reviewing these episodes in greater detail, it is interesting to note that committees whose membership size was reduced were initially larger than the average, while committees where membership size has sizably increased were initially disproportionately small. This finding supports our previous observation that there has been convergence in committee size.

Figure 3 illustrates the dynamics of inflation and output growth during episodes of decreasing ('fewer members') and increasing ('more members') MPC size. Although there is considerable heterogeneity in individual experiences, some general patterns emerge. As shown in the top left graph in Figure 3, central bank reforms that lead to a reduction in the number of monetary policy decision-makers are typically initiated during episodes of high

[11] There is also a difference in samples; Blinder (2004) refers to a J.P. Morgan study of mostly industrialized countries. However, one-person MPCs are equally rare across all country groups in our sample.

[12] Applying other selection criteria would yield essentially identical results. For instance, almost all of these changes were accompanied by amendments in central bank law. Interestingly, adjustments in de jure committee size are not necessarily associated with de facto changes because of existing vacancies (e.g., in Germany). Also, choosing a relative (instead of absolute) cut-off makes little difference because membership size of small committees has rarely changed.

inflation. More importantly, these reforms appear to be highly successful: the reduction in MPC size is accompanied by a decline in inflation, a finding that is robust to the exclusion of Latin American countries. Analogously, the top right graph in Figure 3 plots inflation for episodes of major MPC enlargements. Here, however, the link between notable changes in MPC size and inflation is less clear. While this type of reform seems to be similarly associated with somewhat lower rates of inflation, the effect is comparatively small and hardly different from the sample average.

For real GDP growth, the lower panel graphs in Figure 3 seem to indicate that MPC downsizings occur mostly in countries with below-average growth performance. There are also signs of a further reduction in growth after the MPC size change, but the effect seems moderate compared to the one on inflation. MPC enlargements, in contrast, are typically associated with a more pronounced growth pattern. The membership size of MPCs appears to be increased in periods of a temporary slump of otherwise strong growth performers. For example, the Board of Directors of the Monetary Authority of Singapore was enlarged during the time of the Asian crisis.

While some of these findings are intriguing, any linkage between MPC size and policy outcomes is likely to be conditional on other factors. For instance, if there is indeed an optimal level of MPC size (as suggested by the theoretical literature), a change in membership size should lower inflation only if initial MPC size is further away from its optimum. In the following, we examine the relationship between MPC characteristics and various policy outcomes in more detail.

4.3 Regression Analysis

To take full account of the panel nature of our data, we estimate variants of the augmented inflation model in equation (1). Instead of emphasizing the results from a particular model formulation, we explore a wide range of estimation methods and regression specifications. The dependent variable is a country's normalized rate of inflation in the following year; this timing structure helps to limit potential simultaneity bias. Benchmark estimation results are reported in Table 1.

The impact of MPC size on inflation

We begin our estimation analysis with the most parsimonious specification of equation (1) in terms of data requirements: that is, we estimate a model that includes, besides our variable of interest, only a comprehensive set of binary dummy variables to control for any country-specific and year-specific effects on inflation (while the γ's are set to be zero). This fixed effects estimation approach is similar in style to that used by Acemoglu, Johnson, Querubin, and Robinson (2008). Its advantage is robustness. By controlling for all time-invariant country characteristics that may affect a country's inflation rate as well as any global trend in inflation (such as oil price shocks), this estimator effectively mitigates any potential omitted variables bias. Its disadvantage is that the fixed effects prevent any cross-sectional (or common time) variation in MPC size to influence the inflation outcome in the estimation, thereby reducing the MPC size effect on inflation (as measured by β_1 and β_2) to time-variation at the country level.

We start with an examination of the linkage between MPC membership size and inflation in simple linear fashion. The first column of Table 1 tabulates the results. At first glance, the estimates appear to be not very encouraging; the estimated coefficient on the de jure number of voting members in a central bank's MPC is indistinguishable from zero at conventional measures of statistical significance. This finding, however, is basically consistent with theory. It implies that the optimal number of MPC members as measured by the inflation outcome is likely to be neither very small (i.e., close to one) nor very large – that is, to the extent that there is any association between the MPC membership size and inflation, the optimal MPC size will not be extreme.

To allow for possible nonlinearities, we next add a quadratic term of MPC size to the fixed effects specification.[13] As shown in column 2 of Table 1, this extension indeed improves the empirical fit of the regression. The coefficients on the linear and quadratic measures of MPC size become highly statistically significant and take opposite signs, describing a U-shaped relationship between MPC size and inflation. That is, the positive effect of enlarging the number of monetary policy decision-makers on inflation dies off and eventually becomes

[13] McIntosh and Schlenker (2006) provide a detailed discussion of the use of quadratic terms in models which include fixed effects. For consistent estimation of non-linearities, they propose a hybrid estimator that additionally includes a control for squared deviations from the group mean. We consistently add this variable in our fixed effects models with quadratic MPC terms. However, the point estimates on this regressor are generally negligible in magnitude and almost always statistically insignificant.

negative as committee size increases. Taken at face value, the point estimates indicate that moving from an individual decision-maker to a decision-making body with five members is associated with a decline in inflation by about two percentage points (at the sample mean inflation rate of 8 percent), an effect that is reversed when membership size approaches ten members. Indeed, committees that consist of ten or more members appear to be associated with higher inflation than for an individual central banker. The optimal committee size that minimizes inflation, holding other factors constant, is five members.

While the panel fixed effects estimator captures all country specifics that are constant over our time as well as common time variation, there may be other factors – factors which vary over time and across countries – that shape the inflation experience in individual economies. In the following, we distinguish between two groups of such time-variant country-specific variables. In a first step, we add controls for economic factors that have often been found to affect inflation: trade openness, the fiscal balance, the state of the business cycle, per capita income and market size; see, for instance, Campillo and Miron (1997) for empirical evidence. As shown in columns 3 and 4 of Table 1, however, none of these macro variables has any measurable explanatory power for differences in inflation in addition to the country and time fixed effects. More importantly, our estimates of the β coefficients for the effect of MPC size on inflation remain broadly unaffected by this perturbation; as before, inflation appears to be minimized at a committee size of five members.

