Essays on the Political Economy of Monetary Policy: New Empirical Approaches and Evidence

By

Nicholas Walter Vivyan

A thesis submitted to the
Department of Government of the
London School of Economics and Political Science
for the degree of Doctor of Philosophy.

London, September 2010

UMI Number: U615330

Dissertation Publishing

Declaration

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than Chapter 3. Chapter 3 is based on a paper that was written jointly with Simon Hix and Bjørn Høyland and I certify that I was responsible for forty per cent of the data collection, data analysis, and writing up for this paper.

The copyright of this thesis rests with the author. Quotation from it is permitted, provided that full acknowledgement is made. This thesis may not be reproduced without the prior written consent of the author.

I warrant that this authorization does not, to the best of my belief, infringe the rights of any third party.

Abstract

This thesis is composed of three papers, each of which makes a distinct contribution to the study of the political economy of monetary policy. The first paper reassesses our empirical understanding of central bank independence (CBI) and its relationship with economic performance. To overcome flaws in existing indices commonly used to test the economic impact of CBI, I propose a Bayesian item-response approach to the measurement of cross-national CBI levels. After generating a new set of CBI scores I present a simulation extrapolation procedure enabling researchers to properly account for measurement error when using these scores in subsequent regressions. Using these methods to replicate a prominent existing study yields strong empirical evidence for a conditional economic impact of CBI. The second paper examines whether politicians use central bank appointments to induce electoral monetary policy cycles. An item-response model is used to measure the monetary policy preferences of appointees to the Bank of England's Monetary Policy Committee (MPC) based on interest rate voting records. Comparing the preferences of new appointees with their predecessors and studying movements in the median MPC ideal point over time, there has not been a straightforward electoral cycle in MPC appointments. Nevertheless, central bank appointments are important to UK monetary policy, since they have clearly shifted the median MPC ideal point. The third paper conducts a uniquely clean test for partisan central bank appointments by examining the National Bank of Poland (NBP), where we can observe the interest rate voting behaviour of different central bankers directly appointed by different partisan political actors. A novel statistical model of interest rate voting is derived and estimated, yielding monetary policy preference estimates for each appointee. In line with a partisan appointments hypothesis, parties with a more right-wing economic ideology tend to appoint central bankers with more restrictive monetary policy preferences.

3

Acknowledgements

Contents

List of Tables

List of Figures

1 Introduction

Monetary policy is one of the most important economic tools at a state's disposal and monetary policy decisions have significant economic consequences (Clarida et al. 1999; Friedman 2001, 2008). Contemporary economic theory says that by altering the supply of money and credit in the economy, a monetary policy authority can induce changes in both the rate of inflation and also – because of rigidities in the way economic actors adjust to price movements – in levels of output and employment. This theoretical assertion is supported by empirical research showing that monetary policy has a significant effect on inflation and output (Romer and Romer 1988, 2004; Bernanke and Blinder 1992). Emphasising the growing consensus among economists regarding this issue, Clarida et al. note that "there now seems to be broad agreement that the choice of how to conduct monetary policy has important consequences for aggregate activity" (1999 p.1661). Going further, Friedman argues that based on "the evidence from experience, in one country after another," it is clear that monetary policy "powerfully affects a country's economy, for either good or ill" (2001 p.9976).

If monetary policy is important for economic outcomes in society, then any political factors that influence monetary policy decisions are also important for economic outcomes in society. This logic compels us as political scientists to study and understand how and when political forces drive monetary policy. Given the economic importance of monetary policy, political elites in society will have a strong incentive to influence monetary policy – and through it, economic outcomes – for ideological or electoral ends (Nordhaus 1975; Hibbs 1977). The process in which these political interests interact with institutional rules, bureaucratic actors and economic agents to shape monetary policy outcomes, is the *political*

economy of monetary policy. The three papers in this thesis contribute to our understanding of this process, presenting new empirical methods and measures for the study of this topic and deploying these to gain new substantive insights.

In doing so, these papers draw upon a variety of literatures that deal with different aspects of the political economy of monetary policy. Prominent among these is the work on central bank independence (e.g. Cukierman 1992, 2008; Alesina and Summers 1993; Eijffinger and Schaling 1993; Arnone et al. 2006; Alpanda and Honig 2009, 2010). The main theoretical argument for central bank independence contends that delegating monetary policy to a central banker who is more inflation-averse (or 'conservative') than politicians – and who can thus credibly commit not to induce a surprise inflation, unlike politicians – will improve a country's inflation performance (Rogoff 1985).

In line with this prescription, there has been a remarkable global trend toward greater central bank independence over the past two decades (Blinder 2005; Cukierman 2008; Davies and Green 2010). During this period many countries, such as Canada, Japan, New Zealand, Poland, South Korea, Sweden and the UK, along with the sixteen Euro-zone member states, have adopted laws that significantly enhance the independence of their central banks. In each of these countries – and as had already been the case for several decades in a small number of other countries, including the United States and Germany – central bankers now make regular monetary policy decisions without the participation of elected politicians and without requiring formal government approval for these decisions. Politicians may choose targets for the central bank – such as a certain level of inflation or a more general goal of 'stable prices' – but they do not have a formal input into the bank's regular monetary policy decisions regarding key instruments – such as the interest rate at which it lends to private financial institutions, directions for open market operations, or the reserve requirements imposed on private banks. The scale of the convergence on this model for

monetary policy-making institutions has led some observers to conclude that "the movement toward central bank independence has seemed unstoppable in recent years" (Davies and Green 2010 p.141).

Yet despite this major global trend, the effort to gather robust empirical evidence concerning the economic consequences of central bank independence is still ongoing (e.g. Crowe and Meade 2008; Alpanda and Honig 2009, 2010; Alesina and Stella 2010). The first paper in my thesis (Chapter 2) contributes to this effort by addressing a key methodological question: how can we properly measure central bank independence so as to empirically test whether it improves economic performance? To tackle this problem I present a new Bayesian ordinal item-response approach to the measurement of central bank independence and demonstrate how researchers can appropriately use the new measures generated by this approach to test the economic impact of central bank independence. Like many of the main existing central bank independence measures, the Bayesian ordinal item-response approach that I present uses data sets containing categorical indicators which code central bank characteristics for different countries. However, unlike the existing central bank independence measures that are based on this indictor data, the new approach that I present aggregates indicators according to a principled statistical measurement model, accounting for the categorical nature of indicators and acknowledging measurement error. After inspecting the new measures of central bank independence that result, I also present a simulation-extrapolation technique that enables researchers to employ these new measures as inputs in regression analysis while properly accounting and correcting for measurement error. Finally, I use these new measures and methods to replicate a prominent existing study which showed that central bank independence can have a positive impact on economic performance, but that this is conditional on political context. In this application, using the new measures and properly accounting for measurement error leads to substantive inferences that reinforce our

confidence in the original findings and that are actually more consistent with the substantive

theory the original study sought to test.

But however well we quantify the level of central bank independence across

countries over time, in conducting analyses at this level of aggregation we inevitably risk

obscuring the nuances of the relationship between central bankers and politicians. By

studying these interactions in more contextual detail, we can develop a more rounded and

thorough understanding of the politics of monetary policy. For example, in a context where

there are strong formal constraints on politicians' ability to directly influence monetary policy

– which, as we have seen, is the case in many countries today – do politicians still attempt to

exert a indirect influence on monetary policy via central bank appointments? If so, what

exactly are their motives? And when are they likely to be successful in these attempts? In

particular, how do common institutional practices, such as the use of committees to make

monetary policy decisions, condition this influence?

The second two papers in this thesis (Chapters 3 and 4) address these questions by

conducting more fine-grained country-specific analyses of the political economy of monetary

policy. In thinking about politicians' motives with regard to monetary policy, a useful

starting point is the political business cycle literature, which yields two main schools of

thought as to what are the ends when politicians try to influence any macroeconomic policy

(see Franzese 2002 for an excellent review of this literature). First, the 'electoral business

cycle' theory argues that politicians generally seek to maximise their chances of re-election

by using macroeconomic policies to create economic expansions in the run-up to elections

(Nordhaus 1975). Thus, politicians' monetary policy incentives will depend on the electoral

timetable. In contrast, the 'partisan business cycle' theory posits that politicians' motives

regarding macroeconomic policies are determined by their partisan preferences over the

short-run trade-off between inflation and unemployment (Hibbs 1977). As a result, this

second school of thought argues that politicians from left- and right-wing parties will seek to induce systematically different economic outcomes through monetary policy: lower unemployment at the expense of higher inflation for left-wing parties, and lower inflation at the expense of higher unemployment for right-wing parties.

The early formulations of these theories – and empirical tests of them – often naively assumed that politicians had complete control over policy instruments (e.g. Nordhaus 1975; Hibbs 1977; Alesina and Sachs 1988). More recent theoretical and empirical work has taken a more "context-conditional" approach (Franzese 2002 p.371), asking whether and how politicians may influence macroeconomic outcomes given varying levels of international and domestic constraints on macroeconomic policy. With regard to monetary policy, important progress has already been made in understanding the effect of international constraints, such as formal or informal currency pegs (Clark and Hallerberg 2000; Plümper and Troeger 2006, 2008). Meanwhile, the literature on domestic constraints has examined the potential for political cycles in monetary policy in the context of relatively high levels of formal central bank independence. This latter literature focuses mainly on the German Bundesbank (Lohmann 1997, 1998; Vaubel 1997; Berger and Woitek 1997, 2005) or the US Federal Reserve (Gildea 1990; Havrilesky and Gildea 1992; Morris 2000; Chang, 2001, 2003; Chappell et al. 2005) and analyses politicians' ability either to 'directly' influence monetary policy using overt pressure on the central bank, or to 'indirectly' influence monetary policy via appointments to the central bank.

Empirical studies into these forms of influence have increasingly focused on the voting records of central bank committees (e.g. Chappell et al. 2005; Chang 2001, 2003; Berger and Woitek 2005). Such records detail the monetary policy stance of individual central bankers at each monetary policy meeting, allowing researchers to observe the monetary policy-making behaviour of central bankers appointed under varying political

conditions and therefore test whether their behaviour accords with different theories political influence over monetary policy. The second and third papers in this thesis build on this particular strand of work. Both papers introduce new statistical methods for the analysis of central bank committee voting records and show how these methods can be applied to test for electoral or partisan appointments to these monetary policy-making committees.

The second paper of the thesis shows that the Bayesian item-response models which are commonly employed to perform spatial analyses of legislator preferences (Martin and Quinn 2002; Clinton et al. 2004) can be usefully applied to the study of central bank committee voting. Estimating these models using Markov chain Monte Carlo methods (MCMC) yields measures of central banker monetary policy preferences which can in turn be used to perform a variety of tests as to whether appointments to central bank committees are subject to political influences. The paper derives a 'spatial' model of interest rate voting on a central bank committee, where central bankers have ideal points on an underlying 'dove-hawk' dimension which taps the relative restrictiveness of monetary policy given economic conditions. It then estimates this model using the voting records of the twenty-five individuals who served on the Monetary Policy Committee of the Bank of England between 1997 and 2008, generating a new set of measures of these central bankers' monetary policy preferences.

These measures are used to test for an electoral cycle in central bank appointments. The UK between 1997 and 2008 provides a favourable environment for an electoral cycle in appointments because a single party (the Labour Party) dominated government throughout this period and central bank appointment procedures allowed the government of the day to dominate central bank appointments. However, by comparing the preferences of new Bank of England appointees with those of their predecessors, and using preference estimates to chart the movement in the median member of the Monetary Policy Committee over time, this

paper shows that there does not appear to be a straightforward electoral cycle in Bank of England appointments. Nevertheless, it does provide evidence that central bank appointments *matter*, in the sense that the government was able to shift the position of the median voter on the Monetary Policy Committee over time.

The third paper in this thesis further develops the methods employe in the second paper, and applies these to the case of the Monetary Policy Council of the National Bank of Poland to test for partisan appointments to central banks. The Polish case provides an opportunity to conduct a uniquely clean test for partisan central bank appointments because, not only can we observe the monetary policy voting behaviour of individual central bankers in Poland (via published voting records), but these central bankers have been appointed by clearly identifiable, and differing, partisan political actors. Due to the unusual nature of the voting data for the Monetary Policy Council, standard legislative item-response models are not the most appropriate techniques for generating central banker preferences estimates in the Polish case. Therefore, in this paper I derive a novel hierarchical model of interest rate voting in the Council. This takes account of the discrete nature of the vote choices made by Polish central bankers and also utilises proposal-related information. As a result, when the model is estimated – using Bayesian MCMC methods – it yields measures of central banker preferences on an interest rate scale whose magnitude is easily interpretable. Using the resulting preference measures, I show that Polish central bankers appointed by parties with a more right-wing economic ideology do tend to prefer higher interest rates than those appointed by parties with a more left-wing economic ideology. But despite this clear evidence that politicians do *attempt* to make partisan central bank appointments, analysis of movements of the pivotal voter in the Polish central bank suggest that the magnitude of politicians' influence on policy is often restricted. Analysis suggests that this is due to a

combination of politicians' inability to appoint entirely reliable agents *ex ante*, together with certain key institutional features of the Council.

Overall then, the three papers in this thesis each make distinct substantive contributions to the study of the political economy of monetary policy. The first paper shows that we can measure levels of central bank independence over time and across countries in a more principled statistical manner and, in doing so, reveals that we can only measure this latent concept with substantial measurement error. It also reinforces our confidence in existing inferences regarding the economic impact of central bank independence by showing that these inferences hold when we properly account for measurement error. The second paper provides a spatial framework for the analysis of central bank committee voting records and uses this to show that, even in the UK context where conditions would seem to be most conducive to an electoral cycle in central bank appointments, there is little evidence that this type of cycle occurs. Finally, by analysing central bank committee voting records in the Polish context – where we are able to perform a uniquely clean test for partisan appointments – the third paper in my thesis shows that different political parties do appear to appoint central bankers with different monetary policy preferences, but that certain key institutional features constrain the impact of these appointments on monetary policy.

Although these three papers each deal with a different substantive aspect of the political economy of monetary policy, they are also united by their empirical methodological approach. Whatever the substantive context, each paper places an emphasis on the principled measurement and characterization of uncertainty regarding a key latent variable that is not easy to measure – whether this variable relates to central bank independence levels or the monetary policy preferences of individual central bankers. Each paper also demonstrates how Bayesian measurement models, when estimated via Markov chain Monte Carlo methods, can prove very useful for these purposes. The introduction of these methods to the

study of the political economy of monetary policy, and the application of these methods to generate new measurements of key variables, represent two of the most important overall contributions of this thesis.

The remainder of this text is structured as follows. In the next three chapters I present each of my three papers in turn. Then in the final chapter I summarise the contributions of these papers and discuss how future research can usefully apply and extend the methods and lessons learnt here.

2 Cross-national comparisons of central bank independence: how much information do we really have and how best can we use it?

Abstract

Robust empirical evidence concerning the economic effects of central bank independence (CBI) can aid in the design of appropriate monetary policy-making institutions. But existing tests for these effects are potentially flawed because they measure CBI using indices that (1) aggregate component indicators according to restrictive a priori assumptions, and (2) treat resulting CBI scores as if they are measured without error. This paper helps scholars to address these problems. First, I introduce an item-response approach to the measurement of CBI and use this to generate a new index. The resulting measures aggregate component indicators in a more principled fashion and are accompanied by estimates of measurement error variance. Second, I present methods that allow us to properly utilise these new measures and their accompanying measurement error estimates when analysing the economic effects of CBI. When these methods are used to replicate a prominent study of the relationship between CBI and economic performance results suggest that the reported impact of CBI in the original study is robust both to re-measurement and to uncertainty in the new measures. Results re-enforce our confidence in the impact of CBI, and even suggest that this may be stronger than originally estimated.

2.1 Introduction

Monetary policy can have a major impact on inflation, growth and unemployment. Therefore, political and institutional factors that influence monetary policy can have an important bearing upon a country's economic performance too. The "time-inconsistency" theory emphasises this point, predicting that countries where elected politicians exercise discretion over monetary policy will experience suboptimal inflation levels because these politicians cannot credibly commit not to use monetary policy to induce surprise inflation (Kydland and Prescott 1977; Barro and Gordon 1983). As a solution to this commitment problem political economists have advocated central bank independence: delegating monetary policy-making responsibility to a central bank that is incentivised to pursue price stability and can do so without political interference (Rogoff 1985).

Removing a key macroeconomic policy from the control of an elected government and delegating it to an unelected agency entails a cost in terms of democratic accountability (Alesina and Tabellini 2008). As a result, it is desirable that society is able to evaluate robust empirical evidence regarding the extent to which increased central bank independence (hereafter CBI) is actually likely to lead to improved economic outcomes. To this end, over the past three decades many scholars have sought to test whether, across countries and over time, higher levels of CBI are associated with lower levels of inflation and lower inflation variability. For example, in their comprehensive review of the literature on CBI, Arnone et al. (2006, p.75-78) list twenty-eight such studies conducted in the final three decades of the last century, and the number has continued to grow since in the first decade of this century (e.g. Clark and Hallerberg 2000; Cusack 2001; Keefer and Stasavage 2003; Crowe and Meade 2008; Alpanda and Honig 2009).[1]

---

[1] In addition to these studies, which focus on the economic impact of CBI, measures of CBI have also found wider use in the political economy literature. For example, researchers have used these measures to empirically analyse the political determinants and political consequences of CBI (e.g. Hallerberg 2002; Bernhard and Leblang 2002).

In attempting to test for its economic benefits scholars face the problem that operationalising CBI is not a straightforward task.[2] This is because the level of CBI in a given country at a particular time is a latent variable that cannot be observed and measured directly (Brumm 2000; de Haan et al, 2003). Rather, we can measure it only indirectly by using information from observable indicators which we believe to be (at least partially) a function of the underlying level of CBI in a country. Indeed, in the majority of empirical studies CBI is measured across countries using an index constructed from a set of component indicators, each of which reflects a different observable central bank characteristic. Several of these CBI indices have been developed, each drawing on data sets containing different combinations of indicators and covering varying countries and time-periods (e.g. Bade and Parkin 1977; Grilli et al. 1991; Cukierman et al. 1992; Alesina and Summers 1993; Eijffinger and Schaling 1993).

But these CBI indices suffer from important drawbacks. First, they aggregate component indicators according to restrictive and somewhat arbitrary predetermined weighting schemes and in a manner that ignores the categorical nature of most indicators. This may lead to the mis-measurement of CBI across countries, and in turn to biased inferences when the index is used as a predictor variable in regression analysis. Second, these indices do not quantify the uncertainty with which they measure CBI. As a result, when using a CBI index to proxy true CBI in regression analysis, scholars are unable to properly account for the measurement error inherent in this proxy. This is again likely to lead to biased inferences. In short, existing CBI indices suffer from potential shortcomings, and we should be concerned about these shortcomings because they may impact upon subsequent inferences regarding the economic consequences of CBI.

---

[2] Of course, this is not the only problem facing scholars interested in the economic impact of CBI. For example, another key concern is the potential endogeneity of CBI (Posen 1993, 1995).

This paper addresses these concerns and in doing so makes three contributions to the study of monetary policy-making institutions. First, I introduce an item-response theory (IRT) approach to the measurement of CBI, and apply this approach to a prominent existing set of indicators to generate a new CBI index. IRT models are frequently used to measure latent variables in educational testing (e.g. Johnson and Albert 1999; Fox 2010) and increasingly so in political science (e.g. Martin and Quinn 2002; Clinton et al. 2004; Treier and Jackman 2008; Høyland et al. 2009; Hanretty and Koop 2009), but this is the first time they have been used to study the independence of central banks.[3] Using the IRT approach results in measurements that weight the information contained in component indicators in a principled statistical manner. The approach also explicitly models the categorical nature of many component indicators in CBI indices. Comparisons between this new CBI index and the existing index constructed from the same indicators suggest that the IRT approach leads to substantively different measurements for many country-periods.

The second contribution of this paper is to provide uncertainty estimates to accompany the new CBI measures generated using the IRT approach. The use of a full measurement model, and in particular its estimation via Bayesian Markov chain Monte Carlo (MCMC) methods, allows us to straightforwardly summarise the uncertainty with which we measure CBI for each observation. Moreover, inspection of uncertainty estimates suggests that measurement error is substantial in the context of CBI.

The third contribution of the paper is to present and apply a 'simulation-extrapolation' method (Carroll et al. 2006; Battuaz et al. 2008) that allow us to properly account for measurement error when using CBI as a predictor in subsequent regression analysis. Like the IRT approach to measurement, this simulation-extrapolation method is previously unused in the CBI literature. To demonstrate its usefulness and to investigate the

---

[3] Hanretty and Koop (2009) employs an IRT approach to generate point estimates of the de jure independence of other regulatory agencies. However, unlike this paper, it does not estimate measurement error or examine how this can be dealt with in subsequent analyses where these measures are used as input variables.

.

consequences of the IRT approach to CBI measurement, I use the ordinal IRT measures and simulation-extrapolation method to replicate one prominent empirical study of the economic consequences of CBI. Results suggest that the economic impact of CBI reported in the original study is robust to uncertainty in the measurement of CBI, and is likely stronger when we use statistical methods that extrapolate to a situation of no measurement error. Thus, at least in this case, our confidence in the economic benefits of CBI is reinforced.

The paper proceeds as follows. In section two, I describe the problems with existing approaches to the measurement of CBI in more detail and introduce the particular set of indicators that will be the focus of this paper. In section three, I present the IRT approach to CBI measurement and inspect the resulting set of estimates. In section four, I present and apply methods to account for estimated measurement error when using the new index to test for the economic consequences of CBI. Finally, section five concludes and discusses potential extensions of this new approach to the measurement of CBI.

2.2 The challenge of measuring central bank independence

Existing approaches to the measurement of central bank independence

Over the past three decades, numerous researchers have contributed to the effort to measure the degree of CBI across countries and over time. Bade and Parkin (1977) set the template for this type of endeavour, coding key characteristics of central bank laws in twelve OECD countries to produce a set of categorical indicators relating to the *de jure* autonomy a national central bank. Subsequent researchers have tended to follow this basic template of coding different institutional aspects of central banks based on legal documents, but have broadened the scope of the countries and periods analysed and increased the detail of the indicators

collected (e.g. Grilli et al. 1991; Cukierman et al. 1992; Alesina and Summers 1993; Eijffinger and Schaling, 1993; Crowe and Meade 2008). In addition, recognising that legal provisions may not always reflect the practical functioning of monetary policy-making institutions, researchers have also sought to develop measures of the *de facto* independence of central banks (Cukierman et al. 1992; Cukierman and Webb 1995; Alpanda and Honig 2010), such as the rate of turnover among central bank governors. As a result of these numerous contributions, there exists today an impressive amount of data on various CBI-related indicators recorded for various ranges of countries and time-periods.[4]

This paper focuses on one particular set of *de jure* CBI indicators developed by Alex Cukierman, Steven Webb and Bilin Neyapti (CWN hereafter) (Cukierman et al. 1992).[5] This choice is made for several reasons. First, the indices developed by CWN to summarise their *de jure* indicators are among the most widely used measures of CBI in the literature (Arnone et al. 2006).[6] Second, of all the available sets of indicators, the CWN data represents the richest source of systematically codified, fine-grained information regarding the institutional characteristics of central banks. Third, the CWN data also records this information for a uniquely extensive cross-section of countries and over a lengthy time-period. Fourth and finally, this data is publicly available in a fully disaggregated format (Cukierman et al. 1992 p.383-395; Cukierman 1992 p.396-414).

The CWN data covers seventy developed and developing countries over four time periods (p. 360): the 'gold standard' period (1950-59); the 'dollar convertibility' period (1960-71); the 'two oil-shocks period' (1972-79); and the 'disinflation and debt crisis' period

---

[4] Arnone et al (2006) provide an excellent and detailed review of the differences between existing sets of *de jure* and *de facto* CBI indicators.