Next, we extend our set of control variables by various measures of other central bank characteristics. Acemoglu, Johnson, Querubin, and Robinson (2008) have recently reexamined the relevance of central bank independence for inflation; we include their binary measure of central bank independence, which is expected to have a negative impact on inflation. Fatas, Mihov, and Rose (2007) highlight the importance of quantitative goals for monetary policy; we add their controls for the presence of a de jure quantitative target and the central bank's success in meeting this target, again expecting a negative influence on inflation. Estimation results are tabulated in columns 5 and 6 of Table 1. Again, the estimated coefficients for the additional control variables are not statistically different from zero, similar to our findings for economic factors. More importantly for our purposes, the coefficients on the variables of interest remain largely unchanged, indicating a non-monotonic relationship between MPC size and inflation . Still, the estimation results turn out to be slightly weaker for this specification. A possible explanation is that sample size is reduced substantially (by about

one-half) when these additional controls are included, due to the limited availability of central bank data (especially along the time dimension).

In a final set of benchmark regressions, we modify our estimation technique, applying plain OLS without country fixed effects. As noted before, the use of country fixed effects allows controlling for any time-invariant determinants of inflation, but thereby the estimator also mechanically captures the effect of MPC size on inflation for committees with constant (or close to constant) membership size over our sample period. Along similar lines, the fixed effects also limit the explanatory power of other control variables that show little variation over time. So how do the estimation results change when we exclude the fixed effects? The last two columns on the right of Table 1 report the results. Encouragingly, the coefficient estimates not only confirm our previous finding that the effect of MPC size on inflation is nonlinear and exhibits a U-shaped pattern. We also find that the (γ) coefficients for some of the other covariates of inflation become statistically significant in this specification, taking the anticipated signs. For instance, richer countries and economies more open to international trade tend to have lower inflation. Also, central bank independence and the presence of quantitative targets in monetary policy appear to reduce inflation.

When evidence from central banks with unchanged membership size is additionally taken into account, the optimal number of monetary policy decision-makers as measured by their impact on inflation increases to nine committee members. In combination with lower estimates derived from fixed effects specifications, this result appears to suggest that countries with smaller and size-invariant MPCs have experienced relatively higher inflation rates, after controlling for standard determinants of inflation. Figure 4 illustrates the relationship between MPC size and inflation outcome for two of our benchmark regressions in Table 1 graphically. Since our estimates of optimal committee size are somewhat sensitive to the exact method of estimation, we do not aim to interpret our results too literally. Conceptually, the OLS model appears to be the more attractive benchmark for evaluating the inflation impact of MPC size: it allows the cross-sectional variation in MPC size to influence the inflation outcome and controls explicitly for various other inflation determinants. The fixed effects model, in contrast, may provide the more robust result, holding constant all observed and unobserved country specifics. In sum, we argue, based on our estimation results, that the optimal MPC is of medium size which excludes very small groups (with less than five members) and very large committees (with more than nine members). Interestingly, in practice, a majority of

central bank MPCs appears to fall into this size range (Fry, Julius, Mahadeva, Roger, and Sterne 2000).

To test the robustness of our findings, we have performed extensive checks. Table 2 investigates the sensitivity of our results to changes in the specification and the estimation technique. In a first exercise, we aim to control for persistence in inflation. Inflation is a highly serially correlated variable, which may have affected our estimates. Following Acemoglu, Johnson, Querubin, and Robinson (2008), we try to capture this persistence by including five lags of inflation as additional regressors. Columns 1 to 3 contain the results. As shown, for this specification, the estimated (short-run) coefficients generally keep their signs, but fall in magnitude. The nonlinear association between MPC size and inflation remains intact in the fixed effects regression (first column), but deteriorates to only marginal level of significance in the simple OLS framework (second column). A possible reason is that the impact of smaller changes in MPC membership is dominated by short-run inflation dynamics. To further explore this idea, we also report estimation results for a regression specification that focuses more explicitly on the time-series dimension. When we analyze a smaller subsample of countries whose central bank MPC has changed membership size, the effect of MPC size on inflation is again non-monotonic and significant (column 3).

Another potential problem is that our key variable of interest, MPC size, may be correlated with the error term. If this is the case, our estimators produce inconsistent results. A standard approach to deal with this endogeneity issue is the use of the Arellano-Bond generalized methods of moments (GMM) estimation method. This procedure transforms the variables into first differences (thereby eliminating the fixed effects) and then uses lagged variables to instrument for the differenced terms.[14] Columns 4 to 6 of Table 2 report GMM results analogous to the models estimated in the first three columns of the table, using the same samples and specifications. The results strongly confirm our benchmark findings: the estimated coefficients on the linear and quadratic term of MPC size take opposite signs and are always jointly and (with one exception) individually significant, with estimates of optimal board size being at the lower end of our size range of five to nine members. Also, the test statistics confirm the validity of our model. In sum, we conclude that there is consistent evidence of a nonlinear, U-shaped effect of MPC size on inflation.

[14] For a recent application of GMM estimation in the board size literature, see, for instance, de Andres and Vallelado (2008).

The impact of MPC size on inflation variability and output growth

In another extension, we look at alternative dependent variables. In particular, we explore two alternative measures for monetary policy outcomes. First, we replace the (normalized) level of inflation with inflation variability. As Fry, Julius, Mahadeva, Roger, and Sterne (2000) report, stabilizing inflation around a given target is the focus of many inflation-targeting central banks; it is also close to the indicators of monetary policy success in standard micro-based models of monetary policy (e.g., Woodford 2003). In addition, monetary policy might also influence the average growth performance, for instance by avoiding excess interest rate volatility.

Table 3 presents the results. For each regressand, we report the results from two baseline regressions: the fixed effects specification and the OLS estimation with additional control variables. As shown in the first two columns of the table, the impact of MPC size on the variability of inflation mirrors its impact on the level of inflation: the estimated coefficients on membership size indicate a strong U-shaped relationship between MPC size and inflation variability, irrespective of the exact regression specification. Columns 3 and 4 tabulate analogous estimation results when real GDP growth is the dependent variable. For this regressand, the statistical association with MPC size is generally weaker; none of the estimated β coefficients is individually significantly different from zero. However, for some (unreported) specifications, the coefficients on the linear and quadratic term of MPC size change signs and are jointly significant, thereby exhibiting an inverted U-shaped pattern; that is, MPC enlargement initially tends to increase output growth, but this effect is reversed for large committees.

Overall, our key finding of a nonlinear association between MPC size and the monetary policy outcome seems reasonably robust. Moreover, our estimates imply that gains from varying MPC size in terms of lower and less volatile inflation do not involve a trade-off with output growth.

The role of other MPC characteristics

In Table 4, we vary our key variable of interest. Our default measure of MPC size is the number of MPC members as specified (de jure) in the central bank law.[15] Now we substitute this indicator with measures of de facto MPC size. More specifically, we distinguish between the total number of MPC members (i.e., the number of MPC positions actually filled in a given year) and the number of voting members in the MPC. As before, we tabulate the results for just two benchmark specifications to save space; results for other estimation specifications are qualitatively identical.

Reviewing the coefficients, the estimates appear to be somewhat smaller in magnitude and statistically slightly weaker than for de jure membership size. However, this finding is perhaps not too surprising, given that our size measure now also captures all minor fluctuations in MPC size (e.g., due to temporary vacancies) which are unlikely to have an immediate measurable effect on inflation. Generally, it is reassuring to note that our benchmark results are strongly confirmed. The number of monetary policy decision-makers has a strong and significant nonlinear effect on inflation. The optimal MPC size ranges between three and eight members, broadly in line with our earlier results.

Moving beyond membership size, we also analyze the effect of other measures that characterize a central bank's decision-making body on inflation. Many central bank laws specify not only the number of committee members but also the composition of the decision-making body. A frequent restriction, for example, is the presence of one or more government representatives in the MPC. Other central bank laws require the presence of regional or industry representatives (such as, for instance, a delegate from the national banking association). To examine the impact of these restrictions on inflation, we add a separate dummy variable for the de jure presence of each category of representatives. Columns 1 to 4 of Table 5 show the results of this specification for our default OLS framework; country fixed effects estimation appears to be inappropriate in this setting, given that there has been very little change in this feature over time. While we find no significant effect for the presence of government or industry delegates in the committee, our empirical findings suggest that central banks with required regional representation in the MPC tend to achieve, on average, lower inflation. A possible explanation is that regional representatives indeed bring relevant

[15] When a range is given, we use the mid-point.

information to the MPC. The non-significance of the variable indicating the presence of government agents in the monetary policy committee is equally remarkable. The conventional wisdom often interprets membership of government representatives in the decision-making body of a central bank as an indicator of a government-dominated and therefore more inflation-prone monetary regime (see, for instance, Berger, de Haan, and Eijffinger 2001).

We also explore measures that capture the extent of (de facto) membership turnover in the MPC. The number of central bank governor changes in a given period is frequently used as a proxy for (lack of) central bank independence and often found to be positively associated with inflation. Here, we also examine the effects of the frequency of changes in (non-governor) membership in the MPC on inflation.[16]

The four columns on the right of Table 5 contain the results. We begin by reporting estimates from the country fixed effects specification which is, in our view, a very strong test since the approach automatically controls for the average number of membership changes in a country over the sample period; the two columns on the extreme right tabulate the analogues from the OLS specification without fixed effects.[17] The estimated coefficients on the MPC membership turnover variable are consistently positive, which appears reasonable and is broadly in line with the literature on governor turnovers: greater turnover among central bank decision-makers is typically associated with higher rates of inflation. Not surprisingly, the coefficients increase in magnitude for the OLS specification, but only the estimate on membership turnover becomes statistically significant at any conventional level of confidence. Our finding of a nonlinear association between MPC size and inflation is unchallenged by this extension as is the estimated size range of the optimal number of monetary policy decision-makers.

Finally, Table 6 examines the possible interaction between the size of a central bank committee and quantitative targets in monetary policy. Fatas, Mihov, and Rose (2007) argue that both having established and meeting a quantitative goal for monetary policy is robustly associated with lower inflation. We explore whether MPC size possibly affects the

[16] To the best of our knowledge, this is the first attempt to evaluate the relevance of MPC membership turnover for economic outcomes. The literature on central bank turnover after Cukierman (1992) has focused exclusively on governors; see, for instance, Sturm and de Haan (2001) and Dreher, de Haan, and Sturm (2007). In our sample, the correlation between governor turnover and membership turnover is positive, but not excessively strong; the correlation coefficient is 0.54.

[17] The OLS regressions include the full set of auxiliary control variables but, to save space, only the coefficients of interest are reported.

effectiveness of the link between policy targets and economic outcomes; that is, we examine whether the effects of having and hitting a quantitative target differ for MPCs of different membership sizes.

To investigate this question, we distinguish between large and small MPCs. More specifically, we define a dummy variable that takes the value of one if a given MPC has more than fifteen members and, thus, is clearly 'too large' by the standards of our previous results. This dummy variable is then interacted with the variables signaling the presence of a monetary target and whether the target is hit.

The first column of Table 6 shows the estimation results for the presence of a quantitative goal for monetary policy. The model set-up is similar to our benchmark OLS regression with control variables as reported in the last column of Table 1, except that we add a further control for disproportionately large MPCs and an interaction term. We find that having a quantitative target helps reducing inflation, thereby confirming our previous results. Our estimates also indicate, not surprisingly, that central banks with extremely large MPCs face higher rates of inflation, though the coefficient is not significantly different from zero.[18] Finally, turning to our variable of interest, the estimated coefficient on the interaction term is negative and, with a p-value of 0.15, just misses borderline significance. Therefore, a cautious interpretation would suggest that having a transparent target for monetary policy appears particularly beneficial when the MPC is too large; the effectiveness of having a quantitative goal in reducing inflation is greater for large committees, perhaps working as a device to combine different views.

Column 2 presents analogous estimates for hitting the declared target. Similar to our benchmark findings reported earlier in Table 1, the inflation impact of this feature is much less pronounced, though the coefficient on the interaction term again takes a negative sign. When we include both interaction terms jointly (column 3), our previous results remain unaffected. In sum, there is clear evidence that the membership size of a central bank's MPC affects inflation both directly and indirectly.

[18] Not surprisingly, the inclusion of this additional control weakens the impact of the (other) MPC size variables.

5. Conclusion

There is a growing interest in central bank design and especially the optimal size of the central bank's monetary policy decision-making body. Empirically, the membership size of Monetary Policy Committees (MPCs) differs considerably across countries and, to a lower extent, also varies over time. However, while there is a broad consensus that groups make better decisions than individuals, there is little agreement on how large the MPC should be. Theory suggests that the net benefits of MPC size are decreasing as more members are added, mainly because decision-making costs and externalities in information processing gain in importance. Since the precise magnitude of these forces, however, depends on a variety of factors, the efficient size of a MPC is likely to vary across countries.