[5] It should be noted, however, that the methods presented below could be adapted to combine information from various sets of *de jure* and *de facto* CBI indicators. This is left to future work.

[6] Aside from Cukierman (1992) and Cukierman et al (1992) other studies that use CWN's indices to analyse the economic effects of CBI include: Posen (1995); Banaian et al (1995); Fuhrer (1997); Campillo and Miron (1997); Banaian et al (1998); Crosby (1998); Sikken and de Haan (1998); Cukierman and Lippi (1999); Oatley (1999); Way (2000); Keefer and Stasavage (2003); Hayo and Voigt (2008).

(1980-89).[7] For each country-period the authors code sixteen ordinal-level indicators, each of which captures a different aspect of the formal relationship between the central bank and other political institutional actors within a country. Each of these sixteen indicators is coded using equidistant increments on the [0, 1] interval, with higher scores assigned to categories that are perceived to be associated with greater CBI. Table 2.1 presents the coding scheme developed by CWN for each of these indicators in more detail.

[TABLE 2.1 ABOUT HERE]

Though some authors have critiqued CWN's coding of particular indicators for particular countries (Mangano 1998; Banaian et al. 1998), this paper focuses on the problem of aggregating their data, as given, into a single measure of CBI. However, it should also be emphasised that we face the same essential aggregation problem when working with the CWN data as with any other existing set of *de jure* CBI indicators: namely, combining information from binary or ordinal indicators into a single summary measure of CBI (Banaian 2008). Therefore, an appropriate statistical approach for summarising the CWN indicators would also be applicable to other sets of *de jure* CBI indicators.

CWN's own approach to this aggregation problem involves two stages. In the first step, and as detailed in Table 2.1, they group the sixteen indicators into four "clusters" (p. 356): the terms of appointment for the chief-executive of the central bank; the central bank's role in policy formulation; the objectives of the central bank; and the limitations on central bank lending to the public sector. For each country-period, CWN summarise the information contained in the 'terms of appointment' cluster by taking the un-weighted mean of these indicators. For the 'policy formulation' cluster, they perform the same procedure, but employ a weighted mean (with weights of 0.25, 0.5, and 0.25 respectively for the three policy

---

[7] Crowe and Meade (2008) have extended the CWN data by coding the same set of indicators for countries an even broader set of countries in 2003. However, at present the fully disaggregated data (i.e. the values taken by each country on the sixteen individual indicators in 2003) are currently not publicly available. This fully disaggregated information is essential for the re-measurement procedure employed below, so in this paper I use only the data originally presented in Cukierman et al (1992).

formulation indicators detailed in Table 2.1). The 'objectives' cluster consists of one indicator and so requires no further aggregation at this stage. For the 'limitations on lending' cluster, the first four indicators are treated separately, while the final four are summarised by taking an un-weighed mean. Thus, this first step yields eight variables: three variables corresponding to the first three clusters, and five for the final cluster.

In the second step of the aggregation procedure CWN calculate a weighted mean of the eight cluster variables generated in the first step, with the weights used in this second step detailed in the 'weights' column of Table 2.1. The resulting summary CBI index was dubbed the LVAW (legal variables aggregate weighted) measure in Cukierman (1992), which also presents an alternative summary index, LVAU (legal variables aggregate un-weighted). As its name suggests, this latter index is calculated using precisely the same procedure as for LVAW, except that in the second step the eight summary variables are aggregated via an un-weighted average.

Problems with the Cukierman et al. (1992) approach to aggregating CBI indicators

The CWN data represents a uniquely rich source of information regarding the degree of CBI across countries and over time, but there are two key methodological drawbacks with the way in which the LVAW and LVAU indices summarise this information.

First, both indices aggregate component indicators according to restrictive *a priori* assumptions. For example, by assigning fixed weights to indicators during the aggregation procedure, CWN make very restrictive assumptions regarding the direction and strength of the relationship between each indicator and the underlying level of CBI that they seek to measure (Banaian et al. 1998). In the case of either LVAW or LVAU, these fixed weights imply an assumption that all cluster variables are positively related to underlying CBI and an assumption about the exact strength of these relations. This is the case whether weights are

25

fixed to a set of varying values under LVAW, or to a set of equal values as in the second stage of construction of LVAU.

A further complication here is the way in which CWN deal with missing entries for indicators. These occur at the data collection stage "whenever the charter of a [central bank] does not contain enough information to reliably code a particular legal variable" (Cukierman 1992 p.378). When aggregating indicators into cluster variables for a given country-period, CWN drop any indicator with a missing entry for the country-period in question, and re-assign the weight originally attached to that indicator proportionally to the remaining indicators within the cluster. They apply the same rule when aggregating cluster variables into the final LVAW or LVAU score. Thus, in the construction of these indices, a given indicator is assumed to differentially influence the level of measured CBI for two different country-periods if there happens to be a missing entry on another particular indicator for one country-period but not the other.

Overall, CWN give little theoretical justification for the particular weights they choose in either the first or second steps of the construction of LVAW, stating only that they use the weights that they "find most plausible" (p. 361). In a situation such as this one, where there do not appear to be strong theoretical reasons to guide the assignment of weights to each indicator, it is better to utilise an aggregation method that – based on the data at hand – *estimates* the nature and strength of the relationship between individual indicators and a latent variable of interest (Rosenthal and Voeten 2007 p.716).

Recognising this, some researchers have previously sought to summarise the CWN data using methods that do not aggregate indicators according to restrictive weighting assumptions. Banaian et al. (1998) use principal-components analysis for this purpose. In fact, CWN themselves report using the same technique to check the robustness of the relationship between LVAW and average inflation across country-periods (p. 374).

However, even the principal-components approach shares another restrictive assumption with the LVAW and LVAU aggregation methods: all falsely treat the CWN indicators as interval-level indicators when they are really only provide ordinal information. By treating these ordinal indicators as continuous and assigning equidistant values to categories on each indicator we are imposing the assumption that a movement from the first to the second category on a given indicator must imply the same change in our measure of CBI as a movement from the third to fourth category on the same indicator (Banaian 2008 p.10). Take the example of the *monpol* indicator in Table 2.1, which concerns the formulation of monetary policy: is it plausible that a movement from a situation where the central bank "only advises government" to one where the central bank "participates in the policy-making process, but has little influence" reflects the same increment in underlying CBI as a movement from the latter category to one where "the bank alone" formulates policy? Ideally, this is an assumption to be tested. Thus, we seek a measurement model that simultaneously allows us to relax assumptions regarding the relative weighting of different indicators and that explicitly models the ordinal nature of these indicators.

The second major drawback with the LVAW and LVAU indices is that they offer point estimates of CBI but do not provide information regarding measurement error. If we conceptualise each observed indicator in the CWN data as a function of the underlying level of CBI in a given country-period, then there are two principle sources of error inherent in attempts to infer latent levels of CBI based on these observed indicators.[8] For one, as the earlier discussion regarding the weighting and ordinal nature of indicators illustrated, we do not know the values of the parameters that govern the relationship between observed indicators and underlying CBI levels. Rather, we have to make (uncertain) inferences regarding these parameters based on the data. Furthermore, even if we did know these

---

[8] This assumes the specific data contained in the CWN data are not subject to coding errors.

parameters with certainty, the function that maps underlying CBI levels to observed indicators is likely to be of a fundamentally stochastic nature. For example, we might generally expect that a country with a highly independent central bank will generally have an observed score of 1.00 on the *monpol* indicator (i.e. the bank will formally have the power to formulate monetary policy unilaterally). But we cannot be certain that this will be the case in every instance. Together, our uncertainty as to the parameters that relate latent CBI to observed indicators and the inherently stochastic nature of this very relationship, mean that we cannot infer CBI levels with certainty.

And this uncertainty matters because we generally want to use measures of CBI as independent variables in subsequent regression analysis. Using predictors measured with error in regression can lead to biased inferences if we naively treat these predictors as measured without error (Carroll et al. 2006; Jackman 2008). Brumm (2000) explicitly accounts for measurement error by estimating a measurement model that treats LVAW itself as a continuous indicator of CBI, alongside other proxies for *de facto* CBI. However, because it uses the LVAW index as given, this approach again does not account for the ordinal nature of the CWN indicators. Nor does it relax the restrictive assumptions CWN make about the relative weighting of indicators when creating the LVAW index. A preferable measurement model would estimate uncertainty at the stage where the CWN indicators are aggregated, and would simultaneously address other aggregation issues regarding the categorical nature of the indicators and the appropriate weighting of the indicators.

2.3 An item-response approach to the measurement of central bank independence

The last section identified two major concerns with the methods used to construct the main existing measures of central bank independence: (1) these methods impose restrictive *a priori* assumptions during the aggregation of component CBI indicators; and (2) these methods fail to yield information regarding measurement error in resulting CBI indices. In this section I present an ordinal item-response measurement model that allows us to address these concerns. In doing this I draw on Treier and Jackman's (2008) application of the ordinal IRT method to the measurement of democracy across countries, which demonstrates the applicability and utility of the approach in situations where the researcher wants to measure a continuous latent variable based on multiple ordinal indicators. Their ordinal IRT approach explicitly models indicators (items) as ordinal variables, each of which are related to a latent variable via a stochastic function. The parameters that govern this relationship are estimated alongside latent variable scores using a Bayesian Markov chain Monte Carlo (MCMC) algorithm. This estimation method has the advantage of generating corresponding uncertainty estimates for all model parameters in a straightforward manner.

Model and estimation

To formally define the ordinal IRT approach to CBI measurement, let each entry x_{ij} in the CWN data matrix be the value of indicator $j = 1, ..., M$ for country-period $i = 1, ..., N$. The labels of each indicator j were transformed from equidistant increments on the [0, 1] interval (the labels assigned by CWN) to integer values $k = 1, ..., K_j$, where K_j is the total number of

categories defined for indicator j.[9] The ordinal IRT approach models the observed x_{ij} as follows:

$$\Pr[x_{ij} = 1] = \Phi[\tau_{j1} - \gamma_j \theta_i]$$

$$\Pr[x_{ij} = k] = \Phi[\tau_{jk} - \gamma_j \theta_i] - \Phi[\tau_{j,k+1} - \gamma_j \theta_i], \qquad k = 2, \dots, K_j - 1$$

$$\Pr[x_{ij} = K_j] = 1 - \Phi\left[\tau_{j,K_j-1} - \gamma_j \theta_i\right]$$

where Φ is the normal cumulative distribution function. The θ_i in these equations are our key parameters of interest, as they represent the latent level of central bank independence in country-period i. The other parameters in this model govern the nature of the relationship between latent CBI and each indicator variable j. The γ_j are discrimination parameters, which measure the strength and direction of the association between CBI and an observed indicator j. For example, if $\gamma_j = 0$ then there is no association between latent levels of CBI and the probabilities of responses on indictor j, whereas if $\gamma_j > 0$ then an increase in CBI is associated with an increased probability of higher response categories on indicator j. Given the labelling of indicator categories, our expectation is that γ_j are positive for all indictors in the CWN data. Finally, for each indicator j there are $K_j - 1$ threshold parameters τ_{jk}, which govern the way in which continuous latent responses $\gamma_j \theta_i$ are translated from a latent scale into observed response categories. Readers will note that this model is related to a simple ordered probit, except that there are multiple response variables and all terms on the right-hand side of each equation are unknowns about which we want to draw inferences.

This model is fitted to data containing the responses of $N = 242$ country-periods (seventy countries over a maximum of four time-periods) on $M = 14$ indicators. This analysis only includes country-periods that have enough observed indicator-responses for

---

[9] This re-labelling of indicator values preserves the ordering implied by CWN's original coding scheme.

CWN to calculate their LVAW score.[10] Also, of the sixteen original CWN indicators, two

binary indicators (*adv* and *lprim*) are dropped from the analysis. This is because the

responses for these indicators are extremely lopsided,[11] resulting in highly unstable item-

parameter estimates for these indicators during trial runs of the MCMC estimation

procedure.[12]

The Bayesian MCMC algorithm used to fit the ordinal IRT model to this data

proceeds by iteratively sampling from the conditional distributions of model parameters.[13]

This process yields a set of samples from the joint posterior distribution of the model

parameters given the observed data and priors.[14] I implement this MCMC estimation

[10] CWN do not calculate summary LVAW scores for any country-period where the sum of weights for missing cluster variables is greater than 0.3.

[11] Only two country-period observations (both corresponding to Ethiopia) score 1 on *adv*, while only four country-periods observations (all corresponding to China) score 1 on *lprim*.

[12] Other parameter estimates were however, robust to the inclusion of these two indicators in the model.

[13] For more details on Markov chain Monte Carlo algorithms in general, see Gelman et al. (2003) Gill (2008), and Jackman (2009).

[14] I assign independent standard normal priors for the latent CBI parameters θ_i. These priors induce "near-identification" of the latent CBI scores (Jackman 2009 p. 441). However, to ensure full identification of the location and scale of these latent scores, I follow Treier and Jackman (2008 p. 214-215) by standardising the vector of θ_i's sampled at each MCMC iteration to have mean zero and unit variance, and by transforming other model parameters to account for this standardisation.

Diffuse independent normal priors (mean zero, variance nine) are assigned for thirteen of the fourteen discrimination parameters γ_j. To identify the direction of the latent CBI scale (Quinn 2004) I constrain the one remaining discrimination parameter to be positive (again using a normal prior with mean zero and variance nine, but truncating this to lie above zero). This constraint was applied for the γ_j corresponding to the *conf* indicator, and appears reasonable since the marginal posterior distribution of this parameter is concentrated a good distance from zero.

For threshold parameters the discussion of priors is a little more involved. This is because, for each indicator j, the *MCMCordfactanal* function in R automatically estimates an additional "negative item difficulty parameter" (assigned a normal prior with mean zero and variance nine), equivalent to an indicator-specific intercept on the latent response scale (Quinn 2004 p. 340). For any indicator j, if the difficulty parameter is a free parameter to be estimated, then it and the threshold parameters τ_{jk} are only jointly identified if one threshold parameter is fixed. The *MCMCordfactanal* function solves this by fixing τ_{j1} to zero for all indicators, and assigns remaining threshold parameters uniform priors (Quinn 2004).

The interpretation of an ordinal IRT model is more straightforward if we can simply describe the properties of indicators in terms of item discrimination and threshold parameters, rather than referring to also difficulty parameters. Thus the results reported in this paper are based on a post-estimation transformation of the threshold parameter values generated by the *MCMCordfactanal* function. Specifically, at each MCMC iteration, for each indicator j, I subtract the sampled "negative item difficulty parameter" from each of the $K_j - 1$ sampled threshold parameters and store the resulting transformed threshold parameters. Estimating the ordinal IRT model via *MCMCordfactanal* and then transforming sampled threshold parameter values using this iteration-by-iteration procedure is equivalent to estimating an ordinal IRT model where no constraints are imposed on threshold parameters and the item-difficulty parameters are fixed to zero. The former approach is utilised here because of the greater computational efficiency of the *MCMCordfactanal* function compared to estimating a self-programmed ordinal IRT model using standard software such as WinBUGS (Spiegelhalter et al 1999) or JAGS (Plummer, 2009).

approach using the *MCMCordfactanal* function in the *R* package *MCMCpack* (Martin et al. 2009). After discarding 100,000 iterations of the MCMC sampler as burnin, I ran 1,000,000 iterations and stored every100[th]. This generates a sample of 10,000 draws from the joint posterior distribution from which we can make inferences regarding model parameters.[15]

Before turning to the estimation results, it is worth noting that the MCMC procedure also deals with missing responses in a more principled manner than the CWN aggregation procedure. Of the 3388 cells in the data matrix described above, 313 entries (9 per cent) are missing. The Bayesian MCMC approach treats these missing responses as additional parameters to be estimated based on the model, observed data and priors (Jackman 2000a). Because these inferences are made with uncertainty and because the MCMC algorithm allows this uncertainty to propagate into estimates of other model parameters, it will tend to estimate latent CBI scores with greater uncertainty for country-periods that have more missing indicator responses. This more systematic treatment of missing values again demonstrates the advantages of utilising a fully specified measurement model together with MCMC estimation procedures, in order to measure levels of CBI across country-periods.

Estimation results

To ease interpretation, I present estimation results graphically. Figure 2.1 summarises the estimated ordinal IRT item parameters. The left-hand panel plots the posterior mean and the ninety-five per cent confidence interval for each of the fourteen item discrimination parameters. The majority of CWN indicators are estimated to have a clear positive association with latent CBI levels, as expected. But for four indicators we are plainly unable to distinguish estimated discrimination parameters from zero with ninety-five per cent confidence (*too, app, off, lwidth*), and for one other indicator (*ltype*) we are marginally unable

---

[15] Standard diagnostic checks recommended by Jackman (2009) indicated that the sampler had converged for each of the model parameters, and the sampler displayed good mixing with respect to each parameter.

to do so. This raises a question as to whether these particular indicators, as currently defined by CWN, actually provide us with useful information regarding latent levels of CBI across country-periods. Future research could usefully re-examine the way in which the institutional characteristics classified by these indicators are likely to relate to CBI, and re-design the classification scheme for these indicators accordingly.

[FIGURE 2.1 ABOUT HERE]

More generally, the left-hand panel of Figure 2.1 makes clear that there is considerable variation across CWN indicators in terms of the strength of association between latent CBI levels on the one hand and response probabilities on the other. As was made clear in section two, the LVAW index is also constructed based on the assumption that there is such variation in the strength of association between indicators and underlying CBI levels. But the advantage of the ordinal IRT approach is that it allows us to *estimate* the pattern in this variation in a principled manner, based on the model and data, rather than *fixing* relative strengths of association *a priori*. Furthermore, note that the widths of the ninety-five per cent confidence intervals that surround the item discrimination parameter point estimates show that uncertainty in these parameters is non-negligible. The measurement approach adopted here allows this uncertainty to propagate into inferences regarding latent CBI levels across country-periods.

The right-hand panel of Figure 2.1 displays posterior means and ninety-five per cent confidence intervals for each of the threshold parameters relating to each indicator. Recall that the LVAW and LVAU indices treat the CWN indicators as interval-level variables, and hence assume that a movement from the first to the second category on a given indicator must imply the same change in CBI as a movement from the second to third category on the same indicator. This assumption appears to be unsupported when we inspect the threshold parameters estimated by the ordinal IRT model. For example, the relative distances between

the thresholds estimated for the *conf* indicator suggest that a movement from the second to the third category of *conf* is associated with a much smaller increment in latent CBI than is a movement from the first to the second category of *conf*. This illustrates the ability of the ordinal IRT model to accommodate nonlinear relationships between indicators and latent CBI levels, and also its usefulness for assessing the plausibility of assumptions made by other measurement approaches.

Of course, the parameters of primary interest in this measurement exercise are the estimated latent levels of central bank independence for different country-periods. How do the ordinal IRT estimates of CBI compare with the CBI scores assigned by the LVAW index? The left-hand panel of Figure 2.2 displays a simple scatter plot of LVAW scores (standardised to have mean zero and unit variance) against ordinal IRT point estimates of CBI, for the 242 country-periods in the data used to fit the ordinal IRT model. The general grouping of points along the diagonal, together with the reported Pearson correlation of 0.88 suggests that both LVAW and ordinal IRT estimates are broadly measuring the same latent construct.

[FIGURE 2.2 ABOUT HERE]

However, scatter-plots and correlation coefficients can disguise the disagreement between two methods of measurement if the 'between variation' of scores across units is high relative to the 'within-variation' of measured scores recorded for the same unit by the different measurement methods (Bland and Altman, 1983). To assess agreement between two measures more clearly, we can use a 'Bland-Altman plot' which is commonly used for this purpose in clinical measurement (Cox 2004). For each observation, it plots the average of the measurements taken by the two methods on the x-axis, against the difference between

34

the two measurements on the y-axis.[16] Because the LVAW and ordinal IRT estimates both measure a latent construct, they exist on arbitrary scales. Therefore, when creating a Bland-Altman plot, I standardize each of these measures to have mean zero and unit variance.[17]

The Bland-Altman plot is shown in the right-hand panel of Figure 2.2. The middle horizontal dashed line in this plot lies at the mean of the difference between standardized LVAW and ordinal IRT measurements, while the outer reference lines are drawn one standard deviation of this difference either side of the mean line. The Bland-Altman plot suggests that there is no distinct pattern that relates disagreement between the two measurement methods to average estimates of CBI. However, the vertical spread of points clearly demonstrates that there is substantial variation in the differences between the standardized LVAW and ordinal IRT estimates of CBI. The standard deviation of the difference in CBI scores assigned by these two methods is 0.5. In addition, many points (representing 35 per cent of country-periods) lie outside the region between the two outer horizontal reference lines on the plot: for all of these country-periods, the absolute value of the difference in CBI scores assigned by the two measurement methods is greater than 0.5. Given that both CBI measures are standardized to have a standard deviation of one, this implies that for 35 per cent of country-periods, standardised LVAW and ordinal IRT scores disagree by more than half a standard deviation on the latent CBI scale. Thus, there is considerable disagreement between the main existing measure of CBI and that generated from the same indicators using an ordinal IRT approach. These measures are not interchangeable, and I argue that the set of measurements generated in this paper are preferable because they are based on a more principled statistical procedure.

---

[16] Bland and Altman (1995) show that if we instead use the measurements obtained by one of the methods on the x-axis, we will tend to observe spurious correlation between x-axis and y-axis.
[17] This standardization approach is based on Tractenberg and Asien (2009), who use the same strategy when creating Bland-Altman plots to compare measures of a different latent variable, cognitive impairment.

The other major advantage of the ordinal IRT measurement approach is that it allows us to quantify our uncertainty regarding measurements in a straightforward manner (Treier and Jackman 2008). To allow us to gauge the extent of this uncertainty, Figure 2.3 plots the posterior mean and the ninety-five per cent confidence interval for the latent level of *de jure* CBI in each country during the 1980-89 period. This plot summarises CBI measurements for this period on all seventy developed and developing countries contained in the CWN data.

[FIGURE 2.3 ABOUT HERE]

The first notable feature of Figure 2.3 is that, perhaps unsurprisingly, Switzerland, West Germany, Austria and the United States are among the ten countries with the highest mean posterior CBI estimates. However, a number of developing countries also have relatively high mean posterior CBI estimates (e.g. Nicaragua, Honduras and Kenya). This finding is in line with the LVAW scores for the same 1980-89 period (CWN p.362).

The second notable feature of Figure 2.3 is the high level of uncertainty regarding levels of latent CBI for all countries. The CBI estimates for all countries during this period have 95 per cent confidence intervals that are at least 1.5 units wide. Again, recall that the latent CBI scale is standardized to have mean zero and unit variance across country-period observations. Thus, the results of the ordinal IRT model suggest that the information contained within the CWN data only allows us to measure latent levels of CBI across country-periods with substantial uncertainty: there is a clearly measurement error in our estimates. This finding is common among applications of IRT models to measurement problems (e.g. Treier and Jackman 2008; Høyland et al. 2009).

To illustrate this point more vividly, Figure 2.4 summarises the marginal posterior distribution of each country's CBI ranking for the 1980-89 period. The points in this plot represent the mean posterior rank of each country for this period in terms of latent CBI

36

(averaged over the 10,000 samples from the joint posterior distribution of model parameters, which are generated by the MCMC estimation procedure), while the thick and thin black lines represent, respectively, fifty and ninety per-cent confidence intervals for this ranking. It is clear from this plot that our uncertainty regarding latent levels of CBI makes it very difficult to confidently distinguish between many countries in terms of CBI. For example, taking repeated samples from the posterior distribution, Ireland is on average ranked thirty-ninth in terms of latent levels of CBI for the 1980-89 period. However, in more than five per cent of draws from the joint posterior, Ireland is ranked either tenth and below or sixtieth and above, out of the seventy countries. Even among the high-CBI countries where the uncertainty in ranking is smallest (such as West Germany and Switzerland) CBI rankings still range by around ten places across repeated samples from the joint posterior.