This paper adds to the debate from an empirical perspective, exploring the association between MPC size and the economic outcomes of monetary policy. To analyze this issue, we compiled a new data set that characterizes MPCs in over thirty countries from 1960 through 2006. Our data set contains information on the de jure and de facto membership size, the turnover in membership and the membership composition of a central bank's MPC. We then use all these measures to examine the effects of MPC design on inflation (and other economic outcomes), after controlling for other economic and institutional factors.

In our empirical analysis, we find a U-shaped relationship between MPC size (both de jure and de facto) and inflation. Our estimates suggest that the optimal MPC is of medium size, between five and nine members, and that very small or very large groups lead to higher-than-necessary rates of inflation. Qualitatively similar results are obtained for inflation variability. Other MPC characteristics also matter for the monetary policy outcome, though to a smaller degree. For instance, inflation is lower in the presence of regional representatives in the MPC, there is some evidence that inflation increases in MPC membership turnover and that MPC size and the effectiveness of monetary policy targets in reducing inflation are interlinked. Overall, our results strongly confirm that the institutional setup and, in particular, the size of a MPC are important features of central bank design.

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Table 1: Baseline results

De Jure Membership	0.0151 (0.0101)	-0.0138* (0.0065)	0.0169 (0.0097)	-0.0138* (0.0055)	0.0212* (0.0095)	-0.0120* (0.0050)	0.0027 (0.0045)	-0.0298** (0.0077)
De Jure Membership Squared		0.0014** (0.0005)		0.0015** (0.0004)		0.0015** (0.0003)		0.0017** (0.0004)
Openness (% GDP)			0.0004 (0.0004)	0.0003 (0.0004)	0.0004 (0.0006)	0.0003 (0.0005)	-0.0003# (0.0002)	-0.0004* (0.0002)
Budget Balance (% GDP)			0.0002 (0.0013)	-0.0001 (0.0011)	-0.0010 (0.0023)	-0.0016 (0.0020)	-0.0013 (0.0036)	0.0011 (0.0030)
Business Cycle (Growth–Avg Growth)			-0.0007 (0.0009)	-0.0007 (0.0008)	-0.0004 (0.0011)	-0.0003 (0.0009)	-0.0019 (0.0020)	-0.0021 (0.0014)
Log Real GDP per capita			-0.0482 (0.0824)	-0.0620 (0.0695)	-0.0586 (0.2864)	-0.0494 (0.2831)	-0.1039* (0.0433)	-0.1190** (0.0404)
Log Real GDP			0.0486 (0.0642)	0.0599 (0.0535)	0.0122 (0.2433)	0.0144 (0.2438)	-0.0110 (0.0124)	-0.0260* (0.0096)
Central Bank Independence					0.0618 (0.0350)	0.0422# (0.0230)	-0.0392* (0.0162)	-0.0474 (0.0310)
De Jure Quant. Monetary Target					-0.0473 (0.0337)	-0.0528 (0.0341)	-0.0804# (0.0441)	-0.0940** (0.0281)
Quant. Monetary Success					-0.0130 (0.0087)	-0.0017 (0.0083)	-0.0262 (0.0216)	0.0002 (0.0162)
Country Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	No	No
p-value, membership and membership squared = 0		[0.000]		[0.000]		[0.000]		[0.003]
Optimal Membership Size		5		5		4		9
Observations	1,276	1,276	1,134	1,134	671	671	671	671
Adj. R-squared	0.62	0.66	0.68	0.72	0.77	0.79	0.40	0.57

Notes: OLS estimation with year fixed effects. Country fixed effects models apply the McIntosh and Schlenker (2006) hybrid estimator. Dependent variable is the lead of normalized inflation. Robust standard errors, adjusted for clustering by country, are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 2: Specification sensitivity

Estimation method	OLS with five lags of inflation			Arellano-Bond GMM		
	Full Sample	Full Sample	Countries with change in m'ship	Full Sample	Full Sample	Countries with change in m'ship
De Jure Membership	-0.0079#	-0.0079	-0.0110**	-0.0036**	-0.0039**	-0.0025
	(0.0044)	(0.0048)	(0.0028)	(0.0007)	(0.0016)	(0.0019)
De Jure Membership Squared	0.0009*	0.0005	0.0009**	0.0004**	0.0004**	0.0004**
	(0.0004)	(0.0003)	(0.0002)	(0.0001)	(0.0000)	(0.0001)
Openness (% GDP)		-0.0001	-0.0001#		0.0000	-0.0002**
		(0.0001)	(0.0000)		(0.0002)	(0.0001)
Budget Balance (% GDP)		-0.0006	-0.0005		-0.0010#	-0.0005
		(0.0015)	(0.0010)		(0.0006)	(0.0005)
Business Cycle (Growth–Avg Gwth)		0.0008	0.0006		0.0017*	0.0022*
		(0.0012)	(0.0019)		(0.0007)	(0.0009)
Log Real GDP per capita		-0.0240	-0.0557#		0.0864*	-0.0443
		(0.0180)	(0.0259)		(0.0428)	(0.0420)
Log Real GDP		-0.0091#	-0.0070*		-0.0552#	0.0485
		(0.0046)	(0.0027)		(0.0328)	(0.0369)
Central Bank Independence		-0.0091	-0.0239		0.0038	0.0107
		(0.0088)	(0.0144)		(0.0045)	(0.0080)
De Jure Quant. Monetary Target		-0.0215	-0.0188		-0.0136	0.0002
		(0.0167)	(0.0143)		(0.0141)	(0.0132)
Quant. Monetary Success		-0.0075	-0.0011		0.0013	-0.0021
		(0.0069)	(0.0139)		(0.0070)	(0.0097)
Country Fixed Effects?	Yes	No	No	No	No	No
p-value, membership and membership squared = 0	[0.002]	[0.239]	[0.008]	[0.000]	[0.000]	[0.000]
Optimal Membership Size	4	8	6	5	5	3
Observations	1,141	665	326	1,114	641	314
Adj. R-squared	0.82	0.82	0.68			
Sargan Test				[0.73]	[0.99]	[0.99]
Second-Order Serial Correlation				[0.02]	[0.21]	[0.47]

Notes: The estimation method is noted in the first line. The country fixed effects model applies the McIntosh and Schlenker (2006) hybrid estimator. Dependent variable is the lead of normalized inflation. Robust standard errors are in parentheses; standard errors are adjusted for clustering by country in the OLS fixed effects estimation. **, * and # denote significant at the 1, 5 and 10 percent level, respectively. The GMM (Arellano-Bond) estimation uses all available lags of inflation as instruments.