[FIGURE 2.4 ABOUT HERE]

Figure 2.4 has important implications in and of itself. Mangano (1998) suggests that the problems of measuring CBI can be alleviated by using the rankings implied by CBI indices, instead of the raw scores on these indices, as measures of CBI in subsequent regression analysis. The findings presented in Figure 2.4 would suggest that such an approach is just as likely– and possibly more likely – to result in misleading inferences as is the approach of using raw scores from existing CBI indices. This is because our uncertainty regarding the latent value of CBI for each country leads to even greater uncertainty regarding the CBI rankings of countries.

The final key point to note about the CBI estimates generated using the ordinal IRT approach is that our uncertainty regarding levels of CBI is not constant across country-periods. It is well understood in educational testing that when IRT models are used to measure the latent ability of students, measurements for extremely high- and low-ability students will contain more uncertainty than those for students with middling true levels if

ability (Battuaz et al, 2008; Fox, 2005; Fox and Glas, 2003). The same pattern is observable in the current application. For example, if we return to Figure 2.3, we can note the progressive narrowing and then broadening of confidence intervals as we move from countries with low to high mean CBI estimates. Figure 2.5 illustrates the phenomenon more starkly. For each CBI parameter corresponding to each country-period i, it plots the mean of the marginal posterior density (the mean estimate of CBI for country-period i) against the standard deviation of this marginal posterior density (the standard error of the CBI estimate for country-period i). Though slightly obscured by the presence of some observations that have unusually high posterior standard deviations due to missing indicator responses, there is a general u-shaped pattern in the resulting plot. Our uncertainty regarding CBI inferences is greater for country-periods that have either very high or very low estimated latent CBI levels.

[FIGURE 2.5 ABOUT HERE]

This patent relationship between latent CBI levels and our degree of measurement uncertainty is something that should ideally be accounted for when using these measures in subsequent analyses of the economic consequences of CBI. This is a problem to which I turn in the next section.

2.4   Testing for the economic effects of latent central bank independence using ordinal IRT measures

The ordinal IRT approach to measurement provides us with two key pieces of information regarding latent levels of central bank independence: first, the posterior means of the CBI (θ_i) parameters represent a new set of CBI 'measures'; second, the posterior standard deviations of the CBI parameters quantify the measurement error corresponding to each measured CBI

value. The results presented in the previous section showed that these posterior standard deviations – akin to standard errors – are sizeable, and vary considerably across observations. In other words, we measure latent levels of CBI with both non-negligible and heteroscedastic measurement error. Given these properties, how can we appropriately utilise CBI measures as predictors in subsequent regression analyses aimed at testing the economic consequences of CBI?

Using predictors measured with error in regression can lead to biased inferences if we naively treat these predictors as measured without error (Carroll et al. 2006). In a simple linear regression where a single predictor is measured with error, estimated coefficients will suffer from an attenuation bias (Gustafson 2001; Carroll et al. 2006). But, Carroll et al. (2006) show that in a multiple regression set-up, measurement error in a single predictor can lead to: biased coefficient estimates for both the predictor measured with error and other predictors; the reversal of signs on parameter estimates; and also a loss of power to detect relationships. They point out that the impact of measurement error in a predictor is difficult to assess *a priori* because it depends on the relationship between the measurement error, the response variable, and the other predictors in the model. As Jackman notes, "when multiple predictors enter the regression and one or more of them is measured with error..., frankly, all bets are off" (2008 p.127). Because of the unpredictable nature of the biases caused by measurement error, it is vital that when noisy CBI measures are used as predictors in a regression, the researcher employs an estimation method that explicitly accounts and corrects for this measurement error.

In this paper, the proposed method for measurement error correction is that of "simulation extrapolation" (SIMEX) (Carroll et al. 2006). The rationale behind the SIMEX approach is that "the effect of measurement error on an estimator can be determined experimentally via simulation" (Carroll et al. 2006 p.98). The approach is relatively simple

to implement, applicable to wide variety of models (both linear and generalized linear models), and its utility has already been demonstrated in political science by Benoit et al. (2009). Here I present a version of the SIMEX method that deals with heteroscedastic measurement error. This heteroscedatic-SIMEX method has been applied in educational testing (Battuaz et al. 2008), but this is the first time it has been presented in the political science or political economy context.

The heteroscedastic-SIMEX method is detailed more fully in Carroll et al. (2006 p.102) and Battuaz et al. (2008), but the general logic is as follows. Suppose we want to estimate β from the regression

$$y_i = \alpha + \beta \xi_i + \epsilon_i, \qquad i = 1, \dots, N$$

but ξ_i is only observed via a noisy measurement $\xi_i^* = \xi_i + \eta_i$, where $\eta_i \sim N(0, \sigma_i^2)$ (i.e. ξ_i^* is an unbiased measure of ξ_i but is subject to heteroscedastic measurement error). Naively running the regression with ξ_i^* will generate a biased estimate $\hat{\beta}_{naive}$. The heteroscedastic-SIMEX algorithm corrects for this bias experimentally by: (1) simulating a large number of new datasets containing increasing amounts of additional measurement error; (2) generating naive parameter estimates based on each of these datasets; (3) modelling the relationship between these naive parameter estimates and the degree of measurement error; and (4) based on the model fitted in step (3), extrapolating back to the parameter estimates that would be obtained in the ideal case of no measurement error.

More formally, prior to estimation the researcher specifies an M-length vector of values ζ (in this paper I assign a set of values that are standard in the SIMEX literature, setting $\zeta' = [0.5, 1.0, 1.5, 2.0]$). In step (1) the algorithm simulates $m = 1, \dots, M$ new data sets. For the mth data set and ith observation the algorithm generates an independent *pseudo error* from a normal distribution with mean zero and observation-specific variance $\zeta_m \sigma_i^2$, and adds this to the original ξ_i^* measurement. So, in this mth dataset the total measurement error

variance for $\xi_{i,m}^*$ is $\sigma_i^2 + \zeta_m \sigma_i^2 = (1 + \zeta_m)\sigma_i^2$. In step (2), the algorithm generates naive

estimates $\hat{\beta}_m$ based on the mth dataset. To minimize Monte Carlo error, steps (1) and (2) are

repeated a large number of times and, for each m, the average $\hat{\beta}_m$ taken across these

repetitions is stored as $\bar{\beta}_m$. In step (3) the $\bar{\beta}_m$ are modelled as a function of ζ_m.[18] Finally, in

step (4) the algorithm generates an estimate $\hat{\beta}_{\text{simex}}$ that corrects for measurement error by

extrapolating the model fitted in step (3) back to $\zeta = -1$, which corresponds to a dataset with

zero total measurement error variance: $(1 + \zeta_m)\sigma_i^2 = 0$.

The problem of estimating the economic impact of latent CBI using the noisy

ordinal IRT measures of this latent variable can be conceptualised within the heteroscedastic-

SIMEX framework. Let the ordinal IRT point estimates (posterior means) of latent CBI

levels, $\bar{\theta}_i$, replace the measured values ξ_i^* in the SIMEX setup. Within the SIMEX

framework, these $\bar{\theta}_i$ are assumed to measure true levels of latent CBI on average (i.e. our

ordinal IRT estimates are unbiased), but are subject to independent, identically distributed

shocks drawn from a normal distribution with mean zero and observation-specific variance

σ_i^2.[19] Each observation-specific measurement error variance, σ_i^2, is approximated using the

marginal posterior variance of the corresponding θ_i parameter, taken from the MCMC

samples generated for the ordinal IRT model. Re-casting the task at hand in this way allows

us to use the heteroscedastic-SIMEX approach to estimate regressions which contain ordinal

IRT measures of CBI as predictors.

Before continuing, it should be noted that there are other useful methods that allow

us to test for the effect of a variable that is imperfectly measured. One approach is to jointly

model the 'measurement stage' (in the current context, the ordinal IRT model) and the

---

[18] Following the recommendations of Battuaz et al (2008), this paper employs a quadratic function at this stage.
[19] Inspection of the estimated marginal posterior densities of the CBI parameters suggested that this normality assumption appears reasonable in the current context. Furthermore, Carroll (2006) et al report that "minor violations of the assumption of normality in the measurement errors is not critical in practice" (p. 101).

'outcome stage' (where latent CBI is a predictor of a given measure of economic performance). This approach can be implemented using Bayesian MCMC estimation methods (Gustafson 2003; Fox and Glas 2003; Carroll et al. 2006) and allows information from the outcome model to "feedback" into inferences regarding latent traits. However, Lunn et al. (2008) caution that if this approach is employed the outcome model can unduly influence measurements, resulting in inferences that may not be robust, especially if we are unsure of the appropriate form of the outcome model. Treier and Jackman (2008) present a Monte Carlo approach that cuts this "feedback" between measurement and outcome model, but that does allow uncertainty at the measurement stage to propagate into inferences at the outcome stage. The SIMEX approach shares the advantage of separating measurement modelling from outcome modelling (Battuaz et al. 2008). However, it has the added advantage of allowing the researcher to extrapolate away from the uncertainty generated at the measurement stage, when drawing inferences regarding the outcome model.

An application

To demonstrate how the heteroscedastic-SIMEX method can be deployed to make appropriate use of the ordinal IRT measures of CBI generated in this paper, I replicate a key existing study of the economic effects of CBI. In this study, Keefer and Stasavage (2003) develop and empirically test a formal theoretical model which predicts that the impact of CBI is conditional. Specifically, *de jure* CBI should have a more negative effect on inflation as both the number of veto players in a political system increases, and as the divergence in the inflation preferences of these veto players' increases.

The authors find empirical support for these propositions when they model average inflation levels across country-periods as a function of CBI (measured using LVAW) interacted with the number of veto players in political systems. Furthermore, their empirical

results help to resolve an empirical puzzle noted when previous researchers had only tested

for an unconditional economic impact of CBI (e.g. Cukierman et al, 1992). Specifically,

researchers had previously found that de jure CBI was significantly associated with inflation

levels in developed countries but was not so in tests that pooled these developed countries

together with developing countries. In contrast, Keefer and Stasavage's results regarding the

conditional impact of CBI hold in a sample containing both developed and developing

countries.

So, Keefer and Stasavage's findings are substantively important. But we can be

more confident in their substantive conclusions if their empirical results hold when we use

the ordinal IRT measures of CBI presented in this paper (which aggregate the CWN

indicators in a more principled manner than does the LVAW index), and when we account

for the considerable measurement error in these measures.

To keep matters simple, I report replication results for the third model presented in

Table 2 of Keefer and Stasavage.[20] This linear model is specified by the authors as

$$lninf_i = \alpha + \beta_1 cbi_i + \beta_2 political\ constriants_i + \beta_3 cbi_i * political\ constraints_i +$$

$$\delta' z_i + \epsilon_i \tag{1}$$

where $lninf_i$ is the log of average inflation for country-period i, cbi_i is the level of latent

central bank independence, $political\ constraints_i$ gauges the number of institutional veto

players in the political system,[21] and z_i is a vector of controls that includes the average GDP-

---

[20] The differences between original and replicated results follow similar patterns when other models in Table 2 are replicated. Model 3 replications are reported here because this particular specification utilises approximately twenty-five per cent more country-period observations than do the other models presented in Table 2 of Keefer and Stasavage.

[21] For more details on this variable, see Heinsz (2000). Strictly, this *political constraints* variable could also be considered subject to measurement error. However, because it is neither an additive index nor based on multiple indicators, the task of characterising the measurement-generating process for this variable, and therefore of estimating measurement error for it, is not amenable to an IRT approach and is therefore left to future work. Instead, here I focus on the impact of measurement error in the CBI variable. Experiments were run where equation 1 was estimated using the SIMEX algorithm, allowing for measurement error in both *CBI* and in *political constraints,* setting the level of measurement error variance in the *political constraints* at plausible conjectured values ranging between 0.1 and 0.3. Results are not reported here, but suggest that the coefficients on *CBI* and on its interaction with *political constraints* retain the significance patterns in column 3 of Table 2,

weighted value of imports (*openness$_t$*) and time-period fixed effects. Keefer and Stasavage

estimate this model via OLS, using data for 152 country-periods, spanning the latter three

time-periods defined for the Cukierman et al. (1992) indicators. I replicate this model using

data obtained directly from the authors.

Table 2.2 presents three sets of point estimates and ninety-five per cent confidence

intervals for the parameters in equation (1). The results in the first column are OLS estimates

using the LVAW index to measure country-period latent levels of CBI – the same measure as

used originally by Keefer and Stasavage. Next, column two presents the results generated

from an identical model and estimation method as in column one, except that latent levels of

CBI are measured using the ordinal IRT point estimates (posterior means) rather the LVAW

scores. Finally, the results in the third column of Table 2.2 are again generated using the

ordinal IRT point estimates to measure latent CBI, but here the heteroscedastic-SIMEX

procedure is used to correct for measurement error in these CBI measures. Confidence

intervals in this third column are calculated based on standard error estimates generated using

the asymptotic method described in Battuaz et al. (2008 p.301).

[TABLE 2.2 ABOUT HERE]

For each of the models presented in Table 2.2, Figure 2.6 plots the estimated

marginal effect (and corresponding ninety-five per cent confidence interval) of a one standard

deviation increase in latent CBI (however measured) on logged average inflation levels, as

the number of veto players in a political system varies.[22]

[FIGURE 6 ABOUT HERE]

The three sets of results summarised in Table 2.2 and Figure 6 allow us to separate

out two possible factors behind any changes in parameter estimates across models (Treier and

---

but that the absolute magnitude of these coefficients increases as the conjectured measurement error variance in *political constraints* gets larger.
[22] Following Stasavage and Keefer (p. 418), in creating Figure 7 the *political constraints* variable is set at 0.167, 0.67 and 0.80 to reflect a political system with one, two and three veto players, respectively.

Jackman 2008). First, by comparing results generated using the LVAW scores and ordinal IRT point estimates of CBI (columns one and two), we can assess the effect of using a more principled method for the aggregation of CBI indicators into a CBI measure. To ensure easier comparability across these models, I standardize LVAW scores to have mean zero and unit variance before estimating the regression (recall that the ordinal IRT measures are constrained to have mean zero and unit variance for identification purposes).[23] Second, comparison of columns two and three allows us to assess the impact of accounting and correcting for measurement error in the ordinal IRT measures of CBI – a correction that would not be possible using the LVAW scores because they are not accompanied by uncertainty estimates.

Encouragingly, initial inspection of the coefficient estimates in the second two columns of Table 2.2 indicates that *CBI*, as measured using the ordinal IRT estimates, has a more negative association with average inflation levels the greater are *political constraints*. That is, in both columns, the estimated coefficient on the interaction term *cbi*political constraints* is negative and distinguishable from zero with ninety-five per cent confidence. Because this result holds when we use a more principled measure of latent central bank independence and when we account for measurement error in this measure, we can be more confident of Keefer and Stasavage's original headline conclusion that the impact of central bank independence on economic outcomes is conditional on the characteristics of a political system.

However, closer inspection of Table 2.2 and Figure 2.6 also reveals that the substantive inferences we can draw do vary depending on which measure of CBI is used and whether measurement error is accounted for during estimation. For example, from Figure 2.6 we can see that when the LVAW index is used to measure CBI, then for a country with only a

_____

[23] When the non-standardized LVAW scores were used, results are identical to those reported by Keefer and Stasavage.

single veto player in its political system, an increase in latent central bank independence is actually predicted to have a positive marginal effect on inflation levels with ninety-five per cent confidence. This is a rather counter-intuitive result: the theory presented by Keefer and Stasavage does predict that an increase in *CBI* should not have an effect on inflation levels when there is a single veto player (p. 410), but does not suggest that increasing *CBI* should cause an *increase* inflation levels. In contrast, we can see from Figure 2.6 that when the ordinal IRT point estimates are used to measure *CBI* (model 2 in the plot) then, for a country with a single veto player, the predicted effect of an increase in latent central bank independence is actually indistinguishable from zero using a ninety-five per cent confidence interval. This illustrates that our substantive inferences regarding the economic impact CBI are altered simply by re-aggregating the information contained in Cukierman et al's (1992) indicators in a more principled manner.

But how does accounting and correcting for measurement error in our ordinal IRT estimates impact upon substantive inferences? First, by comparing columns two and three of Table 2.2 we can see that the estimated magnitude of the interaction between *cbi* and *political constraints* increases substantially when we account for measurement error using the heteroscedastic-SIMEX method. This is illustrated in Figure 2.6, where the estimated marginal effect of latent CBI levels varies with the number of veto players to a much greater extent under the heteroscedastic-SIMEX model than when ordinal IRT measures are used naively ignoring measurement error. Furthermore, Figure 2.6 suggests that for a political system with two veto players, we can only be ninety-five per cent confident that an increase in central bank independence is associated with a decrease in inflation levels when measurement error is corrected for.

In sum, this replication exercise not only demonstrates the applicability of the heteroscedastic-SIMEX method for making appropriate use of the ordinal IRT measures of

CBI presented in this paper. It also increases our confidence in previous empirical conclusions regarding the conditional economic impact of CBI. Indeed, compared to existing empirical tests, the results generated when we use these new CBI measures and correct for measurement error are actually more supportive of Keefer and Stasavage's theory.

2.5 Conclusion

Empirical evidence concerning the macroeconomic consequences of central bank independence is not just of academic interest, but can also inform the design of monetary policy-making institutions. This paper makes three contributions to the effort to gather this empirical evidence.

First, it provides a new improved set of country-level measures of *de jure* CBI. These measures are generated by applying an ordinal item-response approach, previously unused in the CBI literature, to aggregate the rich information contained in Cukierman et al's (1992) legal indicators. The ordinal IRT approach to measurement allows us to address the flaws in existing measures of CBI because it explicitly models the categorical nature of component indicators and avoids restrictive assumptions regarding the weighting different indicators receive during aggregation. Furthermore, comparison of the new CBI measures with the main existing ones used in the literature suggests that the ordinal IRT approach does make a difference: disagreement between the two measures is substantial, despite the fact that both are generated based on the same underlying indicator data.

Second, for the first time in the literature, this paper presents CBI measures that are accompanied by observation-specific estimates of measurement error variance. These measurement error estimates are generated in a straightforward manner when the ordinal IRT

model is estimated using Bayesian MCMC methods, and allows us to assess the uncertainty in the measures of latent CBI. Results suggest that this uncertainty is substantively large, and should not be ignored by researchers seeking to test for the economic impact of CBI. It is worth emphasising here that such an assessment of measurement error would not be possible when using the main existing approaches to the construction of CBI indices, as these deterministic approaches do not aggregate information from component indicators using a properly specified statistical model (Quinn 2004 p.339).

Third, this paper presents a simulation-extrapolation method that enables researchers to deploy the new ordinal IRT measures of CBI in subsequent regression analysis while properly accounting and correcting for uncertainty in these measures. This is important because using CBI measures in regression analyses without accounting for measurement error can lead to biased inferences regarding the economic impact of CBI. The simulation-extrapolation method presented here is relatively straightforward to implement and handles the heteroscedastic nature of the measurement error in the ordinal IRT measures. To demonstrate how this method can be used in conjunction with the new CBI measures, I replicate a prominent existing study which tested for a conditional association between CBI and inflation levels. In this application, using the new ordinal IRT measures of CBI and properly correcting for measurement error yields results that not only reinforce our confidence in the conclusions of the original study, but are actually more consistent with the substantive theory that the original study sought to test.

There are a number of ways in which the IRT approach to the measurement of central bank independence presented in this paper can be usefully taken forward. Future researchers seeking to re-code the Cukierman et al. (1992) indicators, or to design schemes for the collection of new CBI indicator data, can draw on the item discrimination and threshold parameter plots presented in section 3 of this paper. These plots can act as a guide

48

as to which indicators, and which categories of these indicators, are particularly informative with regard to latent CBI levels. Also, item-response modelling is very flexible and can be applied to a set of indicators that are not necessarily all ordinal, but also interval-level (Quinn 2004), truncated, or counts (Høyland et al. 2009). As a result, in future work the IRT approach could be applied to systematically combine various *de jure* and *de facto* indicators of central bank independence, yielding a CBI measure that draws on a greater variety of information.

Finally the particular simulation-extrapolation method presented in this paper, which deals with heteroscedastic measurement error in regression inputs, could prove very useful across a range of political science and political economy settings. The advantages of the general SIMEX approach in a setting with homoscedastic measurement error have already been amply demonstrated for the political science community by Benoit et al. (2009). However, in many political science applications, where researchers use IRT-generated measures of unobserved quantities (such as legislators' ideal points, or countries' levels of corruption), these measures are accompanied by observation-specific uncertainty estimates. In these circumstances, researchers could take the average of these uncertainty estimates across observations and apply the generic SIMEX method. But this approach loses information. Rather, the heteroscedastic-SIMEX method would appear to be more appropriate in these circumstances, because it utilises all observation-specific uncertainty estimates when correcting regression estimates for measurement error.

Table 2.1: Original CWN indicators of legal central bank independence and coding scores

Variable description	Weight	Numerical coding
1 Chief executive officer cluster	0.20	
a. Term of office (*too*)		
Over 8 years		1.00
6 to 8 years		0.75
5 years		0.50
4 years		0.25
Under 4 years at the discretion of the appointer		0.00
b. Who appoints CEO? (*app*)		
Board of central bank		1.00
A council composed of central bank board, executive branch and legislative branch		0.75
Legislature		0.50
Executive collectively (e.g. council of ministers)		0.25
One or two members of the executive branch		0.00
c. Dismissal (*diss*)		
No provision for dismissal		1.00
Only for reasons not related to policy		0.83
At the discretion of the central bank board		0.67
At legislature's discretion		0.50
Unconditional dismissal possible by legislatures		0.33
At executive's discretion		0.17
Unconditional dismissal possible by executive		0.00
d. May CEO hold other offices in government? (*off*)		
No		1.00
Only with permission of executive branch		0.50
No rule against CEO holding another office		0.00
2 Policy formulation cluster	0.15	
a. Who formulates monetary policy? (*monpol*)		
Bank alone		1.00
Bank participates, but has little influence		0.67
Bank only advises government		0.33
Bank has no say		0.00
b. Who has the final word in resolution of a conflict? (*conf*)		
The bank, on issues clearly defined in the law as its objectives		1.00
Government, on policy issues not clearly defined as the bank's goals or in the case of conflict within the bank		0.80
A council of the central bank, executive branch and legislative branch		0.60
The legislature, on policy issues		0.40
The executive branch on policy issues, subject to due process and possible protest by the bank		0.20
The executive branch has unconditional priority		0.00
c. Role in the government's budgetary process (*adv*)		
Central bank active		1.00
Central bank has no influence		0.00
3 Objectives cluster	0.15	
a. Objectives (*obj*)		
Price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government objectives		1.00
Price stability is the only objective		0.80
Price stability is one goal, with other compatible objectives, such as a stable banking system		0.60
Price stability is one goal, with potentially conflicting objectives such as full employment		0.40
No objectives stated in bank charter		0.20
Stated objectives do not include price stability		0.00

Table 2.1 (*continued*)

Variable description	Weight	Numerical coding
4 Limitations on lending to the government cluster		
a. Advances (limitations on nonsecuuritized lending) (*lla*)	0.15	
No advances permitted		1.00
Advances permitted, but with strict limits (e.g. up to 15 per cent of government revenue)		. 0.67
Advances permitted, and the limits are loose (e.g. over 15 per cent of government revenue)		. 0.33
No legal limits on lending		0.00
b. Securitized lending (*lls*)	0.10	
Not permitted		1.00
Permitted, but with strict limits (e.g. up to 15 per cent of government revenue)		0.67
Permitted, and the limits are loose (e.g. over 15 per cent of government revenue)		0.33
No legal limits on lending		0.00
c. Terms of lending (maturity, interest, amount) (*ldec*)	0.10	
Controlled by bank		1.00
Specified by bank charter		0.67
Agreed between the bank and the executive		0.33
Decided by executive branch alone		0.00
d. Potential borrowers from the bank (*lwidth*)	0.05	
Only central government		1.00
All levels of government (state as well as central)		0.67
Those mentioned above and public enterprises		0.33
Public and private sector		0.00
e. Limits on central bank lending defined in: (*ltype*)	0.025	
Currency amounts		1.00
Shares of central bank demand liabilities or capital		0.67
Shares of government revenue		0.33
Shares of government expenditures		0.00
f. Maturity of loans (*lmat*)	0.025	
Within 6 months		1.00
Within 1 year		0.67
More than 1 year		0.33
No mention of maturity in law		0.00
g. Interest rates on loans must be (*lint*)	0.025	
Above minimum rates		1.00
At market rates		0.67
Below maximum rates		0.33
Interest rate is not mentioned		0.00
h. Central bank prohibited from buying or selling government securities in the primary market? (*lprim*)	0.025	
Yes		1.00
No		0.00

Source: Table 2.1 of Cukierman et al. (1992 p.358-359).

Table 2.2: replications of Keefer and Stasavage (2003) model 3

Explanatory variable	LVAW	IRT point estimates	IRT heteroskedastic SIMEX
Intercept	-2.46	-2.48	-2.48
	[-2.79, -2.14]	[-2.81, -2.16]	[-2.83, -2.14]
CBI	0.34	0.31	0.45
	[0.06, 0.62]	[0.01, 0.62]	[-0.04, 0.93]
Openness	-1.2	-1.17	-1.17
	[-1.83, -0.56]	[-1.81, -0.53]	[-1.8, -0.54]
Political Constraints	-0.6	-0.59	-0.57
	[-1, -0.21]	[-0.98, -0.19]	[-0.98, -0.16]
Period 3 Dummy	1.08	1.08	1.07
	[0.74, 1.42]	[0.73, 1.42]	[0.77, 1.37]
Period 4 Dummy	1.16	1.14	1.14
	[0.82, 1.49]	[0.81, 1.48]	[0.78, 1.5]
CBI * Political Constraints	-0.65	-0.67	-0.92
	[-1.06, -0.23]	[-1.14, -0.2]	[-1.57, -0.27]
N	152	152	152

Note: These are results from replications of Model 3 in Table 2 of Keefer and Stasavage (2003). The model in the first column uses the standardised LVAW index to measure CBI and is estimated via OLS. In the second and third columns the new ordinal IRT point estimates are used to measure CBI. The results in the second column are estimated via OLS, while those in the third column are estimated using a heteroscedastic-SIMEX method that corrects for measurement error in the IRT point estimates of CBI. Estimated ninety-five per cent confidence intervals are presented in parentheses. For the heteroscedastic-SIMEX model, these are based on standard errors estimated using Carroll et al's (2006) asymptotic method (see also Battuaz et al. 2008).

Figure 2.1: ordinal IRT, estimated item discrimination and item threshold parameters
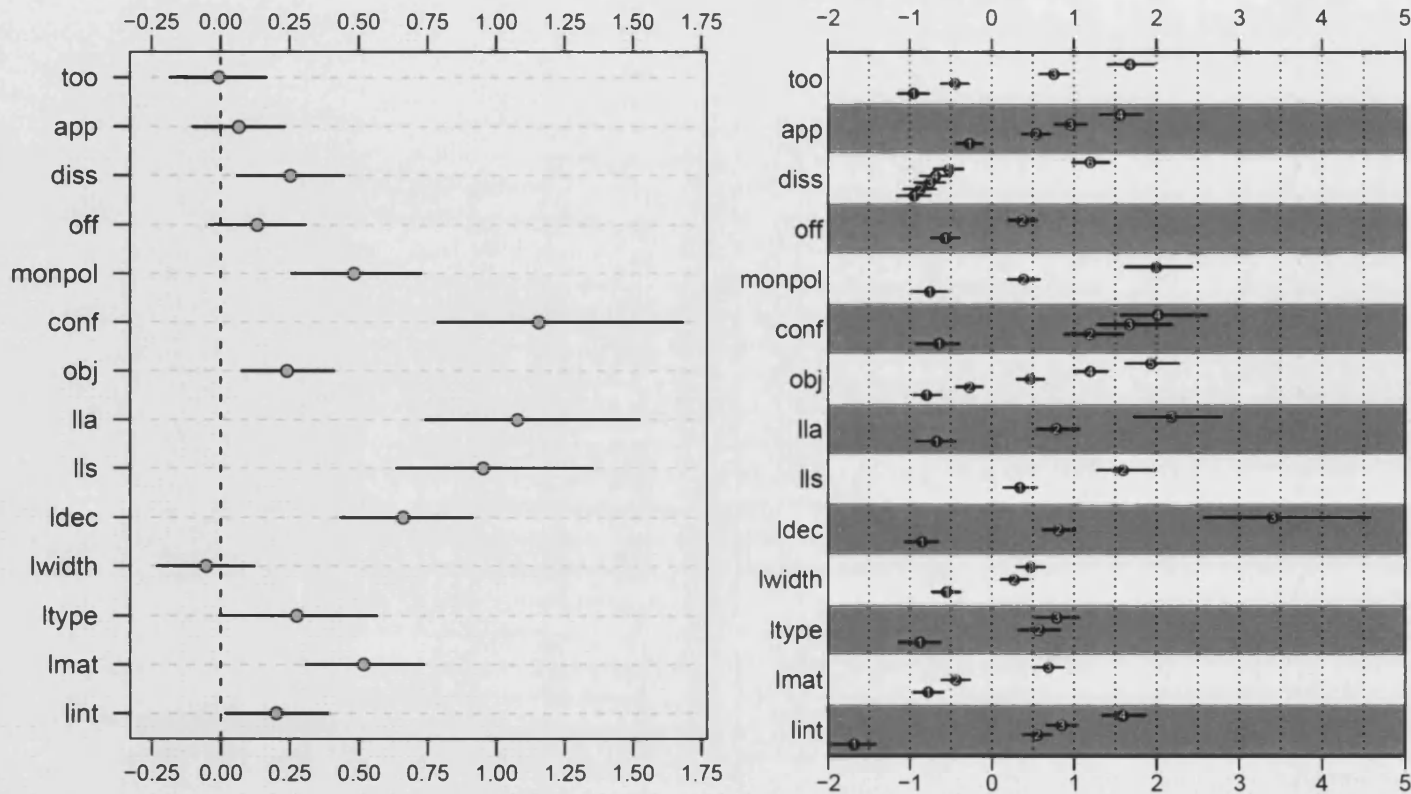
Note: Both panels present item parameter estimates for the ordinal IRT model fit to the Cukierman et al. (1992) data (see Table 2.1 for full definitions of each indicator). The left-hand panel plots item-discrimination parameter point estimates and ninety-five per cent confidence intervals for each indicator included in the model. The right-hand panel plots point estimates and ninety-five per cent confidence intervals for all item-threshold parameters. For each indicator, the points are labelled to corresponding to the *k*-indexing of threshold parameters in the main text. Where a given response category was never observed for a given indicator, this category is dropped from the analysis. Hence some indicators have fewer thresholds to be estimated than implied than in Table 2.1.

Figure 2.2: (dis)agreement between new and old central bank independence measures
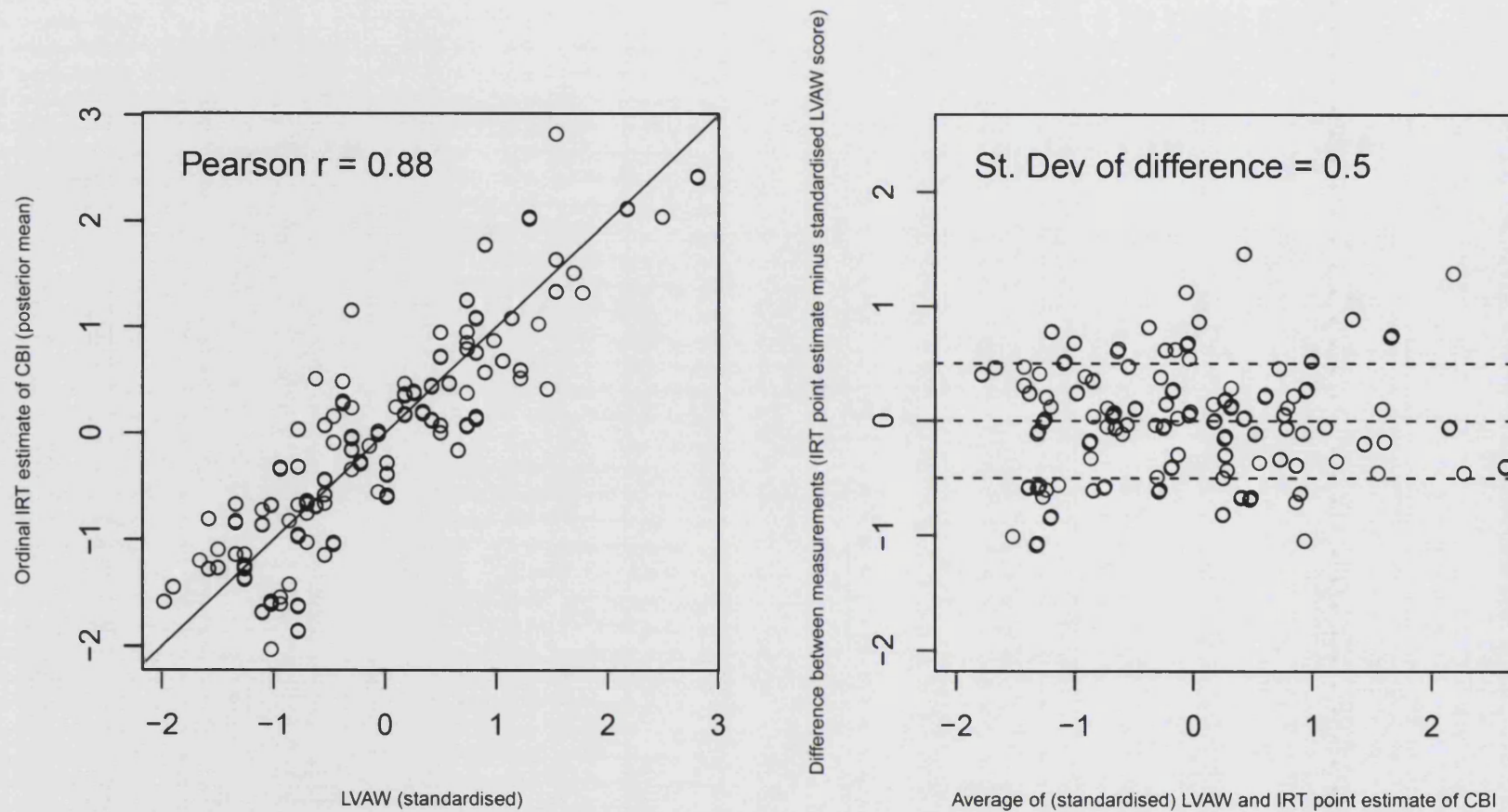
Note: The left-hand panel plots standardized LVAW measures of CBI against ordinal IRT point estimates of CBI (posterior means), with a reference line along the diagonal. The right-hand panel presents a Bland-Altman plot. For each country-period, this plots the average of the standardised LVAW and ordinal IRT measures of CBI, against the difference between the two measures. The middle dashed reference line indicates the mean difference between the two measurement methods across country-periods, while the two outer lines are drawn one standard deviation of the difference either side of mean line.

Figure 2.3: ordinal IRT, estimated levels of central bank independence for the 1980-89 period
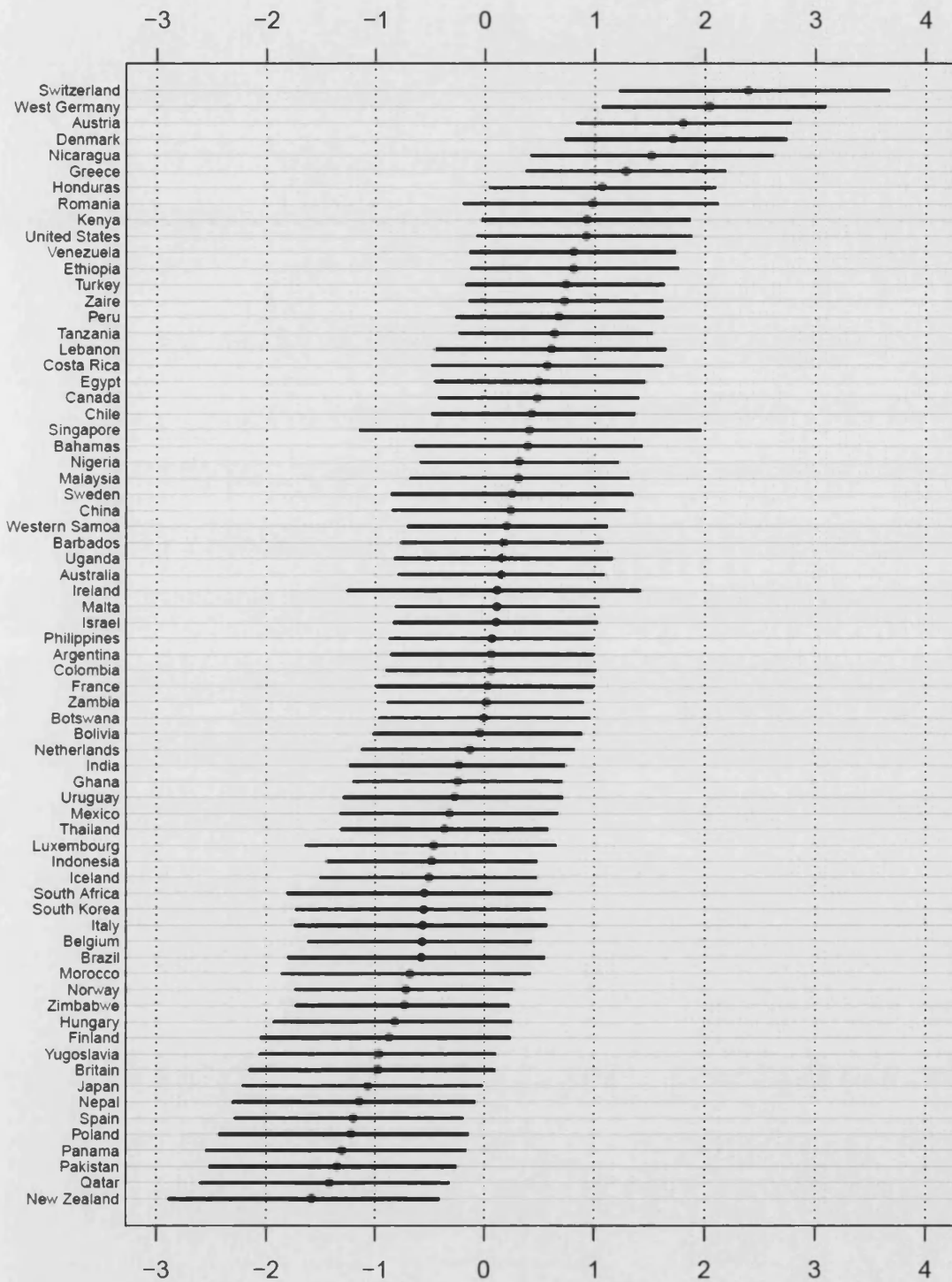
Note: Based on the ordinal IRT model estimated in Section 3, this plot displays the point estimate (posterior mean) and ninety-five per cent confidence intervals for latent levels of CBI in different countries for the 1980-89 period. Estimates are presented for all seventy countries included in the Cukierman et al. (1992) data.

Figure 2.4: posterior central bank independence rankings for the 1980-89 period
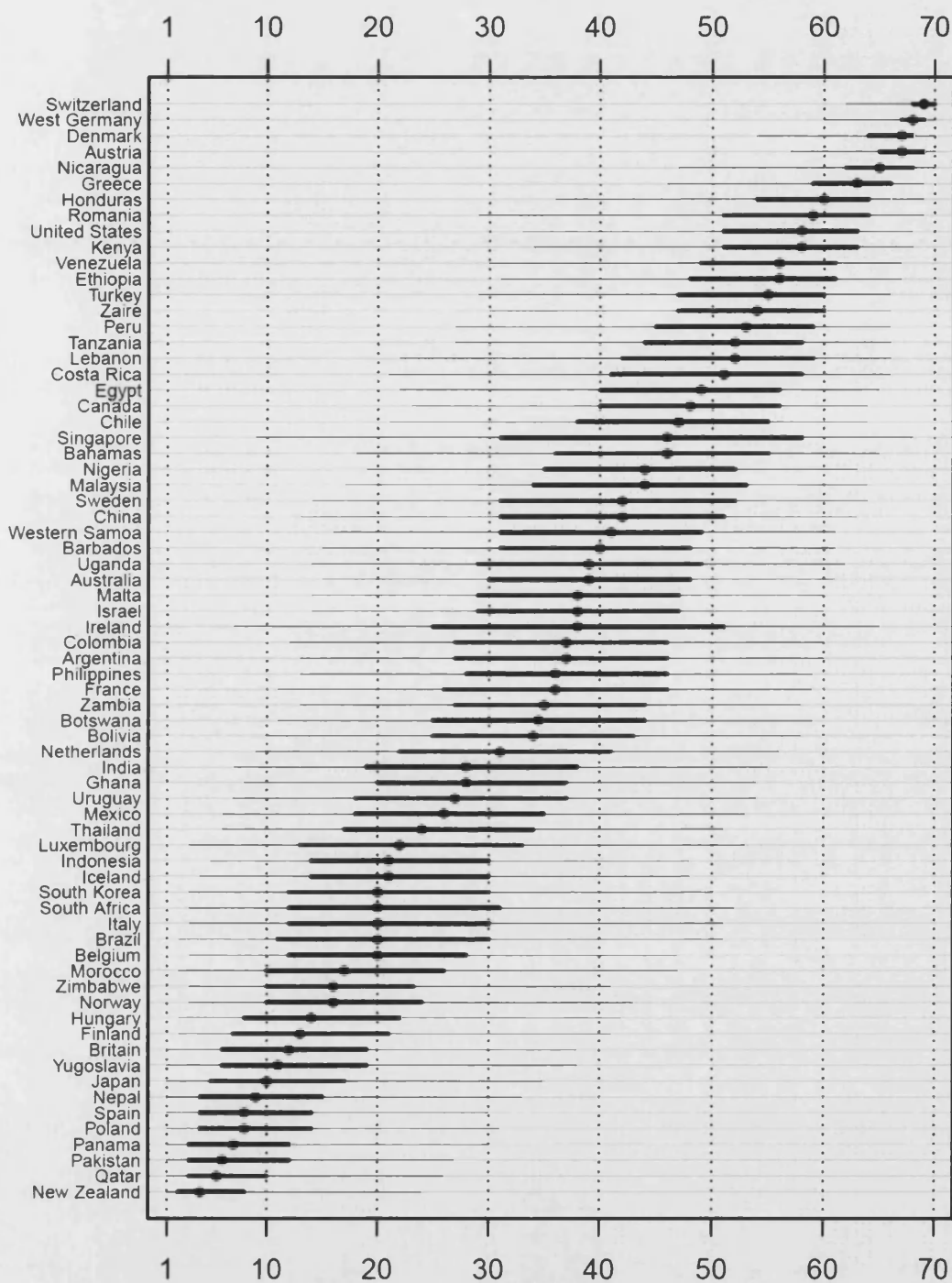
Note: Based on the ordinal IRT model estimated in Section 3, this plot displays the posterior density of the CBI ranking of each country for the 1980-89 period. The points indicate the mean rank of the country over multiple draws from the posterior density, while the thick and thin lines indicate, respectively, fifty and ninety-five per cent confidence intervals.

Figure 2.5: non-constant measurement error variance in ordinal IRT central bank independence estimates
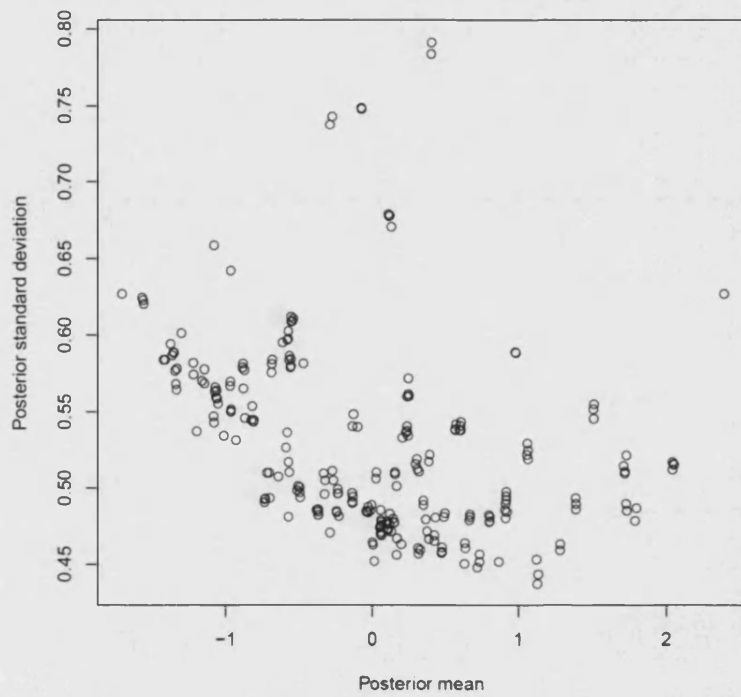
Note: Based on the ordinal IRT model estimated in Section 3, for every country-period this plots the posterior mean of the latent CBI parameter against the posterior standard deviation of this parameter.

Figure 2.6: estimated marginal effect of central bank independence on log inflation
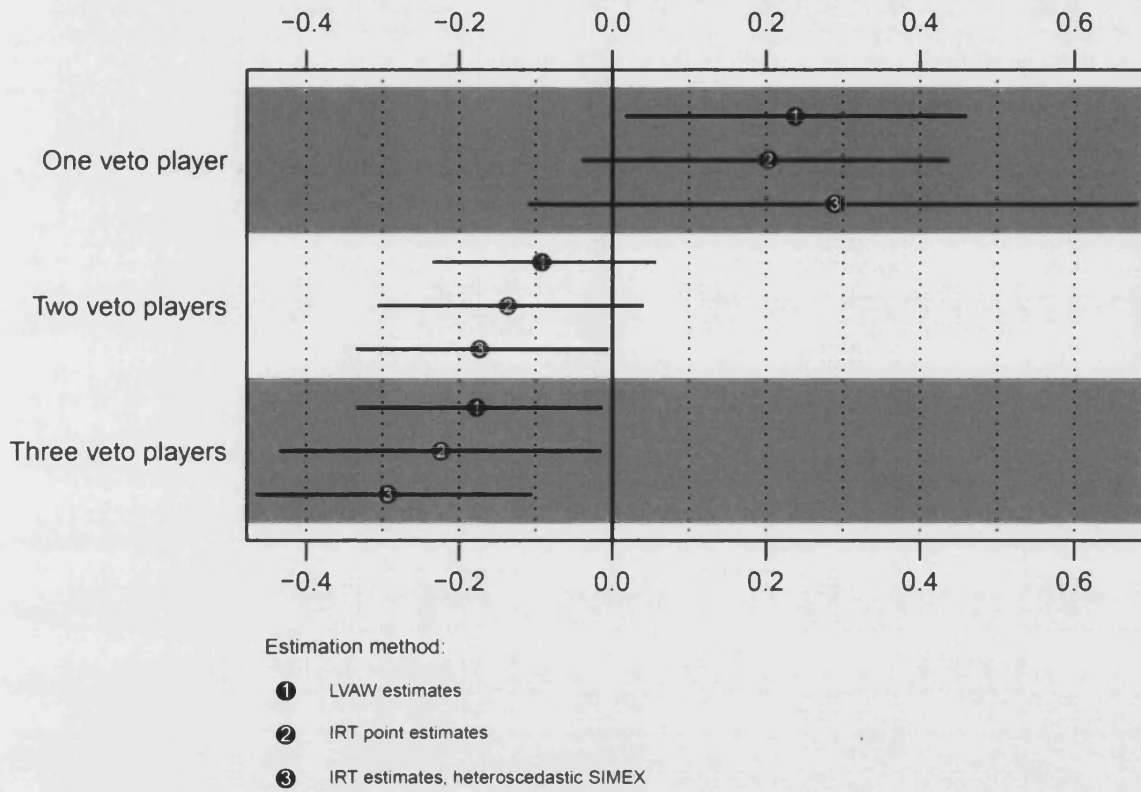
Note: This plot is based on the three regression models reported in Table 2.2. Each point is indexed to a particular model, as indicated in the legend. For each of these models, and for a given number of veto players (indicated on the left-hand side) the points in the plot represent the mean estimated marginal effect of a one standard deviation increase in latent CBI on log average inflation levels. The horizontal lines indicate the ninety-five per cent confidence intervals for these estimated marginal effects.