Table 3: Other dependent variables

Dependent variable	Inflation variability		Output growth	
De Jure Membership	-16.9597*	-28.9002*	-0.0327	0.0962
	(8.2915)	(10.4200)	(0.2309)	(0.0942)
De Jure Membership Squared	1.4373**	1.7543*	-0.0005	-0.0047
	(0.3957)	(0.6297)	(0.0090)	(0.0045)
Openness (% GDP)		-0.1611		0.0148**
		(0.1266)		(0.0016)
Budget Balance (% GDP)		2.7702#		0.0160
		(1.4855)		(0.0271)
Business Cycle (Growth–Avg Grth)		-0.5574		0.9874**
		(1.0684)		(0.0090)
Log Real GDP per capita		-43.1282*		-1.6568**
		(20.1217)		(0.4850)
Log Real GDP		-18.0420#		0.1670
		(9.6164)		(0.1791)
Central Bank Independence		-9.6623		-0.1442
		(21.5393)		(0.2967)
De Jure Quant. Monetary Target		-46.2451*		0.0730
		(17.5139)		(0.4139)
Quant. Monetary Success		15.2392		-0.5233
		(13.4742)		(0.3361)
Country Fixed Effects?	Yes	No	Yes	No
p-value, membership and membership squared = 0	[0.000]	[0.035]	[0.757]	[0.593]
Optimal Membership Size	6	8		10
Observations	1,194	676	1,197	679
Adj. R-squared	0.84	0.58	0.35	0.93

Notes: OLS estimation with year fixed effects. Country fixed effects models apply the McIntosh and Schlenker (2006) hybrid estimator. The dependent variable is noted in the first line. Robust standard errors, adjusted for clustering by country, are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 4: Other measures of MPC size

De Facto Membership	-0.0078 (0.0071)	-0.0243* (0.0103)		
De Facto Membership Squared	0.0012** (0.0004)	0.0015* (0.0005)		
De Facto Voting Membership			-0.0145# (0.0074)	-0.0194* (0.0080)
De Facto Voting Membership Squared			0.0015** (0.0005)	0.0014** (0.0004)
Openness (% GDP)		-0.0005# (0.0003)		-0.0005 (0.0003)
Budget Balance (% GDP)		-0.0001 (0.0027)		-0.0001 (0.0029)
Business Cycle (Growth–Avg Grth)		-0.0034# (0.0020)		-0.0032 (0.0019)
Log Real GDP per capita		-0.1322** (0.0365)		-0.1205** (0.0352)
Log Real GDP		-0.0284* (0.0111)		-0.0194# (0.0111)
Central Bank Independence		-0.0277 (0.0225)		-0.0481* (0.0215)
De Jure Quant. Monetary Target		-0.1103** (0.0380)		-0.0964* (0.0411)
Quant. Monetary Success		-0.0168 (0.0220)		-0.0325 (0.0231)
Country Fixed Effects?	Yes	No	Yes	No
p-value, membership and membership squared = 0	[0.000]	[0.020]	[0.000]	[0.005]
Optimal Membership Size	3	8	5	7
Observations	1,299	691	1,300	691
Adj. R-squared	0.65	0.50	0.65	0.51

Notes: OLS estimation with year fixed effects. Country fixed effects models apply the McIntosh and Schlenker (2006) hybrid estimator. Dependent variable is the lead of normalized inflation. Robust standard errors, adjusted for clustering by country, are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Table 5: Other MPC characteristics

De Jure Membership	-0.0277** (0.0062)	-0.0280** (0.0057)	-0.0278** (0.0065)	-0.0280** (0.0055)	-0.0144* (0.0067)	-0.0140* (0.0066)	-0.0302** (0.0067)	-0.0299** (0.0076)
De Jure Membership Squared	0.0016** (0.0003)	0.0017** (0.0003)	0.0016** (0.0004)	0.0018** (0.0003)	0.0014** (0.0005)	0.0014** (0.0005)	0.0016** (0.0004)	0.0017** (0.0004)
Government Representatives	0.0047 (0.0097)			0.0002 (0.0080)				
Regional Representatives		-0.0223* (0.0085)		-0.0252** (0.0080)				
Industry Representatives			0.0008 (0.0042)	-0.0027 (0.0030)				
Turnover Rate Membership					0.0047 (0.0038)		0.0127* (0.0046)	
Turnover Rate Governor						0.0094 (0.0098)		0.0342 (0.0232)
Other Controls?	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Country Fixed Effects?	No	No	No	No	Yes	Yes	No	No
p-value, membership and membership squared = 0	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.003]
Optimal Membership Size	9	8	9	8	5	5	9	9
Observations	634	634	634	634	1,251	1,251	669	669
Adj. R-squared	0.60	0.62	0.60	0.62	0.67	0.66	0.60	0.58

Notes: OLS estimation with year fixed effects. Country fixed effects models apply the McIntosh and Schlenker (2006) hybrid estimator. Dependent variable is the lead of normalized inflation. Robust standard errors, adjusted for clustering by country, are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