3 From Doves to Hawks: A Spatial Analysis of Voting in the Monetary Policy Committee of the Bank of England[*]

Abstract

This paper examines the making of UK monetary policy between 1997 and 2008 by analysing voting behaviour in the Bank of England's Monetary Policy Committee (MPC). We provide a new set of measures for the monetary policy preferences of individual MPC members by estimating a Bayesian item response model. We demonstrate the usefulness of these measures by comparing the ideal points of outgoing MPC members with their successors and by looking at changes over time in the median ideal point on the MPC. Our analysis indicates there has not been a straightforward electoral cycle in MPC appointments, but that the British government has been able to move the position of the median voter on the MPC through its appointments to the committee. This highlights the importance of central bank appointments for monetary policy.

Keywords: monetary policy, central banks, ideal point estimation.

[*] This paper is based on Hix et al (2010).

3.1 Introduction

On 11 January 2007 the Monetary Policy Committee (MPC) of the Bank of England increased the interest rate by a quarter of a per cent to 5.25 per cent. The increase came as a surprise to most observers given the economic conditions and past behaviour of the MPC. When the minutes of the meeting were published three weeks later, they revealed that the committee had split 5 to 4 in favour of the increase. In fact, the MPC has been divided about two-thirds of the time since the Bank of England was made independent in 1997, although rarely split down the middle as in January 2007. Presented with the same information about the state of the British economy each month, why do the members of the MPC disagree on the appropriate interest rate? Clearly, British central bankers, like all policymakers, do not all think the same way. This suggests that had the composition of the MPC been slightly different in January 2007, the decision might have been to hold rates rather than increase them.

We offer a spatial analysis of voting in the MPC from the first meeting of the committee after the Bank of England was made independent in June 1997 until April 2008. We use Bayesian simulation methods, introduced by Martin and Quinn (2002) and Clinton et al. (2004) in the context of courts and legislatures respectively, to estimate an item response model that measures the monetary policy preferences of all of the 25 individuals who have been members of the MPC during this ten-year period. We measure these preferences along an underlying dimension that we label a dove-hawk dimension, where 'hawks' tend to prefer higher interest rates than 'doves' when faced with identical economic conditions. Our estimates control for varying economic conditions across MPC meetings and incorporate information as to the substantive direction of the interest rate proposals voted on by MPC members. Furthermore, the Bayesian estimation method we employ ensures that our

preference measures are accompanied by statistically valid uncertainty estimates and also makes it straightforward to draw inferences regarding auxiliary parameters of substantive interest. We demonstrate the value of these features by using our measures to investigate patterns in the monetary policy preferences of individuals appointed to the MPC, and in the median ideal point on the MPC over time. Our analysis indicates that the observed pattern in MPC appointments is not consistent with a simple political business cycle in central bank appointments. Nevertheless, through its appointment powers, the British government has been able to move the position of the MPC over time. This suggests that central bank appointments matter for monetary policy. In light of this, we discuss possible alternative incentives that might have motivated the British government's appointment choices.

In the next section we provide a brief review of the existing literature on monetary policy-making on the MPC and on central banks more generally. In section three we motivate and develop the statistical model we employ to measure monetary policy preferences, as well as describing our data and estimation method. We present the resulting measures in section four. Finally, in section five we apply our measures to investigate whether there is a pattern in the composition of the MPC over time.

3.2   Studying the Bank of England MPC

One of the first acts of the newly elected British Labour government in May 1997 was to grant operational independence for setting monetary policy to the Bank of England. After almost two decades in opposition the new Labour Chancellor of the Exchequer, Gordon Brown, was eager to demonstrate his party's commitment to economic stability. Economists have argued that central bank independence with a clear and simple mandate is an effective

institutional arrangement for delivering low and stable inflation (Rogoff 1985). The logic is that removing representative government from direct involvement in monetary policy-making and placing responsibility in the hands of a relatively inflation-averse central bank mitigates the 'time-inconsistency problem', where suboptimal inflation levels arise because a policy-maker cannot credibly commit not to induce surprise inflation (Kydland and Prescott 1977; Barro and Gordon 1983). Granting independence to the Bank of England hence sent a strong signal to financial markets and the electorate that Labour could be trusted to manage the British economy.

The act of parliament which established central bank independence in the UK provided for the Chancellor to set an inflation target and for a Monetary Policy Committee to set monetary policy instruments at monthly meetings with the aim of achieving this target. The inflation target is currently set at 2 per cent on the Consumer Price Index (CPI). If this target is missed by more than one percentage point on either side, the Governor of the Bank has to write a letter to the Chancellor explaining why the target has been missed. This implies that the inflation target is symmetric (below-target inflation is not deemed to be more desirable than above-target inflation) and that a range of inflation rates around the target are politically acceptable. The key monetary policy instrument set by the MPC is the official Bank Rate; the interest rate at which the Bank of England supplies funds to the banking system for a two-week period.

The MPC consists of nine members who decide on the Bank Rate by majority vote at each monthly meeting. The decision-making process on the MPC has been described by Bank of England employees Bean and Jenkinson (2001p.435-437) as follows. First, committee members are presented with the latest economic information by Bank staff at a monthly briefing. Second, members discuss economic conditions on the first of a two-day policy-meeting the following week. Third, on the second morning of the policy-meeting, the

Governor invites each member in turn to summarize his or her views regarding the appropriate monetary policy (usually including his or her preferred interest rate). Members are called in a random order, with the Deputy Governor responsible for Monetary Policy speaking first and the Governor concluding. Finally, the Governor proposes an interest rate "that he expects will command a majority" (p.438) and members vote on this proposal. The governor votes last. The preferred interest rate of a member who votes against the winning proposal is recorded.

Of the nine individuals who sit on the MPC at any one time, five "internal" members are appointed as staff of the Bank of England and four "external" members are appointed by the Chancellor. Of the internal members, the Governor and the two Deputy Governors of the MPC are appointed for renewable five-year terms by the Crown, which effectively means the Chancellor. The two other internal members, the Executive Directors of the Bank, are appointed for renewable three-year terms by the Governor of the Bank of England, after consultation with the Chancellor. The four external members are appointed for renewable three-year terms. Nominees are required to go before the House of Commons Treasury Select Committee, which can take a vote of approval, but does not have the power to veto a Chancellor's appointment choice.[1] Thus the government, and particularly the Chancellor, would appear to possess a great deal of control over the appointment of most MPC members.

Table 3.1 lists the details of the twenty-five individuals who were members of the MPC at one time or another between June 1997 and April 2008. As the table shows, there is variance in the career background of both internal and external members prior to their appointment. A plurality of the eleven internal appointees had a background within the Bank of England, but six came from other backgrounds such as financial institutions, academia and the civil service. Similarly, a plurality of the externally appointed members had a

---

[1] In fact, in May 2000 the Treasury Select Committee voted to reject Christopher Allsopp as the replacement of Charles Goodhart, but the Chancellor ignored the position of the committee.

background in academia, but others come from financial institutions in the City of London, the civil service, or industry.

[TABLE 3.1 ABOUT HERE]

Turning to existing research on the MPC, several scholars have estimated reaction functions of varying specifications to assess the response of MPC interest rates to key economic variables (cf. Gascoigne and Turner 2004; Adam et al. 2005; Goodhart 2005). Other researchers have exploited the availability of MPC voting records to investigate monetary policy-making behaviour within the committee. Some papers concentrate on the voting behaviour of groups of members, particularly internals versus externals. Spencer (2007) and Harris and Spencer (2007) find that external members are more likely to vote for a cut in interest rates than internal members. Gerlach-Kristen (2007) draws similar conclusions from an analysis of the relative voting behaviour of insiders and outsiders. In a slight modification of this result, Hansen and McMahon (2008) find evidence that, after their first year on the committee, external members tend to vote for lower interest rates than internal members.

In contrast to these studies, we analyse voting behaviour on the MPC at the individual rather than group level. This approach reduces the risk of confounding individual-level with group-level explanatory variables. To elaborate, the result that external members on average vote for lower rates than internal members might be caused by idiosyncratic factors rather than anything systematically related to being an external member. Of course, if this result was obtained from analysis of a time-period that included the terms of a large number of external and internal members, then we could be reasonably confident in attributing preferences for lower rates to the external-*ness* of a member. However, as the time-period reduces to include fewer numbers of individuals within each group, this confidence reduces. Unfortunately, the MPC has only been in existence since 1997 and, as of April 2008, any

study can compare the votes of a maximum of only eleven internal and fourteen external members. Given this relatively small number of members within each group, we prefer to look at individual-level voting behaviour and assess patterns in group behaviour based upon our measures of individual-level behaviour.

Other studies of MPC voting records have also sought to measure differences in voting behaviour at the individual level. For example, Besley et al. (2008) estimate a reaction function for the preferred interest rate of each MPC member at each MPC meeting between June 1997 and July 2007. They find evidence of heterogeneity in reaction functions across individual members, but show that this heterogeneity does not appear to be systematically related to career background or the internal or external status of a member. Brooks et al. (2007) find evidence for significant differences in reactions to economic conditions across individual members. Finally, Bhattacharjee and Holly (2005) find that individuals place more weight on personal economic forecasts (and thus increasingly differ in preferred interest rates) as Bank forecasts become more uncertain. In addition to these studies of the Bank of England, Chappell et al. (2005) estimate individual FOMC member heterogeneity and investigate political influences on monetary policy via the Federal Reserve appointment process.

We depart from these latter studies by analysing member-specific voting behaviour on the MPC within a spatial voting framework.[2] As explained in more detail in the next section, we operationalise the spatial voting theory with an item response model and estimate the revealed relative monetary policy preferences of MPC members using Markov Chain Monte Carlo (MCMC) methods. This approach allows us to make two key contributions to the literature on the MPC. First, we provide a new measure of the relative voting behaviour of the 25 individuals who have sat on the committee between 1997 and May 2008. Second,

---

[2] Chang (2005) has analysed voting on the U.S Federal Open Market Committee within the spatial voting framework. However, her empirical analysis treats all votes to decrease interest rates and all votes to maintain interest rates as substantively the same, thereby losing valuable information.

because the MCMC method we use estimates the posterior distribution of all parameters in the statistical model, it is straightforward to make inferences about any auxiliary or composite quantity of interest within the model (Clinton et al. 2004).

This latter feature allows us to draw inferences regarding the differences between new MPC appointees and their predecessors, as well as changes in the median monetary policy preference on the MPC over time. As a result, we are able to investigate whether the Labour government was able to use its MPC appointment powers to influence monetary policy and, if this was the case, what may have been its incentives in doing so. This is an important issue since, as Mueller notes: "if the government cannot commit itself not to meddle with the macropolicy in general, how can it credibly commit itself not to meddle with the central bank?" (Mueller 2003 p.465). Evidence of political patterns in central bank appointments has been reported in studies of the US Federal Reserve (Havrilesky and Gildea 1992; Chang 2003; Chappell et al. 2005) and the German Bundesbank (Lohmann 1998; Berger and Woitek 2005). We demonstrate how our preference estimates enable tests for such political patterns in the UK context. These estimates also provide political scientists with the opportunity to empirically assess more general theories of appointments to independent policy-making bodies in the context of central banks committees.

3.3   Measuring the Monetary Policy Preferences of MPC Members

Our dataset consists of the voting choices of sitting MPC members in all 95 non-unanimous votes taken on interest rates between June 1997 and April 2008.[3] In total we observe the

---

[3] Although there are 132 meetings in this time-period, observations from 37 meetings where voting was unanimous were dropped. These unanimous votes do not provide any information about relative differences between committee members on the underlying dove-hawk dimension.

voting decisions of 25 MPC members over the period analysed. The data were coded from an MPC voting spreadsheet maintained by the Bank of England.[4] Each observed pairwise vote choice y_{it}, by individual i at meeting t, was coded as 0 if it was cast in favour of the lower nominal interest rate alternative and 1 if it was cast in favour of the higher nominal interest rate alternative.[5]

The starting point for our analysis of this data is the standard spatial model of voting (e.g. Hinich and Munger 1997). Our model assumes that monetary policy alternatives can be placed according to some underlying dimension, that MPC members have preferences over the location of policies on this dimension, and that each member maximises her utility by voting for the alternative closest to her most preferred location on the dimension (her ideal point).

At each meeting MPC members vote to set a nominal interest rate, the Bank rate. However, the same nominal interest rate of, say, 4 per cent, could be considered relatively restrictive if inflation and output growth were low, but relatively stimulatory if inflation and output growth were high. Therefore, through their choice of a nominal interest rate in a given meeting, we model policy-makers as choosing a point on an underlying dimension that measures the relative restrictiveness of a nominal interest rate given economic conditions. We call this the 'dove-hawk' dimension.[6]

---

[4] http://www.bankofengland.co.uk/publications/minutes/mpc/index.htm.

[5] If votes at an MPC meeting were split three ways, where some members dissent in favour of higher interest rates than the majority position while other members dissent in favour of lower interest rates than the majority, we coded the decision as two separate pairwise votes: one the majority-preferred interest rate against the lower rate alternative; and the other the majority-preferred nominal interest rate against the higher rate alternative. We assume that somebody who supports lower interest rates than the majority in the former vote opposes higher interest rates than the majority in the latter vote. Our coding scheme thus implies that MPC members' state their preferred interest rate truthfully. Overall, there were five MPC meetings in the time-period covered where members voted for three different interest rates; hence T = 95 pairwise votes from 90 MPC meetings.

[6] Initial investigation of the MPC voting data suggests that the pattern of voting is overwhelmingly one dimensional. That is, members who tend to disagree with the majority tend to disagree in favour of a lower interest rate or tend to disagree in favour of a higher interest rate. The only exception to this one-dimensional structure is the behaviour of Buiter, who occasionally disagreed with the majority on the level of interest rate activism (in other words, Buiter is observed to vote on some occasion for greater rate increases than the majority and on other occasions for greater rate decreases than the majority).

Formally, let the location of a nominal interest rate proposal on the dove-hawk dimension be a function $f(r_t, x_t)$, where r_t denotes the nominal level of the proposed interest rate and x_t is a vector characterizing contemporaneous economic conditions at meeting t. Although we leave the exact functional form of $f(.)$ unspecified, it is reasonable to assume that $f(r_t, x_t)$ is increasing in r_t. That is, if r_t^l and r_t^h are two nominal interest rates evaluated at the same meeting, where r_t^l is the lower of the two nominal rates (i.e. $r_t^l < r_t^h$), then we assume that the higher nominal rate will always be a more restrictive policy than the proposal for the lower rate, and would thus be located higher on the dove-hawk dimension. Letting $l_t = f(r_t^l, x_t)$ and $h_t = f(r_t^h, x_t)$ denote the mapping of the lower nominal rate and higher nominal rate respectively onto the dove-hawk dimension, we thus assume that $l_t < h_t$. However, as economic conditions vary between meetings, the same nominal interest rate level would be mapped to different locations on the dove-hawk dimension.

Our goal is to use observed voting behaviour to make inferences about the systematic differences in the preferred points of MPC members on this underlying dimension. That is, we measure whether some members tend to prefer more restrictive interest rates relative to other members, across meetings which take place in different economic circumstances.

There are several possible reasons why members might disagree about the desired interest rate given a common set of economic circumstances. For example, members may have different perceptions about the level of potential output in the British economy (Gerlach-Kristen 2006; Blinder 2007). The size of the output gap is generally considered to be a key driver of future inflation, so if members differ in their assessment of potential output, and these differences are reasonably stable over time, then members are likely to exhibit differences in preferred interest rates across meetings. Alternatively, heterogeneity in underlying monetary policy preferences may reflect systematic differences in the way in which individual members believe economic variables interact to produce inflation. Hansen

and McMahon (2008: 5) describe these as differences in the "philosophy" of members, while

Blinder (2007 p.109) labels them "differences in decision-making heuristics". Finally,

members may also have differing preferences regarding the short-run trade-off between

inflation and unemployment, perhaps reflecting "personal judgements about the relative

social costs of inflation versus unemployment" (Blinder, 2007 p.108).[7]

We are agnostic about the precise reasons why certain MPC members might tend to

prefer higher interest rates to other members across different meetings. It is sufficient for us

to assume that MPC members can be conceptualized as having reasonably stable underlying

monetary policy preferences such that a member with more hawkish policy preferences will

tend to prefer more restrictive interest rates relative to others.

Specifically, we model an individual MPC member as an actor who chooses between

proposals for the nominal interest rate according to the relative distance between the location

of these proposals on the dove-hawk dimension and his or her preferred point on this

dimension. In a given MPC meeting at time t, committee member i evaluates the utility he or

she would derive from two proposed nominal interest rates r_t^l and r_t^h, where $r_t^l < r_t^h$, as

follows:

$$U_i(r_t^l) = -(\theta_i - f(r_t^l, x_t))^2 + \eta_{i,t} = -(\theta_i - l_t)^2 + \eta_{i,t} \qquad (1)$$

$$U_i(r_t^h) = -(\theta_i - f(r_t^h, x_t))^2 + v_{i,t} = -(\theta_i - h_t)^2 + v_{i,t} \qquad (2)$$

where $\eta_{i,t}$ and $v_{i,t}$ are random independently distributed utility shocks with zero mean.[8] The θ_i

parameter in equations (1) and (2) measure member i's time-invariant preferred point on the

dove-hawk dimension. In other words, θ_i represents the underlying monetary policy

preference of individual i.

---

[7] King (2002: 222) has argued that all MPC members have a responsibility to meet the same inflation target, so that there is no room for differences in preferred inflation levels. However, Blinder (2007: 110) states that in his experience as Vice-Chairman of the Federal Open Market Committee, such differences are 'common in practice'.

[8] See Bhattacharjee and Holly (2006) for an attempt to model the voting of a subset of five MPC members while relaxing the independence assumption.

We follow Clinton et al. (2004) in deriving an item response specification, originally developed for education testing, to formalize the spatial model of voting. First, given the utility functions laid out in equations 1 and 2, we can write member i's utility differential for two proposed interest rates at locations $l_t = f(r_t^l, x_t)$ and $h_t = f(r_t^h, x_t)$ on the dove-hawk dimension as

$$y_{i,t}^* = U_i(h_t) - U_i(l_t)$$

$$= [- (\theta_i - h_t)^2 + v_{i,t}] - [- (\theta_i - l_t)^2 + \eta_{i,t}]$$

$$= \beta_t \theta_i - \alpha_t + (v_{i,t} - \eta_{i,t}) \tag{3}$$

where $\beta_t = 2(h_t - l_t)$ and $\alpha_t = (h_t^2 - l_t^2)$. Recall that h_t denotes the more hawkish interest rate proposal. Individual i votes for the more hawkish proposal located at h_t if $y_{i,t}^* > 0$, for the more dovish proposal at l_t if $y_{i,t}^* < 0$, and is indifferent between the two proposals if $y_{i,t}^* = 0$.

If we assume that the random variable $(v_{i,t} - \eta_{i,t})$ has a logistic distribution and is independent across MPC members and meetings, then we can express the probability of individual i voting for the more hawkish of the two interest rates proposed at time t as

$$\Pr(y_{i,t} = 1) = 1/(1 + \exp(\alpha_t - \beta_t \theta_i)). \tag{4}$$

This is essentially a binary logistic regression to be estimated based on the observed binary vote choices, $y_{i,t}$, of members over pairs of interest rate proposals.

Interpreting the proposal-related parameters in (4) substantively, β_t is commonly called the "item discrimination parameter", and measures the extent to which the two members' preferences over the dove-hawk dimension determine their choice over two competing interest rate proposals observed at time t. For example, if $\beta_t = 0$ then the two competing interest rate proposals are at identical positions on this dimension and different voting behaviour between members does not reflect considerations captured by the dove-hawk dimension. α_t is the "difficulty parameter", measuring the general probability of voting for the more hawkish interest rate proposed at time t. In a one-dimensional policy space, the

ratio α_t/β_t is equal to the midpoint between the two interest rate proposals on the dove-hawk

dimension (Jackman 2000a). Holding member i's monetary policy preference constant at θ_i,

as α_t/β_t increases then the midpoint becomes more hawkish and the probability that i votes for

the more hawkish proposal decreases. Conversely, holding constant α_t/β_t (i.e. for a given

pairwise vote over interest rate proposals) if member i has an ideal point that is higher than

that of member j (i.e. $\theta_i > \theta_j$) then i is more likely to vote for the more hawkish proposal than

is j.

Note that by the derivation above, for a given pairwise vote, the parameters α_t and β_t

are functions both of the nominal interest rate alternatives being voted upon at t and

contemporaneous economic conditions at t. In this sense, the inclusion of these parameters,

which are estimated (along with the θ_i) based on observed voting patterns on the MPC and

can be thought of as random effects for each specific pairwise vote, allows us to control for

time-varying economic conditions. That is, by allowing the α_t and β_t parameters to vary

across time-periods we tap variance in the level of nominal interest rate proposals over time

and variance in economic conditions over time. An alternative approach might be to model

the proposal-related parameters for each pairwise vote as a function of observed economic

indicators. However, since our primary focus is on the preference estimates θ_i, we leave the

inclusion of such variables for future research.

Model (4) is estimated using a Markov Chain Monte Carlo (MCMC) algorithm.[9] For

the purposes of estimation, the model specified in (4) was identified by constraining the

---

[9] We estimated the posterior distribution of the parameters in 4 using the MCMCirtKd function from the
MCMCpack library in R (Martin and Quinn 2006). The MCMC algorithm iteratively updates the estimates of
the model parameters. After a sufficient number of iterations (or burnin period), each set of parameter estimates
for each given iteration represents a draw from the joint posterior distribution. This posterior distribution
'summarizes our information about the parameters having observed the [voting] data' (Clinton et al. 2004
p.357). Given the large number of iterations for which MCMC algorithms are generally run, the estimates from
a smaller subset of these iterations are stored and utilized for inference (for more technical details see Jackman
2000a,b). The MCMC algorithm ran for 1,000,000 iterations, with the first 500,000 iterations discarded as
burnin. Every 50th iteration after this burnin period was stored for inference. Therefore, the results presented
below are based upon 10,000 draws from the posterior distribution. Standard tests show no indication of non-
convergence of the parameter estimates (Jackman, 2000b; Gelman et al. 2003).

discrimination parameters β_t to be positive for every observed vote. This implies that the probability of observing $y_{i,t} = 1$ is always increasing in θ_i. Such a constraint is desirable in the monetary policy-setting because a vote for the more restrictive interest rate proposal in any pairwise vote is clearly a more "hawkish" vote and is always coded as 1 in the data. Thus we include information as to the directionality of each voting alternative (i.e. which alternative is the more restrictive, or hawkish, of the two) in model estimation. This is unusual in applications of ideal point estimation which have generally focused on legislatures and the U.S. Supreme Court, since in these settings coding the substantive direction of voting alternatives on various different issues is more difficult (Bafumi et al. 2005). In this application, each β_t is assigned a prior distribution $\beta_t \sim N(1,10)$ truncated to lie above zero. The truncation ensures that the direction of the model is identified. Aside from the positivity constraint this prior distribution is relatively uninformative, in the sense that the relative differences in MPC member preferences estimates are robust to alternative specifications of the priors. Aside from the discrimination parameter, we select standard normal priors $\theta_i \sim N(0,1)$ for all ideal point parameters and vague priors $\alpha_t \sim N(0,10)$ for the discrimination parameters. Again, the relative differences in MPC member preferences estimates are not sensitive to alternative specifications of these priors.