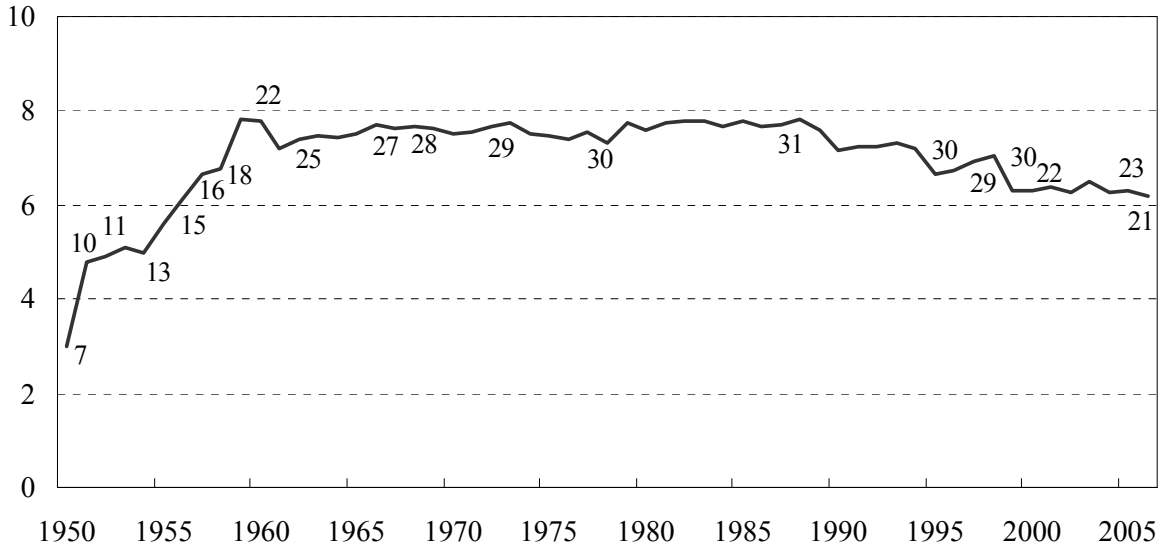
Table 6: MPC membership size and quantitative targets

De Jure Membership	-0.0181* (0.0082)	-0.0244** (0.0071)	-0.0177* (0.0080)
De Jure Membership Squared	0.0008 (0.0005)	0.0012* (0.0004)	0.0008 (0.0005)
Dummy for Large Committees (>15 Members)	0.3079 (0.2132)	0.1683 (0.1475)	0.3268 (0.2089)
De Jure Quant. Monetary Target	-0.0605* (0.0256)	-0.0998** (0.0285)	-0.0659* (0.0272)
De Jure Quant. Monetary Target × Large Committee	-0.2766 (0.1870)		-0.2458 (0.1733)
Quant. Monetary Success	-0.0121 (0.0126)	0.0138 (0.0179)	-0.0059 (0.0116)
Quant. Monetary Success × Large Committee		-0.1612 (0.1170)	-0.0633 (0.0408)
Openness (% GDP)	-0.0003* (0.0001)	-0.0003* (0.0001)	-0.0003* (0.0001)
Budget Balance (% GDP)	-0.0010 (0.0022)	0.0001 (0.0027)	-0.0012 (0.0023)
Business Cycle (Growth –Avg Growth)	-0.0014 (0.0012)	-0.0021 (0.0014)	-0.0015 (0.0012)
Log Real GDP per capita	-0.1055* (0.0391)	-0.1200** (0.0372)	-0.1063* (0.0389)
Log Real GDP	-0.0248* (0.0099)	-0.0317* (0.0119)	-0.0269* (0.0113)
Central Bank Independence	-0.0296 (0.0292)	-0.0356 (0.0318)	-0.0270 (0.0299)
Country Fixed Effects?	No	No	No
p-value, membership and membership squared = 0	[0.049]	[0.007]	[0.051]
p-value, large committee, policy measure and interaction = 0	[0.041]	[0.554]	[0.049]
Observations	671	671	671
Adj. R-squared	0.62	0.59	0.63

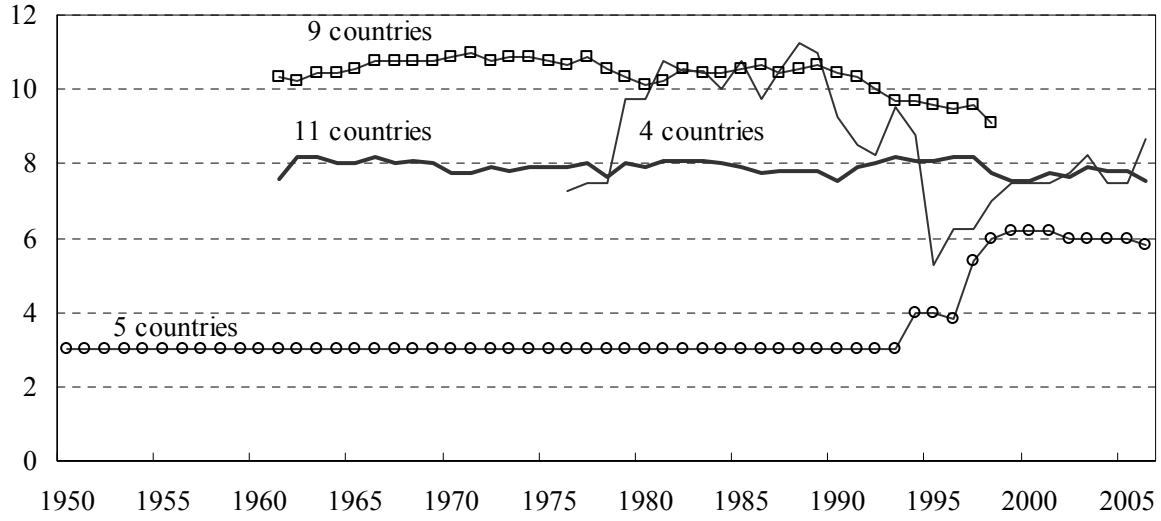
Notes: OLS estimation with year fixed effects. Dependent variable is the lead of normalized inflation. Robust standard errors, adjusted for clustering by country, are in parentheses. **, * and # denote significant at the 1, 5 and 10 percent level, respectively.