3.4 Estimates of MPC Member Monetary Policy Preferences

Our ideal point estimates for the MPC members are summarised in Figure 3.1. Each point indicates the median estimate of the ideal point of each individual, while the thick line indicates the 50 per cent credibility interval of the distribution and the thin line indicates the 95 per cent credibility interval.

Inspection of Figure 3.1 suggests three distinct groups of MPC members: the doves, centrists, and hawks. First, Wadhwani, Blanchflower, Julius and Allsopp are the doves. All of these four members have estimated monetary policy preferences that are clearly statistically distinguishable in the dovish direction from at least 18 other MPC members, in that none of the former has a 95 per cent credibility interval that overlaps with any of the latter. Second, Large, Besley and Sentence are the hawks. All have estimated monetary policy preferences that are statistically distinguishable in the hawkish direction from 14 other members if we consider 95 per cent credibility intervals, and 22 other members if we consider 50 per cent central tendencies. The remaining 18 MPC members are the centrists, as their monetary policy preferences are indistinguishable from each other if we consider 95 per cent credibility intervals. Davies's ideal point is estimated with large uncertainty because he only voted in two MPC meetings.

[FIGURE 3.1 ABOUT HERE]

Figure 3.1 also reveals that, aside from Large, internal members tend to be located in the centrist group. Interestingly though, externally appointed members are found in both the group of hawks, the doves and amongst the centrist group. Thus our results, which are based upon an analysis of individual-level voting behaviour, do not entirely agree with the previous research that concluded that external members tend to vote for less restrictive interest rates than internal members (e.g. Spencer 2007; Harris and Spencer 2007; Gerlach-Kristin 2007).

Given that each committee member's estimated ideal point is associated with varying degrees of uncertainty, it is useful also to compare members according to their probable ranking on a dove-hawk scale. For each of the 10,000 samples from the posterior distribution, we ranked the sampled ideal point of each of the twenty-five individuals on a dove-hawk scale and stored the resulting ranking. Table 3.2 summarises the distribution of rankings across these samples. A rank of one indicates that the individual was ranked as the

most dovish of the 25 members, while a rank of 25 indicates that he or she was ranked the most hawkish.

[TABLE 3.2 ABOUT HERE]

The results in Table 3.2 support the idea that there have been three distinct groups of MPC members since 1997. Regarding the doves, Allsopp, Julius, Wadhwani, and Blanchflower were all ranked 5 or lower (i.e. as one of the five most dovish members) in at least 95 per cent of samples. Regarding the hawks, Large, Besley and Sentence were ranked 21 or higher (i.e. as one of the four most hawkish members) in at least 95 per cent of the samples. Overall, then, these results corroborate our interpretation of Figure 3.1. It is also worth noting that we can be confident that the present Governor, Mervyn King, is among the more hawkish of the remaining centrists, since he is ranked between 16 and 21 at least 95 per cent of the time.

As a validity check, we compare our ideal point estimates with two alternative ways of measuring the preferences of the MPC members that are commonly used by the media and MPC-watchers. The first is a simple 'batting average' score, where members are ranked according to the proportion of times they voted for an increase in interest rates. The second is a measure which is commonly used by *The Financial Times* (FT) and other publications (e.g. Edmunds 1999). This measure is calculated by assigning scores for each vote of each member, where a member scores 1 if he or she voted with the majority, 2 if he or she voted for a higher interest rate than the majority and 0 if he or she voted for a lower interest rate than the majority. An average of these scores is then calculated for each member across all of his or her votes.

The estimates from our Bayesian ideal point model compared to these 'batting average' and 'Financial Times' scores are illustrated in Figure 3.2 and Figure 3.3, respectively. The first thing to note is the relatively high correlation between our estimates

74

and both these types of measures – as shown by the clustering of most of the MPC members along the two regression lines. In other words, our method clearly passes the face validity test.

[FIGURES 3.2 AND 3.3 ABOUT HERE]

The figures nevertheless highlight some important differences between our estimates and the two more commonly used methods. The batting average method does not take account of the economic conditions at the time of each vote. For example, if a large portion of a member's time on the committee happens to coincide with a period when economic circumstance dictates that the Bank cut interest rates, he or she will tend to be artificially located towards the dovish end of the scale. This is the case with both Allsopp and Bean: Figure 3.2 shows that who we locate in much less extreme (albeit still relatively dovish in the case of Allsopp) positions than does the batting average measure.

The FT method improves on the batting average method because it measures whether each vote is part of the majority or the minority. To the extent that the majority view on the MPC tends to reflect economic conditions, it provides some sort of control for economic conditions: that is, a dissent vote implies that an individual prefers lower or higher rates relative to the majority of members, given economic circumstances.

But our method improves on the FT measure in this regard also. For example, Figure 3.3 shows that our method locates Allsopp in a less extreme position than the FT measure; which locates Allsopp as almost as dovish as Wadhwani. The close proximity of Wadhwani and Allsopp in the FT's scores is due to the fact that, over the course of their respective terms on the MPC, they had a similar proportion of dissenting votes in favour of lower rates (13 out of 37 for Wadhwani and 11 out of 37 for Allsopp), while neither dissented in favour of higher rates. However, these simple summaries, which drive the FT scores, do not reflect the fact that, during the period when Wadhwani and Allsopp were simultaneously on the committee

75

(between June 2000 and May 2002), Allsopp voted for higher rates than Wadhwani on eight

occasions while Wadhwani never voted for higher rates than Allsopp. By modelling each

voting observation directly, rather than averaging over a member's entire voting history like

the FT method, our measure picks up the fact that, given the same economic circumstances in

the same meetings, Allsopp voted for higher rates than Wadhwani eight times.

Finally, neither the batting average nor the FT method provides uncertainty estimates

surrounding MPC member preference estimates. This may invite the observer to conclude

that any two individuals differ in their preferences when the difference between their

estimated ideal points may in fact be well within the margin of error given the available data.

3.5 Patterns in the Composition of the MPC

With these estimates of the relative location of MPC members' monetary policy preferences

we can investigate patterns over time in the composition of the committee in terms of

preferences. We test whether these patterns are consistent with an electorally driven cycle in

appointments.

Is there an electoral cycle in appointments to the Bank of England MPC?

The classic 'political business cycle' (PBC) theory predicts that incumbent governments seek

to engineer economic booms prior to elections, then implement restrictive policies after

elections in order to deal with the inflationary consequences (Nordhaus 1975). In the present

context, this would imply that the British Chancellor would have wanted to use his

appointment powers to ensure favourable economic conditions prior to general elections.

That is, the Chancellor would be expected to use appointments to bias the MPC in a dovish

direction in a pre-election period so that a comparatively easier monetary policy stimulates

(or one that at least does not restrict) the economy in the run-up to the election. Given that it is generally thought that monetary policy affects output with a six to nine month lag (Clarida et al. 1999 p.1685), and that appointment opportunities are relatively rare because of fixed MPC terms, it appears reasonable to focus on the period between 24 and 6 months prior to a general election as the 'pre-election period'. In the remaining 'non-election periods', without pressing electoral incentives, the Chancellor would be expected to seek a more balanced, centrist MPC to deal more rigorously with the inflationary consequences of any pre-election stimulus.

It should be noted that the Chancellor could not possibly have perfect information about the likely behaviour of each member he appointed to the MPC. This may have limited his ability to appoint the 'types' of central banker he wanted given the political and economic circumstances. Nevertheless, it is reasonable to assume that the Chancellor had some idea about the preferences of potential appointees. These beliefs, based upon past academic work by the individual, their career background and also information gathered via mutual acquaintances, can be thought of as probability distributions along the dove-hawk scale for each appointee, some relatively wide (indicating high uncertainty regarding preferences), some narrower (indicating less uncertainty regarding preferences). Of course, the Chancellor would also have been able to observe the voting behaviour of existing MPC members and use this information when deciding whether to re-appoint someone.

In order to investigate whether there are electorally driven patterns in MPC appointments, we first examine the outcome of each instance where a new committee member was appointed to replace an existing member. Each 'appointment episode' is measured in terms of the probability that a new member of the committee is more dovish than

his or her predecessor was.[10] A probability of 0.5 indicates that a new member is estimated to have an equal probability of being more dovish than was his or her predecessor and being more hawkish than was his or her predecessor. A higher score indicates a higher probability of an appointee being more dovish than was his or her predecessor. Likewise, a lower score indicates a lower probability of an appointee being more dovish than was his or her predecessor. These scores are presented in Table 3.3.[11]

[TABLE 3.3 ABOUT HERE]

The appointment data in Table 3.3 can be interpreted in terms of four key periods. First, consistent with a PBC pattern in MPC appointments, during the pre-2001 election period (June 1999 to January 2001) new appointees tended to be more dovish than the members they replaced. This trend is particularly pronounced in the cases of Wadhwani's and Allsopp's appointments. Wadhwani replaced the relatively hawkish Budd, who had only served on the committee for a shortened two-year term, in June 1999, two years before the general election. According to our ideal point estimates the probability that Wadhwani is more dovish than Budd is greater than 0.99. At the same time, the Chancellor opted to re-appoint the executive director, Plenderleith, who appears to be relatively dovish compared to Budd.

Allsopp replaced Goodhart in June 2000, eleven months before the general election. Interestingly, Goodhart, relatively centrist on our dove-hawk scale, stated publicly that he had expressed an interest in serving a second term (Beattie 2000). Despite this, the Chancellor chose to replace him with Allsopp who again has an estimated probability of being more dovish than Goodhart that is greater than 0.99. Notably, most economic journalists at the

---

[10] Each probability is based upon the 10,000 draws from the joint posterior distribution and corresponds the frequency with which the appointee in question is drawn as being more dovish than his or her predecessor.

[11] The table does not include those individuals who were original members of the MPC in June 1997 (George, King, Buiter, Goodhart, Plenderleith and Davies), or who were appointed in the months thereafter to fill hitherto empty positions on the committee (Julius, Budd and Vickers).

time of Allsopp's appointment expected him to be a dove (Thornton 2000). The Chancellor is unlikely to have been unaware of these expectations.

Furthermore, in addition to these stand-out cases, every replacement during the pre-election period for the 2001 general elections involved the appointment of an individual who has an estimated probability greater than 0.99 of being more dovish then his or her predecessor. The result of this appointment policy was that, from October 2000 until the general election in May 2001, the MPC contained three of the four individuals identified above as the clearest doves out of all MPC members since 1997: Allsopp, Wadhwani and Julius. In sum, the pattern of appointments in the pre-2001 election period is consistent with the predictions of the PBC theory.

Second, and again consistent with the PBC predictions, during the subsequent non-election period (February 2001 to May 2003) MPC appointments reduced the dovish bias on the MPC. In this period, appointments resulted in either (1) the replacement of dovish or centrist MPC members with centrist individuals, or (2) the replacement of centrist MPC members with more hawkish individuals. The appointments of Barker, Tucker and Bell fall into the first category, while that of Large falls into the second. That is, although the estimated probability of Barker, Tucker and Bell being more dovish than their predecessors is lower than 0.01, 0.01 and 0.04 respectively, all are far from hawks according to our ideal point estimates in Figure 3.1. In contrast, the probability that Large is more dovish than his predecessor, Clementi, is lower than 0.01 *and* we have already identified Large as one of the clear hawks according to Figure 3.1.

Third, however, the observed pattern in appointments during the pre-2005 election period (June 2003 to December 2004) runs contrary to PBC expectations that the Chancellor would use appointments to induce a dovish bias on the MPC in the run-up to an election. During this period appointments made only a marginal difference to the overall balance

between doves and hawks on the MPC. For example, Lambert, appointed in June 2003, has estimated probability lower than 0.01 of being more dovish than his predecessor Allsopp, but is still only a centrist according to Figure 3.1. In addition, according to our estimates, the probability that Lomax was more dovish than George, whom she replaced[12] in July 2003, is only 0.43. The policy of making a mixture of both dovish and hawkish replacements continued during the final non-election period in our data (January 2005 to April 2008).

Another way of assessing whether there is a PBC pattern in MPC appointments is to look at how appointments shift the location of the median member of the committee. Given that the MPC is a collective choice body that make decisions by majority vote, the Chancellor is able to influence monetary policy via appointments only to the extent that he or she can move the position of the median voter on the committee (cf. Krehbiel 2007). In line with the PBC predictions, we inspect the estimated change in the MPC median between key points in the electoral cycle: namely, the last month of a "non-election period" and last month of the subsequent 'pre-election period', and vice versa.[13] Figure 3.4 plots the median estimate of these changes, together with 95 per cent credibility intervals.[14]

[FIGURE 3.4 ABOUT HERE]

As with our analysis of individual appointment episodes, observed changes in the position of the MPC median are consistent with the PBC predictions in the pre-2001 election period but not in the pre-2005 election period. Figure 3.4 shows that, between the end of the first non-election period and the end of the pre-election period for the 2001 general elections (i.e. from June 1999 to January 2001), the estimated shift in the MPC median is negative and

---

[12] While Mervyn King replaced Sir Eddie George as the Governor of the Bank when Sir Eddie George's term ended, it was Rachel Lomax who filled the resulting vacancy on the MPC.

[13] These estimates are again based on draws from the posterior distribution. For each draw, the median ideal point of each combination of members that have sat on the MPC together at any point in time was calculated. To obtain a draw of the change in the median between two time points we then took the difference between the median of the committee composition at the first time point and the median of the committee composition at the second time point. This exercise was repeated 10,000 times, yielding a sample from the posterior distribution of the change in the median MPC member at each time interval of interest.

[14] The final non-election period is defined using the last month of observed voting data, and would correspond to a general election in April 2010.

is statistically distinguishable from zero. In addition, between the end of the pre-2001

election period and end of the subsequent non-election period (January 2001 to May 2003),

the estimated change in the MPC median is positive and marginally indistinguishable from

zero at the 95 per cent level. This is consistent with the PBC prediction that the Chancellor

would seek to re-balance the MPC post-election after inducing a dovish bias in the pre-2001

election period. However, between the end of this non-election period and the end of the

subsequent pre-2005 election period (May 2003 to December 2004), where the PBC would

predict a dovish change in the MPC median, the estimated change in fact tends to be positive,

though clearly indistinguishable from zero at the 95 per cent level.

In sum, our analysis of individual appointments and of changes in the median does not

appear to support the contention that there was a straightforward PBC-type electoral cycle in

appointments to the Bank of England MPC. Though in the pre-2001 electoral period the

Chancellor did tend to appoint relative doves to replace more hawkish predecessors on the

MPC, and in doing this successfully shifted the MPC median in a dovish direction, no such

pattern is apparent in the pre-2005 election period. These results are consistent with existing

research that has found only weak support for political business cycles in the UK (e.g.

Alesina et al. 1997).

Discussion

Despite the lack of evidence for a straightforward electoral cycle in MPC appointments, it

does appear that the British Chancellor is able to move the position of the median voter of the

MPC through his or her appointment powers. Indeed, as Figure 3.4 shows, we estimate that

there was a clear dovish shift in the MPC median between and June 1999 and January 2001,

and that there was hawkish shift in the MPC median, marginally distinguishable from zero, in

two later periods. This suggests that appointments to the MPC matter for monetary policy.

As a result, it is important to develop a better understanding of the likely incentives of the Government with regard to MPC appointments. We have demonstrated that there is weak support for a straightforward electoral cycle in appointments. But given that monetary policy is one of the most powerful tools of macroeconomic management at a state's disposal, it is likely that politicians will have some interests regarding the composition of the body that sets this policy.

One potentially fruitful avenue for future research would be to analyse the Chancellor's monetary policy (and thus MPC appointment) incentives conditional on fiscal policy. Political economists have analysed the interaction of fiscal and monetary policy in the context of varying levels of central bank independence (Alesina and Tabellini 1987; Agell et al. 1996; Clark and Hallerberg 2000). However, the British Labour government operated in a context of varying levels of constraints on fiscal policy. Specifically, in order to demonstrate that Labour could be responsible with the public finances, during the 1997 general election campaign the party leadership pledged that for its first two years in office Labour would stick to the public spending plans of the previous Conservative government. This pledge committed the new Labour government to a relatively austere fiscal policy for at least two years. For example, in the financial year 1999-2000 public expenditure as a percentage of GDP reached its lowest point since 1980 (HM Treasury 2007). During the financial year 2000-01 public expenditure began to rise, but only slowly. Moreover, the government continued to record a positive budget surplus until the end of the financial year 2001-02.

Thus, there were political constraints upon fiscal policy in the period prior to the May 2001 general election. Given these constraints, the Chancellor may have had an incentive to ensure that a relatively dovish MPC maintained economic growth in the run-up to this election.

In contrast, from the financial year 2001-02 until the present, government expenditure as a percentage of GDP has increased rapidly, while the cyclically adjusted budget balance has been in deficit since 2002-2003 (HM Treasury 2007). Having gained a reasonable reputation for economic competence, Labour did not need to make similar restrictive fiscal policy pledges prior to the 2001 general election. In a context where increased public investment was likely to fuel continued economic growth, and was indeed electorally popular in itself, the Chancellor may have had an incentive to ensure a more centrist or hawkish MPC in order to minimise the inflationary consequences of fiscal expansion.

To explore the relationship between MPC appointments and fiscal policy, Figure 3.5 and 6 plot the location of the estimated median preference on the committee between June 1997 and April 2008 together with time series of the budget balance and public spending over this period, respectively.

[FIGURE 3.5 AND 3.6 ABOUT HERE]

Figures 3.5 and 3.6 raise the possibility that MPC appointments may be related to the stance of fiscal policy. Consistent with the evidence presented earlier, the plots in Figures 3.5 and 3.6 suggest that the MPC median became markedly more dovish in the two years prior to the May 2001 general election and then reverted back to a relatively more hawkish trend, which persisted during the pre-2005 election period and thereafter. We see in Figure 3.6 that when the budget surplus is at its highest we also measure the most dovish MPC median for the entire 1997-2008 period. As the budget surplus moves toward a deficit hawks and centrists start to replace doves in the committee and the estimated MPC median becomes more centrist.

This observed pattern is only suggestive, but raises the possibility that the Chancellor used MPC appointments to pursue a less constrained monetary policy during a pre-election period when public spending was constrained (prior to the 2001 general election), and then to

pursue a more centrist or hawkish monetary policy after the initial spending constraints had been lifted (after Labour's re-election in 2001). Given the evidence that MPC appointments matter – in the sense that they have enabled the Chancellor to move the median – and the inadequacy of a straightforward PBC-type explanation for appointment patterns, the possibility of an interaction between the Chancellor's fiscal policy and MPC appointment incentives at least merits further investigation. We leave this to future research.

3.6 Conclusion

We have examined the making of monetary policy in the UK in the first ten years of the independence of the Bank of England. We employed a Bayesian estimation technique to undertake a spatial analysis of voting on the Bank of England Monetary Policy Committee between June 1997 and April 2008. To our knowledge, this is the first time such a statistical estimation technique has been applied to voting in a central bank committee and is also the first spatial analysis of voting in the Bank of England MPC. Using this method we produced an original set of estimates of the ideal points of MPC members on a 'dove-hawk' scale representing relative preferences over interest rates given economic conditions.

These estimates constitute a valuable contribution to the literature on the MPC, independent central banks, and on appointments to independent policy-making committees in general. They provide new and substantively motivated measures of the relative monetary policy preferences of individual MPC members together with easily interpretable uncertainty estimates for these measures. In addition, because we use Bayesian simulation to produce our estimates it is straightforward to make inferences about auxiliary or composite quantities of interest, such as the position of the median voter on the MPC.

We illustrated the practical value of our dove-hawk measures by using them to investigate the British Chancellor's appointments to the MPC. The observed pattern in MPC appointments, and in the movement of the median voter on the MPC over time, is not consistent with a political business cycle approach where the Chancellor seeks a more dovish MPC composition in the run-up to general elections. Although MPC appointments did lead to a clear dovish shift in the MPC median in the period prior to the 2001 general election, this was not the case in the period prior to the 2005 general election.

Nevertheless, our analysis indicates that MPC appointments do matter for monetary policy, in that the Chancellor has been able to move the MPC median through appointments. This finding has implications for research on independent central banks more generally, in that it suggests that politicians may still influence the monetary policy of a highly independent central bank via appointments. Some may argue that a degree of democratic control upon such a major macroeconomic policy tool is desirable, while others may argue the opposite. Either way, our results highlight the importance of appointments as a channel for political influence. Given the inadequacy of the straightforward political business cycle approach to explaining appointments, we have suggested that future research may usefully investigate the relationship between the Chancellor's appointment incentives and the current stance of fiscal policy.

The Bayesian item-response model we use to study voting behaviour on the Bank of England MPC has already been demonstrated to be useful for studying voting in other committees such as courts (see Martin and Quinn 2002) as well as legislatures more generally (Clinton et al. 2004). But this approach is also applicable to other central banks that publish individual level voting data. These include the Federal Reserve, the Swedish Riksbank, the Bank of Japan, and the National Bank Poland. In different central bank settings scholars can use central banker preference estimates to test alternative theories of central bank

appointments. Indeed, the next paper in this thesis demonstrates this point, exploiting variation in the partisan affiliation of political actors who appointing different central bankers to the National Bank of Poland to test for partisan appointments.

Furthermore, for every country that publishes central bank voting records, the opportunities to test alternative theories of central bank appointments will expand in the future: as time passes we will be able to observe the monetary policy voting behaviour of greater number of central bankers appointed under a greater variety of political circumstances. A case in point is the recent election of a new Conservative-Liberal Democrat coalition government in the UK. Here, in a number of years it will be possible to test whether the individuals appointed to the Bank of England by this new government have systematically different preferences to those appointed under the previous Labour government.

So that researchers can fully exploit these opportunities to test alternative theories of central bank appointments, in future work we aim to examine extensions of the ideal-point estimation framework presented above that may be possible in the context of monetary policy voting. Such extensions include explicitly incorporating economic information in the statistical model, incorporating information regarding the nominal interest rate alternatives being voted upon, and experimenting with alternative specifications of the utility function guiding the voting behaviour.