Figure 1: MPC Membership Size

(a) Sample average

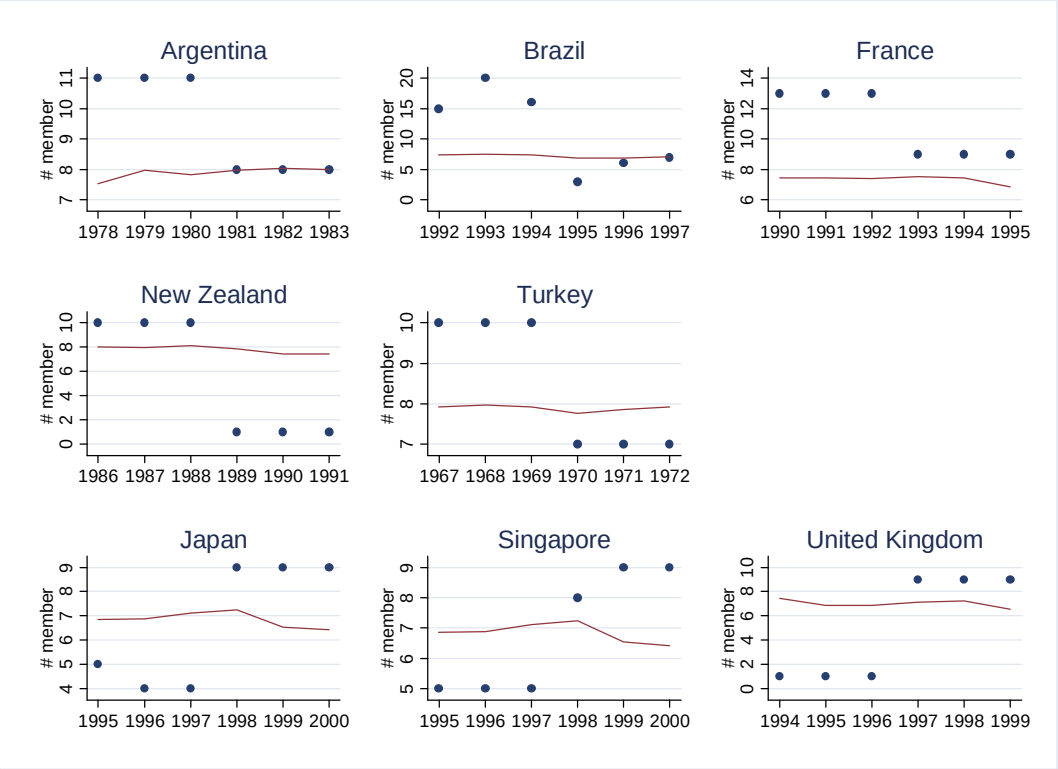


(b) Average for various groups of countries



Notes: Panel (a) plots the average membership size of monetary policy decision-making bodies; the numbers denote sample size. Panel (b) depicts the average MPC size for various groups of countries. Countries were grouped according to data availability. The groups are as follows. *5 countries*: Canada, Denmark, Japan, and Switzerland, and U.K.; *11 countries:* Australia, Iceland, Israel, Korea, Malaysia, New Zealand, Norway, Sweden, Trinidad & Tobago, Turkey, U.S.; *4 countries*: Botswana, Brazil, Mauritius, and Singapore; *9 countries (euro area):* Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal.

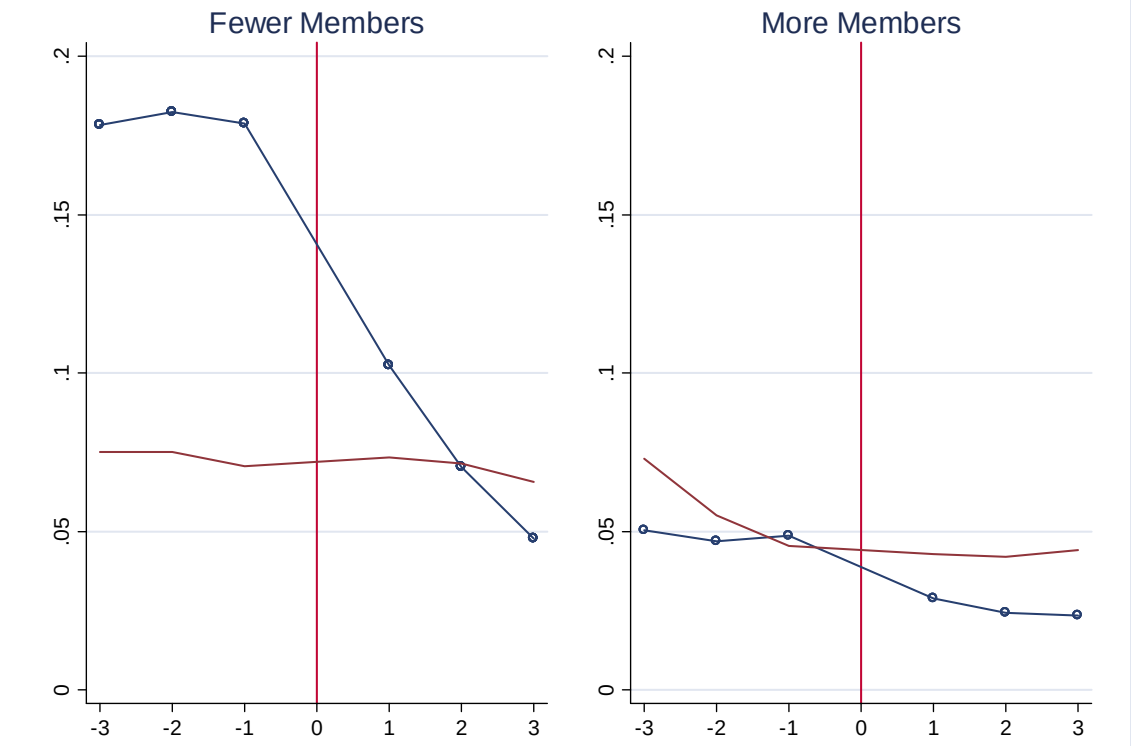
Figure 2: Episodes of Major Changes in MPC Membership Size