Table 3.1

MPC Members, June 1997-April 2008

Name	First Meeting	Last Meeting	Status	Background prior to appointment
Howard Davies	June 1997	July 1997	Internal	Bank of England
Willem Buiter	June 1997	May 2000	External	Academia
Charles Goodhart	June 1997	May 2000	External	Academia
Ian Plenderleith	June 1997	May 2002	Internal	Bank of England
Sir Edward George	June 1997	June 2003	Internal	Bank of England
Mervyn King	June 1997	--	Internal	Bank of England/Academia
DeAnne Julius	September 1997	May 2001	External	Industry
David Clementi	September 1997	August 2002	Internal	Finance
Sir Alan Budd	December 1997	May 1999	External	Government
John Vickers	June 1998	September 2000	Internal	Academia
Sushil Wadhwani	June 1999	May 2002	External	Finance
Christopher Allsopp	June 2000	May 2003	External	Academia
Stephen Nickell	June 2000	May 2006	External	Academia
Charles Bean	October 2000	--	Internal	Academia
Kate Barker	June 2001	--	External	Industry
Paul Tucker	June 2002	--	Internal	Bank of England
Marian Bell	July 2002	June 2005	External	Finance/Government
Sir Andrew Large	October 2002	January 2006	Internal	Finance
Richard Lambert	June 2003	March 2006	External	Financial journalist
Rachel Lomax	July 2003	--	Internal	Government
David Walton	July 2005	June 2006	External	Finance
Sir John Gieve	February 2006	--	Internal	Government
David Blanchflower	June 2006	--	External	Academia
Tim Besley	September 2006	--	External	Academia
Andrew Sentance	October 2006	--	External	Industry

Table 3.2

Summary of Rankings by iteration

MPC Member	Rank 5%	Rank 25%	Median rank	Rank 75%	Rank 95%
Large	21	23	24	25	25
Besley	21	23	24	25	25
Sentance	21	23	24	25	25
Budd	17	20	21	22	24
Vickers	16	19	21	22	24
King	16	18	19	20	21
Walton	9	14	18	20	23
Tucker	14	16	17	19	21
Buiter	9	14	17	19	21
Goodhart	10	14	16	18	20
Gieve	9	13	16	18	20
Lambert	7	9	13	15	18
Lomax	7	9	12	14	17
George	7	9	11	13	15
Barker	7	9	11	13	15
Clementi	7	9	11	13	16
Bean	7	9	10	12	15
Plenderleith	7	8	10	12	15
Davies	3	5	9	19	23
Nickell	5	5	6	7	7
Bell	4	5	6	7	8
Allsopp	3	4	4	4	5
Julius	1	2	3	3	4
Wadhwani	1	1	2	2	3
Blanchflower	1	1	2	3	4

Table 3.3

MPC Replacements

New appointee	Predecessor	Date of replacement	Appointment type	Probability that new appointee is more dovish than his or her predecessor
Clementi	Davies	September 1997	Internal	0.45
Wadhwani	Budd	June 1999	External	> 0.99
Nickell	Buiter	June 2000	External	> 0.99
Allsopp	Goodhart	June 2000	External	> 0.99
Bean	Vickers	October 2000	Internal	> 0.99
Barker	Julius	May 2001	External	< 0.01
-------------------- GENERAL ELECTION, June 2001 --------------------				
Tucker	Plenderlieth	June 2002	Internal	< 0.01
Bell	Wadhwani	July 2002	External	0.04
Large	Clementi	October 2002	Internal	< 0.01
Lambert	Allsopp	June 2003	External	< 0.01
Lomax	George	July 2003	Internal	0.43
-------------------- GENERAL ELECTION, May 2005 --------------------				
Walton	Bell	July 2005	External	0.01
Gieve	Large	February 2006	Internal	> 0.99
Blanchflower	Nickell	June 2006	External	> 0.99
Besley	Lambert	September 2006	External	< 0.01
Sentance	Walton	October 2006	External	0.05

Figure 3.1

Revealed Preferences in the MPC
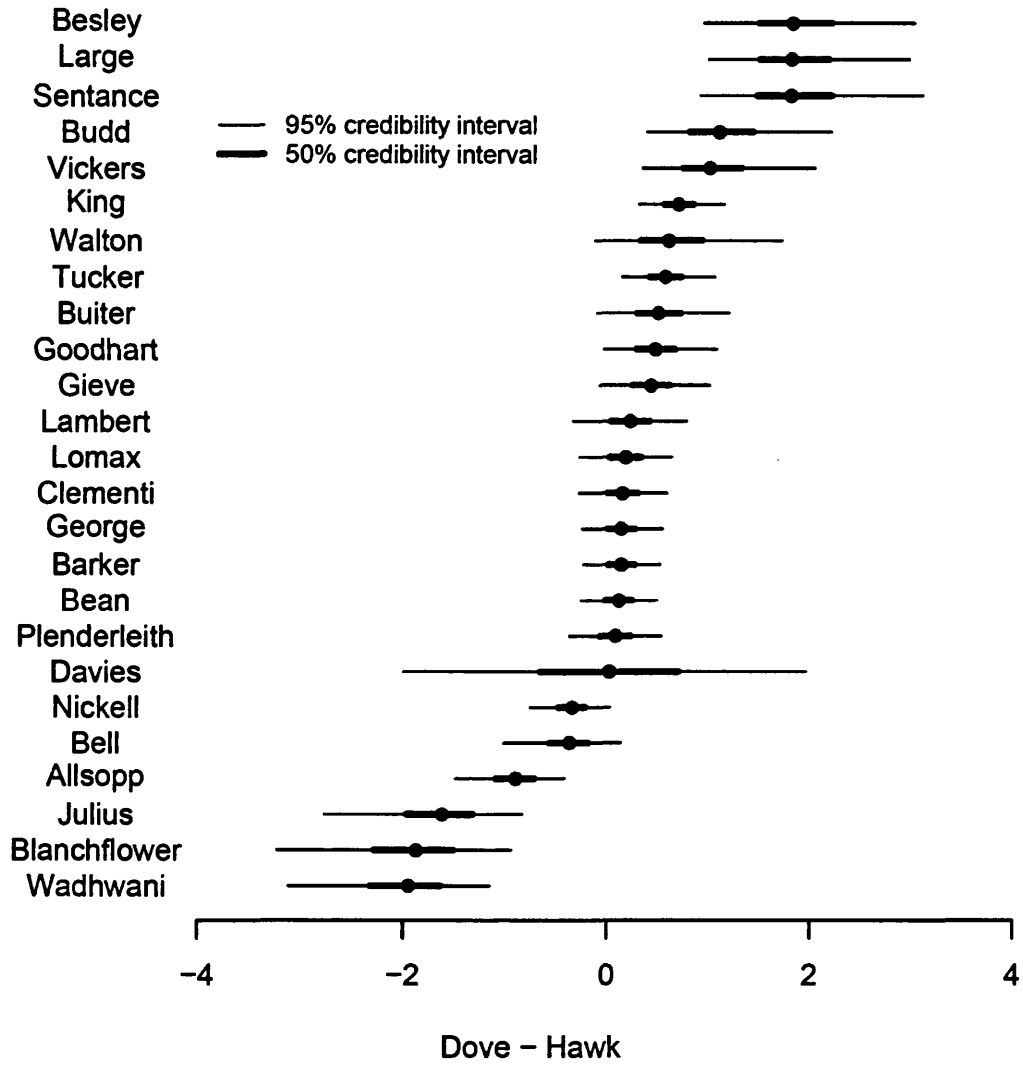
Figure 3.2

Comparison of Bayesian estimation with batting averages
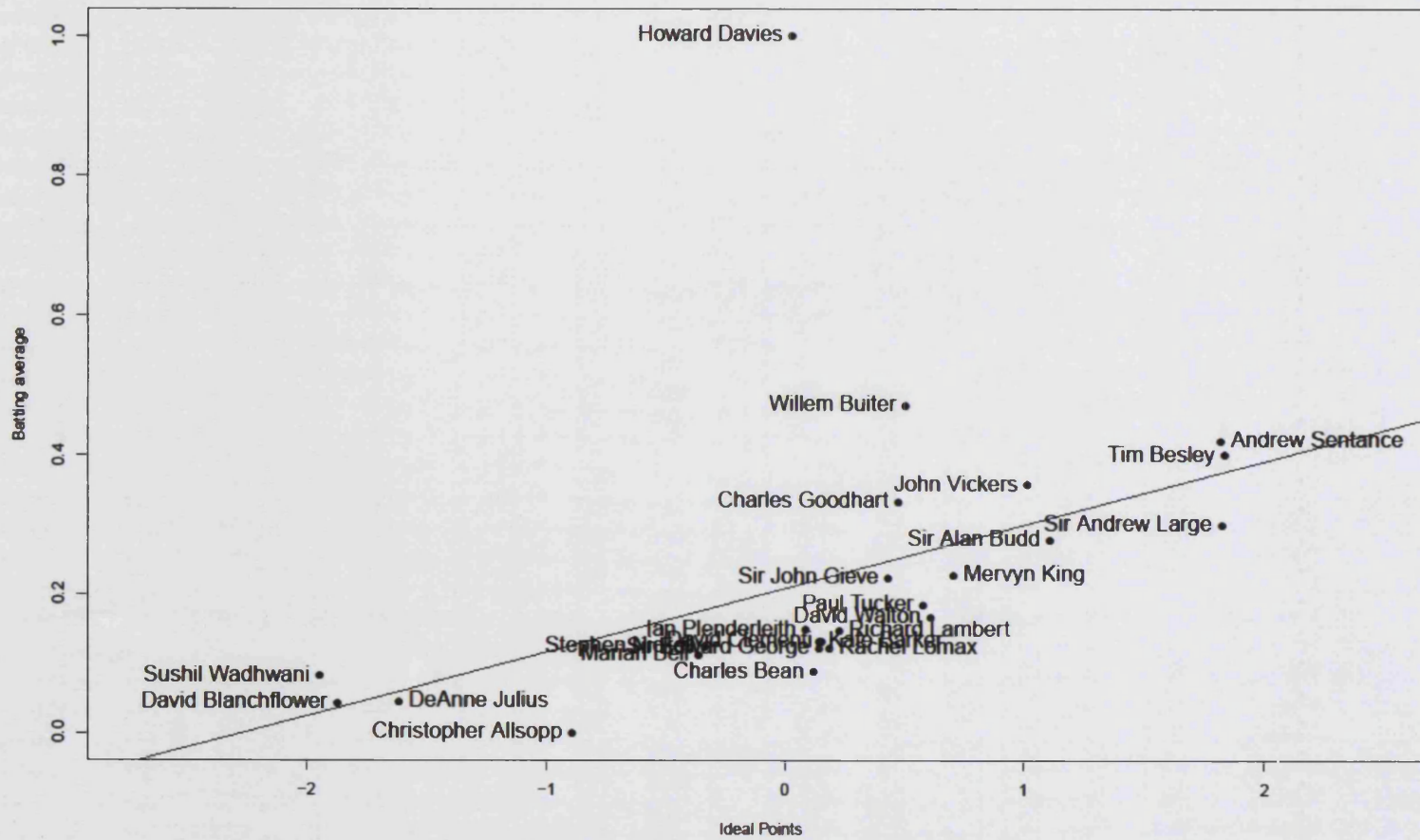
Note: The functions in the figures are bivariate regressions of our Bayesian ideal point estimates on the FT score for each member.

Figure 3.3

Comparison of Bayesian Estimation with FT Scores
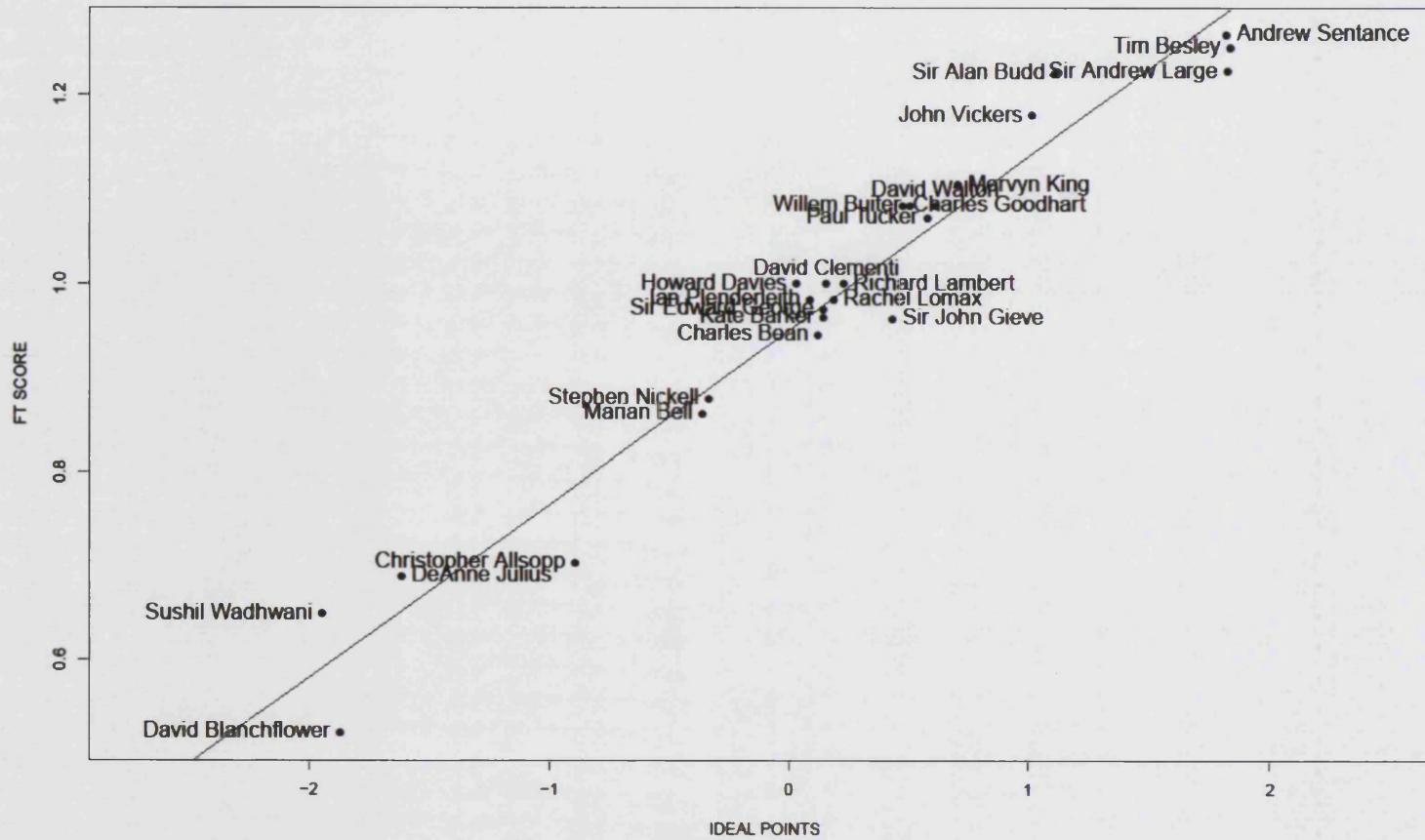
Note: The functions in the figures are bivariate regressions of our Bayesian ideal point estimates on the FT score for each member

Figure 3.4

Changes in MPC median between key points in electoral cycle

June 1999 -> Jan 2001
(Non-election -> Pre-election)

Jan 2001 -> May2003
(Pre-election -> Non-election)

May 2003 -> Dec 2004
(Non-election -> Pre-election)

Dec 2004 -> April 2008
(Pre-election -> Non-election)

-0.5   0.0   0.5

Change in MPC Median

Figure 3.5

MPC Appointments and Public Expenditure
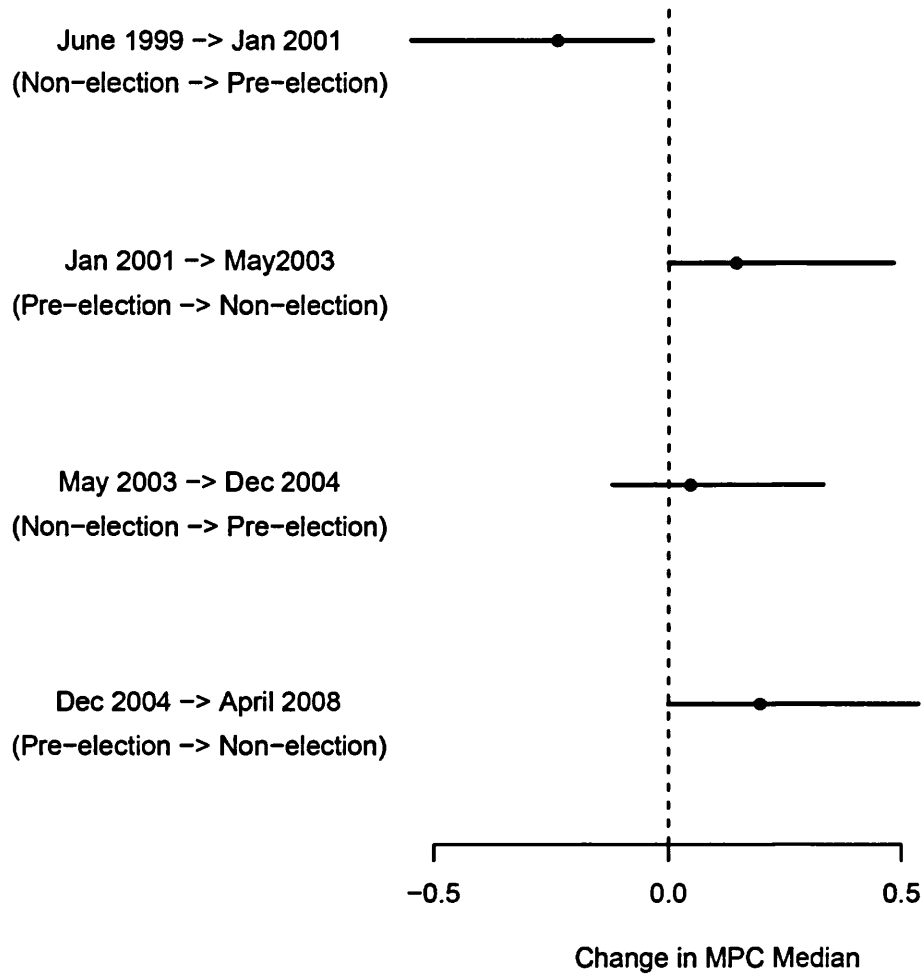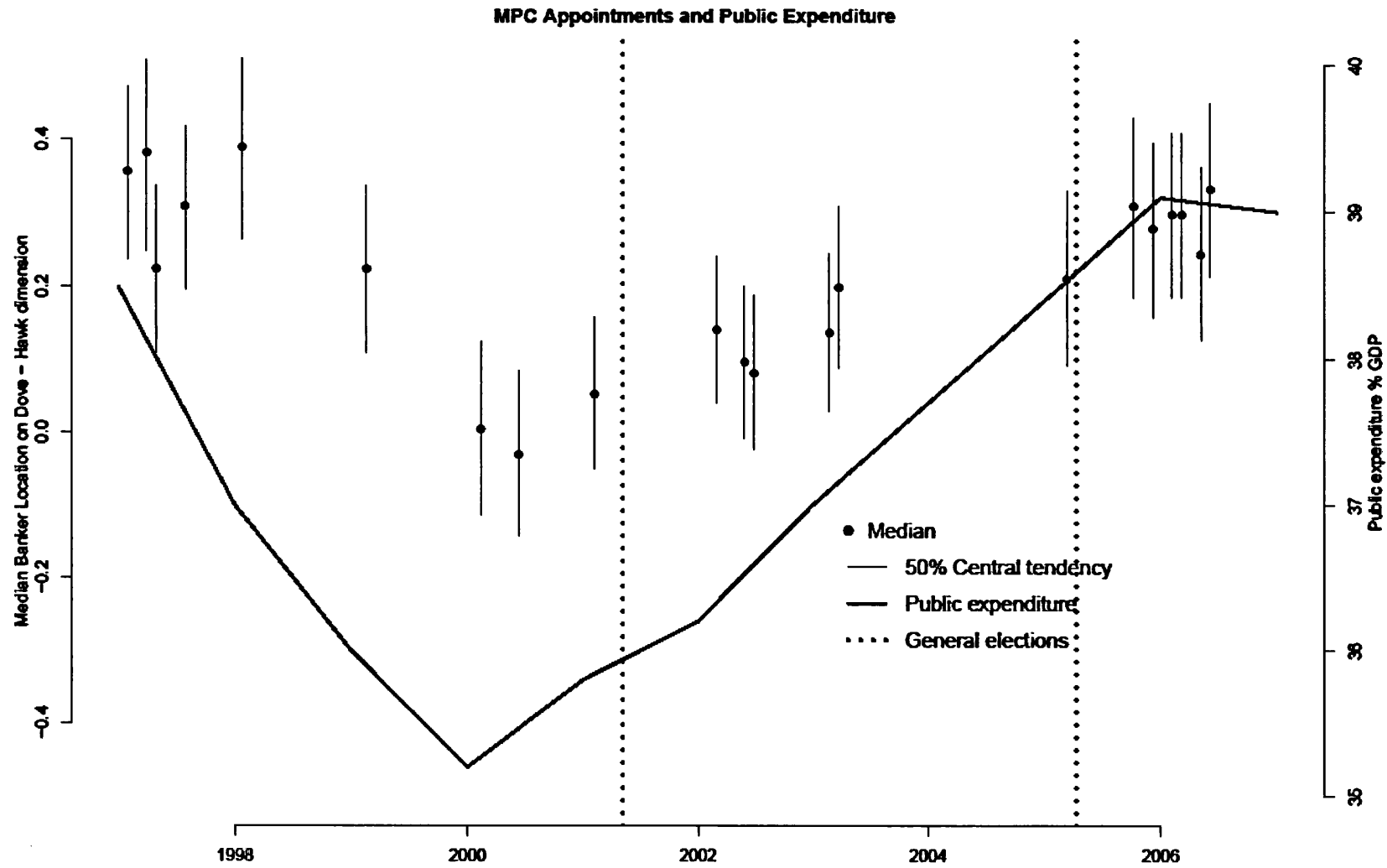
Figure 3.6

MPC Appointments and Budget balance
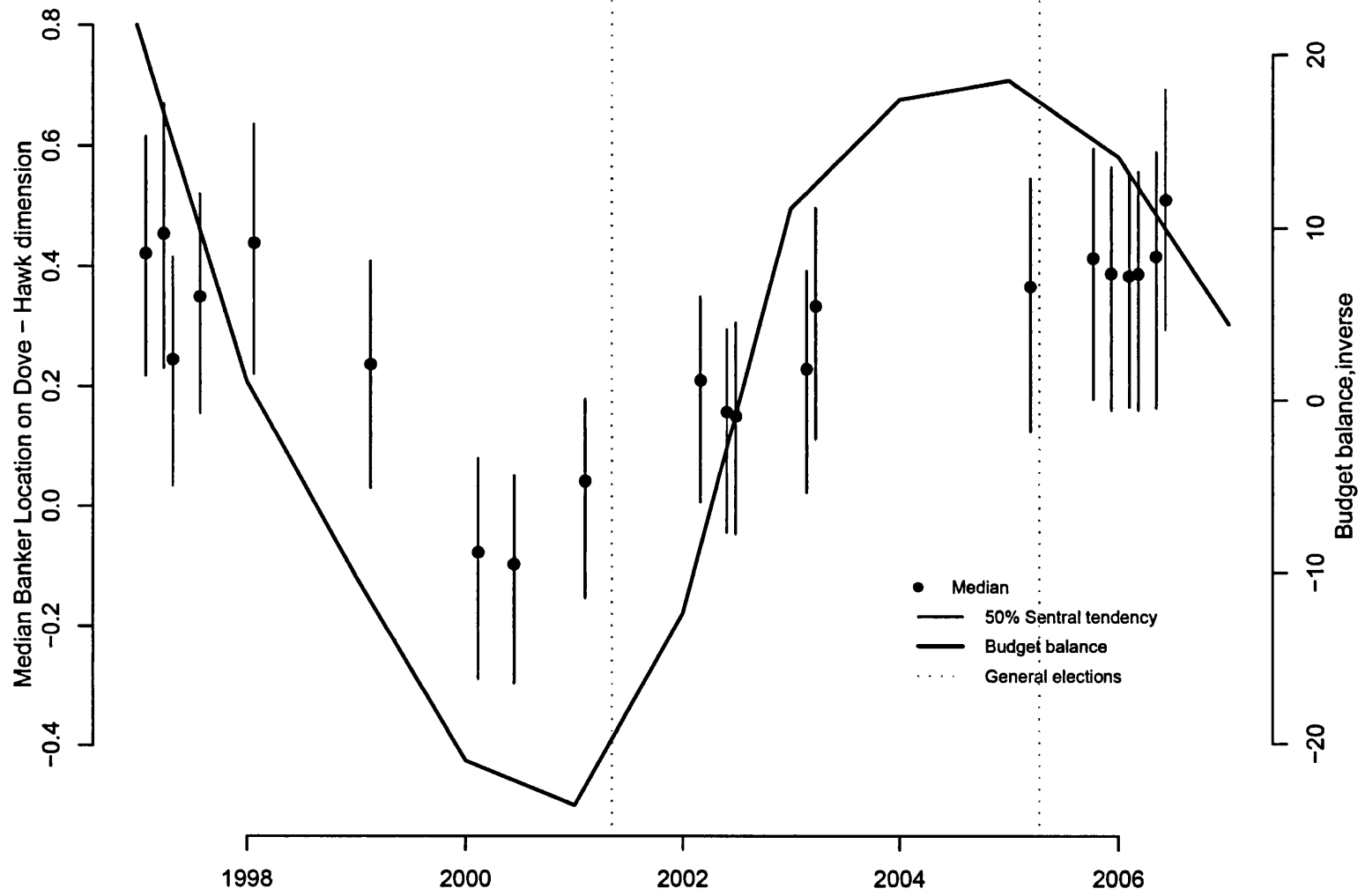
4 Do politicians make partisan appointments to central banks? Evidence from the National Bank of Poland

Abstract

In many countries today monetary policy is delegated to a highly independent central bank. Yet politicians may seek to exert a residual indirect influence on monetary policy via appointments to a central bank. This paper explores this possibility, testing for partisan political patterns in the behaviour of appointees to the Monetary Policy Council of the National Bank of Poland (NBP). The NBP provides a rare situation where the researcher can observe the interese rate voting of central bankers appointed by different partisan political actors. I derive and estimate a novel Bayesian hierarchical choice model to estimate the revealed monetary policy preferences of NBP appointees based on their voting behaviour. The model specification takes account of the discrete nature of the votes taken by NBP members and also makes use of proposal-related information so that revealed preference estimates can be measured on an interest rate scale. Using these estimates, I examine whether the left-right economic ideology of an appointing party is associated with the revealed preferences of NBP appointees. My results provide support for the proposition that parties seek to appoint central bankers with monetary policy preferences similar to their own. However, despite evidence of partisan appointments, parties are constrained in their ability to shift the position of the pivotal voter on the NBP Council.