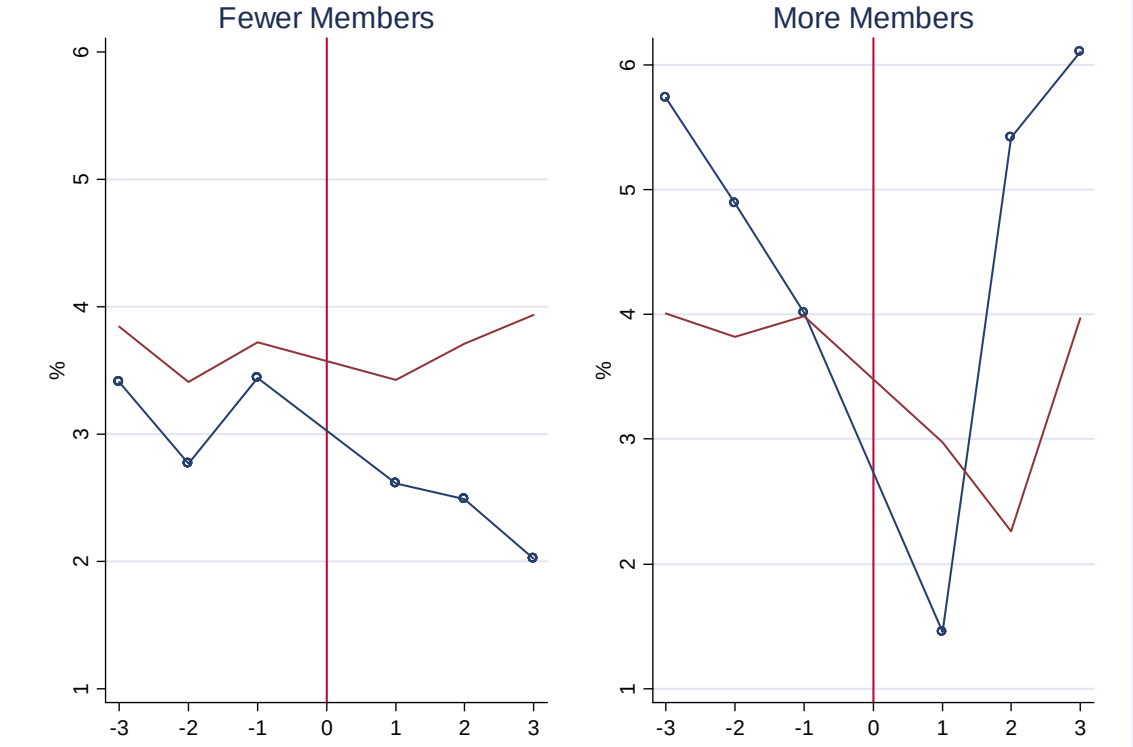
Notes: The dots show the number of de facto voting members; lines represent, for comparison, the sample average membership size of MPCs.

Figure 3: Inflation and Growth around Large MPC Changes: Event Study

(a) Inflation

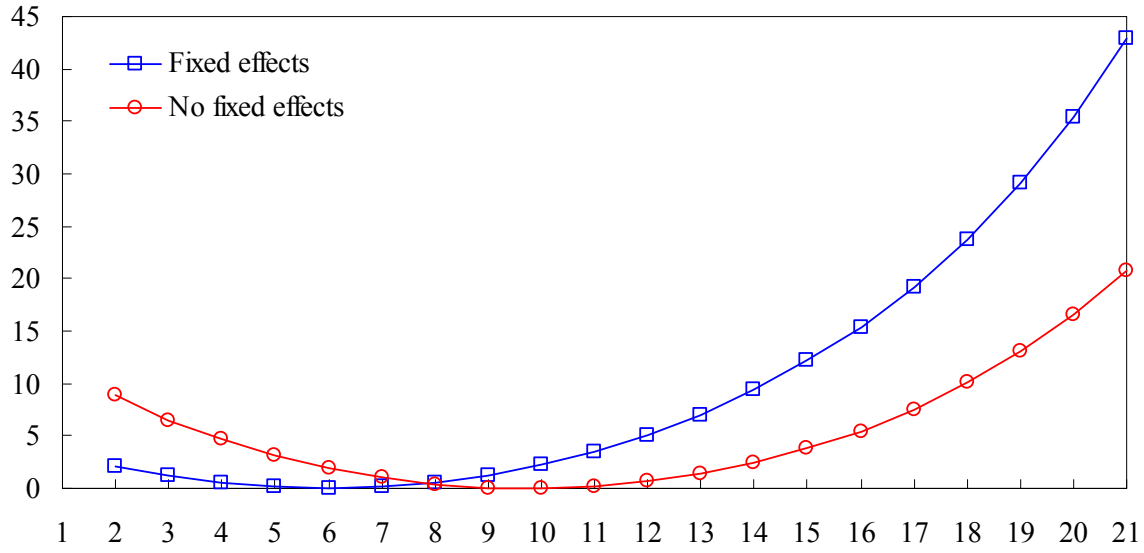


(b) Real GDP growth



Notes: Dotted lines show averages of the variable of interest for central banks with large changes in membership size; lines represent, for comparison, the sample averages.

Figure 4: Simulated Effect of MPC Size on Inflation



Notes: Inflation in percent. The simulation is based on the estimation results reported in column 2 (fixed effects, no other covariates) and column 8 (no fixed effects, other covariates) of Table 1, keeping all other variables constant. The minimum inflation rate has been calibrated to zero.

Appendix 1: Countries in sample

Argentina
Australia
Austria
Belgium
Botswana
Brazil
Canada
Denmark
Finland
France
Germany
Iceland
Ireland
Israel
Italy
Japan
Korea
Malaysia
Mauritius
Netherlands
New Zealand
Norway
Pakistan
Portugal
Singapore
Spain
Sweden
Switzerland
Thailand
Trinidad & Tobago
Turkey
U.K.
U.S.A.

Appendix 2: Data sources and variable list

Variable:	Description:	Source:
Inflation	CPI inflation, %	IMF IFS
Inflation Variability	Standard deviation of inflation over (non-overlapping) five-year intervals	Own compilation
Output Growth	Real GDP growth, %	Own compilation
De Facto Membership	Number of actual members in the MPC	Own compilation
De Jure Membership	Number of members in the MPC as defined in the central bank law	Own compilation
Membership Turnover Rate	Fraction of membership changes in total membership of MPC	Own compilation
Governor Turnover Dummy	Dummy variable if central bank governor changed	Own compilation
Government Representatives	Dummy variable if MPC comprises government representative(s)	Own compilation
Regional Representatives	Dummy variable if MPC comprises regional representative(s)	Own compilation
Industry Representatives	Dummy variable if MPC comprises industry representative(s)	Own compilation
Central Bank Independence	Dummy variable if central bank is independent	Acemoglu, Johnson, Querubin & Robinson
De Jure Quant. Monetary Target	Dummy variable if the country had a quantitative monetary policy target	Fatas, Mihov & Rose
Quant. Monetary Success	Dummy variable if the country hit its de jure quantitative target	Fatas, Mihov & Rose
Openness (% GDP)	Trade, % GDP, from PWT	PWT 6.2
Budget Balance (% GDP)	Government budget balance, % GDP, from IFS & WDI	IMF IFS
Business Cycle (Growth –Avg Growth)	Difference between real GDP growth and average (country-specific) GDP growth, percentage points	Own compilation
Log Real GDP per capita	Log of real GDP per capita (chain method)	PWT 6.2
Log Real GDP	Log of real GDP, computed from per capita GDP and population	PWT 6.2