Keywords: Monetary policy, central bank independence, partisan business cycle, appointments, committee voting.

4.1 Introduction

Described by Layard as "the central tool of macroeconomic stabilization" (1998 p.ix), monetary policy is one of the most important economic policies at a state's disposal. Political economists have argued that there will be systematic differences in the monetary policy pursued by left- and right-wing politicians because these politicians have differing partisan motivations (Hibbs 1977; Havrilesky 1987; Alesina and Sachs 1988). However, in many countries today, monetary policy-making responsibilities are delegated to highly independent central banks. In these countries elected politicians may choose medium- or long-term economic targets for the central bank, but they do not formally have a direct role in deciding the current setting of monetary policy instruments. This paper examines whether, unable to directly make monetary policy decisions, politicians attempt to exert an indirect partisan influence on monetary policy through appointments to independent central banks. It also assesses the extent to which they are successful in this endeavour.

To investigate this, I collect and analyse data on the voting behaviour of members of the Monetary Policy Council of the National Bank of Poland (NBP), the ten-person committee that sets interest rates in Poland. The NBP Council presents an advantageous context in which to test a partisan theory of appointments to independent central banks for three main reasons. First, the nature of appointment procedures for the NBP, together with Polish electoral developments over the last decade, have resulted in variation in the left-right economic ideology of the partisan coalitions involved in the appointment of Council members. Second, for nine of the ten members on the Council at any time, the nature of the appointment procedures has allowed both left- and right-wing coalitions to unilaterally make appointments, without having to bargain and compromise with actors from the opposing side of the left-right economic divide. Thus, in the vast majority of cases, it is possible to clearly

identify the partisan orientation of the actors that appoint individual Council members. Third, because the NBP publishes the records of votes regarding interest rates on the Council, it is possible to compare the revealed monetary policy preferences of Council members appointed by different parties. The NBP Council is unique among central bank monetary policy-making committees in the degree to which it satisfies all three of these criteria.

I measure the revealed monetary policy preferences of NBP Council members by estimating a Bayesian hierarchical choice model of interest rate voting behaviour on the Council. This approach is similar in some senses to the item-response models already used to analyse voting in central banks (Hix et al. 2010) and before that legislatures (e.g. Martin and Quinn 2002; Clinton et al. 2004), in that it operationalises the spatial model of voting. But it also makes novel use of extra information available in the monetary policy context, regarding prevailing economic conditions and interest rate proposals. Incorporating this extra information allows me to estimate revealed monetary policy preferences on an interest rate scale, so that the magnitude of estimates is easily interpretable.

These estimates are used to draw inferences regarding the differences in the monetary policy preferences of NBP Council members appointed by economically left-wing and right-wing parties. Consistent with partisan theories of appointments, I find that Polish central bankers appointed by left-wing parties tend to prefer lower interest rates than those appointed by right-wing parties, controlling for economic conditions. However, there is evidence of heterogeneity in the preferences of members appointed by the same party, suggesting that politicians cannot select agents who will perfectly accord with their preferred monetary policy. Furthermore, I find that politicians are limited in their ability to shift the position of the pivotal voter on the Council. Analysis suggests that this is due to a combination of politicians' inability to appoint entirely reliable agents *ex ante* together with certain institutional features of the Council, in particular its fundamental multi-member nature and

the disproportionate voting power of the NBP President, the only Council member appointed according to a different cycle and as a result of inter-institutional – and thus, in some situations, left-right – bargaining.

This paper not only contributes to the literature on partisan macroeconomic policy, but also relates to that on central bank independence. The delegation of monetary policy to a legally independent central bank has been advocated as a solution to a time-inconsistency problem (Rogoff 1985). Empirical studies have constructed indices to measure central bank independence in order to test its effectiveness in reducing inflation (e.g. Grilli et al. 1991; Cukierman 1992; Alesina and Summers 1993; Eijffinger and Schaling 1993). This paper can help inform the construction of such indices by providing micro-level evidence concerning politicians' ability to influence monetary policy via central bank appointments and by exploring how this ability may be conditioned by the institutional design of a monetary policy-making committee.

The paper also demonstrates the usefulness of monetary policy-making committee voting records as a resource for testing more general theories of appointments to collective choice bodies. Recently, political scientists have sought to model such processes, often with courts in mind (e.g. Rohde and Shepsle 2005; Krehbiel 2007) but also applied to central banks (Chang 2001). The method presented here for measuring monetary policy preferences yields estimates of individual preferences and pivotal voter preferences, measured on a substantively meaningful scale, that are ideally suited for testing these appointment models in the central banking context.

The rest of the paper is structured as follows. The next section reviews relevant literature and develops basic theoretical expectations. Then, section 4.3 introduces the case of the National Bank of Poland. Section 4.4 details the data set and statistical method used to

develop measures of central banker behaviour in Poland. These measures are used to test for partisan influences on the National Bank of Poland in section 4.5. Section 4.6 concludes.

4.2   Politicians and central banks: theory and existing evidence

According to theories of the 'partisan business cycle' (PBC), political parties have macroeconomic policy preferences that differ systematically. Regarding monetary policy, it is asserted that economically left-wing parties tend to prefer a less restrictive monetary policy than economically right-wing parties. For most PBC advocates, such as Hibbs (1977) and Alesina and Sachs (1988), this difference is due to the higher relative inflation-aversion among a right-party's core electoral constituency compared to a left-party's core electoral constituency, and the higher relative unemployment aversion among a left-party's core electoral constituency compared to right-party's core electoral constituency. Havrilesky (1987) suggests an alternative motivation, stemming from the ideological preference among left-wing parties for fiscal redistribution to low income voters. He suggests that left-wing parties seek to mitigate the resulting disincentive effects of this redistribution, which might otherwise lower real output and reduce voter support, by pursuing a relatively loose monetary policy. Whichever motivational story is posited, in general the PBC asserts that, in general, parties with left-of-centre economic ideologies prefer a less restrictive monetary policy than parties with right-of-centre economic ideologies.

The initial formulations of the PBC assumed that politicians had direct control over key macroeconomic policy instruments, including monetary policy. For example, explaining their model in terms of the US, Alesina and Sachs make "the implicit assumption... that the [incumbent] administration has some direct or indirect control over monetary policy, despite

the relative independence of the Federal Reserve" (1988 p.67). But given the prevalence of central bank independence in developed and developing countries today, a more complete understanding of politicians and the economy must account for how, and under what conditions, partisan politicians can influence the monetary policy of a highly independent central bank.

In the course of the past two decades, political scientists have begun to address this issue. Several scholars have identified appointments as a key channel through which political influence on a formally autonomous central bank may take place (Chang 2001; Havrilesky & Gildea 1992; Lohmann 1997; Waller 1998).[1] They have formulated formal appointment models where politicians with partisan macroeconomic motivations seek to appoint central bankers whose views on monetary policy are aligned with their own. Generally, these models have been designed to examine how key institutional features of the appointment process affect equilibrium appointment outcomes. For the U.S., Chang (2003) models the President's influence over monetary policy via Federal Reserve appointments, as constrained by the preferences of the Senate Banking Committee, the other key actor in the appointment game. Lohmann (1997) and Morris (2000) model how indirect political influence is constrained by staggered central bank committee appointment opportunities, and also decentralized appointment powers (where regional political actors control appointment for a number of posts).

In terms of empirical research, with regard to the Federal Reserve, Beck (1982) and Morris (2000) find that the reaction function of the Federal Funds Rate is influenced by political conditions. In the case of Germany, Lohmann (1998) and Berger and Woitek (2005) estimate reaction functions of monetary policy and find that the partisan affiliation of the median member of the Bundesbank Council affects monetary policy in a manner consistent

---

[1] Some have also analysed 'direct' political influence on legally independent central banks (Lohmann, 1998; Morris, 2000). From this perspective, politicians can pressurise the bank to implement a desirable monetary policy using, for example, the threat of legislation to reduce the bank's autonomy should it fail to comply.

with partisan appointments (though Lohmann finds the effect to be non-significant). However, a focus on policy outcomes as the dependent variable leads to a reduced-form test of the partisan model of central bank appointments.

With this concern in mind, it is desirable to test whether the behaviour of individual central bank appointees accords with partisan appointment models. Where voting records for central bank monetary policy-making committees are available, researchers are able to perform this test. Taking advantage of the availability of Federal Open Market Committee (FOMC) voting records, both Gildea (1990) and Havrilesky and Gildea (1992) find that the frequency with which FOMC members appointed by Democrat Presidents vote for easier policy is significantly higher than that of Republican appointees. Regarding the Bundesbank, Berger and Woitek (2005) study limited Bundesbank voting data from 1948-1961 and find that Christian Democrat appointees tend to dissent more against discount rate cuts.[2]

Since they do not control for economic circumstances, these analyses might lead to biased inferences regarding appointee behaviour. For example, an individual who sits on a central bank committee during a period of relatively low economic growth may appear artificially 'dovish' because they vote for lower rates frequently given the economic circumstances. Chappell et al. (2005) and Chang (2001) address this problem, estimating reaction functions that measure the relationship between the votes of FOMC members and key macroeconomic indicators. Chang (2001) utilises estimated differences in the average preferred interest rate of FOMC members, controlling for economic conditions. She identifies the probable location of the median member of the FOMC at any given time, and in turn shows that movements of the location of the median member over time provide support for her model of partisan appointments. Chappell et al. (2005) also find evidence for indirect

---

[2] Berger and Woitek (1997) also use the 1948-61 Bundesbank voting data to reject Vaubel's (1997) hypothesis that central bankers appointed by the incumbent governing party favour easier policy in the run-up to elections.

partisan political influences, in that being the appointee of a Democrat President has a statistically significant negative effect on the preferred interest rate of an FOMC member.

This paper contributes to this literature by using new data to provide a relatively clean empirical test of the simple motivational assumption underlying models of partisan central bank appointments. In other words, it asks: relative to an economically left-wing party, does an economically right-wing party seek to appoint a central banker who generally prefers a more restrictive monetary policy? To answer this I collect and analyse voting data from the Monetary Policy Council of the National Bank of Poland.

The NBP Council presents an advantageous setting in which to conduct such a test. Not only is there variation in the left-right orientation of political actors involved in the appointment of different Council members over the past decade, but almost all of the appointments to the Council in this period have also been products of either an economically left-of-centre or right-of-centre appointing coalition, rather than some left-right compromise. This latter feature results from the fact that the Polish President, Senate (upper house) and Sejm (lower house) each unilaterally appoint three members to the ten-person Council. The consequence is that, in the Polish context, the partisan appointments logic generates relatively clean expectations as to the relative monetary policy preferences of appointees, which can then be tested using the voting data. This also enables me to assess whether, even in favourable institutional conditions where a party is relatively unconstrained in its ability to appoint its ex ante preferred candidate, appointees may turn out not to be "perfect agents" (Lohmann 1997 p.228; see also Keech and Morris 1997). In other words, can central bank appointees be relied upon to act according to the wishes of the politicians who appointed them?

The features of NBP appointments can be contrasted with the more extensively analysed case of the twelve-person FOMC in the US. There all seven Board of Governors

(BOG) appointments are the product of inter-institutional bargaining between the President and the Senate, while the five remaining positions are taken by individuals appointed by regional Reserve Banks. For the five latter positions, it is difficult to generate expectations of relative monetary policy preferences using the partisan appointment logic because they are not appointed directly by political actors. For the seven BOG positions, there is variation in the left-right orientation of appointing actors, but often BOG members are appointed in a period where party control of the Presidency and Senate differs. As a result, BOG appointments are often the product of some form of left-right interaction. For example, eight of the twenty-three BOG appointments analysed by Chang (2001) occur at a time when party control of the Presidency and Senate differs. Of course, Chang's formal appointment model is specifically intended to tease out the monetary policy implications of this inter-institutional and cross-party interaction theoretically. Nevertheless, because of the frequency with which these left-right interaction appointments occur in the US case, it is difficult to use an empirical analysis of the Fed to separately test the partisan behavioural assumptions underlying Chang's model and the conditional impact of institutional features posited by the model. The Polish case enables us to test partisan behavioural assumptions more directly.

The case of the Polish NBP is also advantageous for testing for partisan appointments relative to national central banks other than the Fed. Currently, six other OECD countries – namely, Czech Republic, Hungary, Japan, Korea, Sweden and the UK – have central banks that publish voting records and consequently enable researchers to observe and analyse the voting behaviour of individual central bank appointees.[3] However, in both Korea and Sweden political actors are involved in the central bank appointment process only indirectly. In the remaining four countries, politicians are directly involved in central bank appointments but there is little or no variation in the partisan orientation of appointing actors during the

---

[3] For an analysis of UK voting records, see for example, Besley et al (2008) and Hix et al (2010).

time-period in which central bank votes are available. Finally, though voting data is also available for the German Bundesbank Council in the years 1948-1961, Berger and Woitek (2005 p.752) report that this data is not always complete. Thus it is difficult to test theories of partisan appointments in other countries where voting data is available. This underlines the value of studying appointments to the National Bank of Poland, where we are better able to perform this test.

4.3   The case of the National Bank of Poland: institutional and political context

Having outlined the theoretical motivation for the study of the National Bank of Poland, in this section I introduce the NBP and its Monetary Policy Council in more detail.

Institutional context

According to the 1997 National Bank of Poland Act, the Monetary Policy Council of the NBP is the body designated with the sole authority to determine monetary policy in Poland. While the Act mandates the NBP Council to pursue a primary objective of price stability, it leaves the Council to define price stability in operational terms. Since 1999 the Council has set multi-annual inflation targets and has set monetary policy with the stated goal of achieving this inflation target. These targets have generally taken the form of an acceptable inflation range measured on the Consumer Price Index (for example, since January 2004 the NBP inflation target has been 2.5 per cent CPI plus or minus one percentage point), and there are no formal sanctions for Council members if this target is missed.

The Council consists of ten individuals: nine 'rank-and file' members together with the NBP President. All are appointed for a non-renewable term of six years and can only be

involuntarily removed from their posts on the grounds of serious misconduct. The Council has held a monetary policy meeting, chaired by the NBP President, once a month since February 1998. Decisions are taken by majority vote with the NBP President holding the casting vote in the event of a tie and any Council member can submit a proposal to be voted on (Maier 2007, pp.28). Records of these votes are available from January 2000 onward, enabling us to examine the relative monetary policy preferences of Council members (I detail below how these votes are coded and analysed). Though Sirchenko (2008) and Kotlowski (2006) have estimated economic reaction functions of NBP Council members, this is the first paper to exploit the variation in the partisan orientation of member's appointing principals in order to examine political appointment patterns.

The appointment procedures for the NBP Council are as follows. Every six years, the Polish President, Senate (upper house) and Sejm (lower house) each unilaterally appoint three of the rank-and-file Council members. The tenth Council member is the NBP President and chair of the Monetary Policy Council, who is appointed by the President with majority approval from the Sejm. Originally following the same appointment cycle as the nine other Council members, since 2001 the NBP President has been appointed according to a cycle that is three years advanced to that of the nine other members.[4]

Political context of appointments

Appointment procedures for the nine rank-and-file Council members present a unique opportunity to test for evidence of partisan appointments. Each of these members is appointed by a single partisan-controlled institution, so that the identification of the party responsible for selecting a Council member is straightforward. Furthermore, in instances where there have been majority coalitions in control of either the Senate or Sejm at the time

---

[4] This is because of the early resignation of one NBP President, Hanna Gronkiewicz-waltz, with three years left of her term.

of an appointment round, contemporary newspaper reports detail how party coalitions have divided up the available Council positions according to their respective seat-share and have agreed to support each other's candidates in the floor vote. Contemporary newspaper reports also state which coalition partners nominated which candidates, enabling me to code the party responsible for the appointment of each rank-and-file Council member.[5]

Appointment procedures for the NBP President are not so straightforward, since his or her appointment is subject to the agreement of the Polish President and a Sejm majority. For each NBP President appointment I therefore code appointing parties as a combination of the party with control of the Polish Presidency and majority coalition partners in the Sejm.

Table 4.1 presents the appointment details of each of the twenty-one individuals to have sat on the NBP Council since 1998. The first three columns list each member's name (with 'Ch' indicating the NBP President) along with the dates of their term on the Council. The fourth and fifth columns detail the institution (or set of institutions, in the case of the NBP President) and party responsible for appointing the member, respectively. Appointing party(s) are coded according to the scheme detailed above. Looking at the Appointing Party(s) column of Table 4.1, there has been variation in the party or party coalition that has appointed MPC members.

[TABLE 4.1 ABOUT HERE]

The final two columns of Table 4.1 show that there has also been variation in the economic orientation of NBP Council members' appointing principals. These two columns characterize the economic ideology of these appointing actors in two ways. First, for each Council member I report the mean score of his or her appointing party(s) on the dimension concerning "state ownership of business and industry versus privatization" in Benoit and

---

[5] A full list of the newspaper reports used is available on request from the author.

Laver's (2006) expert survey-based party position data. [6] I report Benoit and Laver's privatization dimension scores rather than their tax/spend dimension scores because, for post-Communist countries such as Poland, the privatization dimension is "both more important overall [in terms of salience scores] and capture[s] more variation in economic policy among different parties" than the tax/spending dimension (Benoit and Laver 2006 p.244). Nevertheless, our confidence in the validity of using privatization scores as proxies for Polish parties' economic ideologies may be enhanced by noting the similarity between privatization scores and tax/spending scores in the Benoit-Laver data: the relative ordering of the parties listed in Table 4.1 is the same on both dimensions save for a switch in the ordering of the Democratic Left Alliance (SLD) and Polish Peasants' Party (PSL), who are both relatively 'left-wing' on each dimension anyway.

Comparisons with other potential measures of Polish party economic ideology also enhance confidence that the Benoit-Laver privatization dimension scores are a valid measure of the economic ideology of Polish parties. For example, the left-right economic scores assigned to Polish parties in the 2002 Chapel Hill expert survey data (Hooghe et al. 2010) yield the same ordering of parties as the Laver-Benoit privatization dimension scores. In addition, the Benoit-Laver privatization scores broadly agree with Markowski's (2006 p.817) positioning of Polish parties along a "socialist/redistributive – liberal/pro-market" axis, which is based on the mean self-placement along this dimension of voters for each party at the 2001 election. [7] Perhaps most importantly, Markowski's method also places the average SLD supporter as economically to the left of Solidarity (AWS), and both parties to the left of Freedom Union (UW).

---

[6] These scores are measured on a scale from 1 to 20, with 20 being least favourable to state intervention in the economy. For NBP Presidents, I report the average score of the parties controlling the Presidency and the Sejm, with the Sejm parties weighted by their respective share of majority-coalition seats. The expert surveys upon which this data is based were conducted between 2002-4 (Benoit and Laver 2006).
[7] Markowski uses the 2001 Polish National Election Survey data on the self-placement of voters for each Polish party.

In order to simplify subsequent analysis, in the final column of Table 4.1 I classify the appointing party(s) for each Council member into three categories based on their Benoit-Laver privatization scores. A member is classified as being appointed by an economically 'Left' party if the appointing party has an economic policy score lower than the midpoint 10.5, and by an economically 'Right' party if the appointing party has an economic policy score greater than the midpoint 10.5. Where Presidents are appointed by a coalition of parties where some individual parties have a score greater than 10.5, and some lower, I classify them as being appointed as a result of a left-right 'compromise'.[8] The left-right classifications in this final column will be used in section 5 to assess whether the revealed monetary policy preferences of NBP Council members' are consistent with the economic policy orientation of their appointing principal.

4.4   Estimating a statistical model of NBP Council member voting behaviour

In order to assess whether there are partisan political patterns in the voting behaviour of NBP Monetary Policy Council members, we need to systematically measure the voting behaviour of these central bankers. In this section I describe the data and model specification used to do this.

---

[8] For example, though the economic policy score for his appointing coalition is 12.17, Table 1 classifies Slawomir Skrzypek's as being appointed as a result of a left-right compromise. This coding reflects the fact that to appoint Skrzypek the Law and Justice (PIS) party, which is measured as economically right-of-centre, required the support of two economically left-of-centre parties, Self-Defence (SRP) and League of Polish Families (LPR).

NBP voting data

The data on NBP Council voting behaviour was coded from the English version of the official voting records. These records have been published in the annex of each NBP Inflation Report since 2000. Therefore, the voting data covers all monthly Council policy meetings held between January 2000 and August 2008, a sample of 104 meetings in total.

For each Council meeting, the official voting record contains details on any proposal submitted to the Council for voting. These details include: a description of the proposal; a list of members who voted 'yes'; and a list of members who voted 'no'. Thus, when a proposal is voted upon, we have a set of observations on a pairwise vote between two alternatives (the proposal versus the status quo), together with information as to the character of these alternatives.

In constructing the data set I coded only those votes taken by the Council on proposals that involved changes to the NBP reference rate[9] and measure each proposal in terms of the reference rate choice it implies.[10] For each reference rate-related proposal, I record the new reference rate level proposed and the status quo reference rate at the start of the meeting. The vote of a Council member is coded as: 0 if he or she voted in favour of the lower rate alternative; 1 if he or she voted in favour of the higher rate alternative (regardless of whether the status quo rate was the higher or lower alternative on offer); and 'n/a' if he or she was not present at the meeting in which the proposal was made.

---

[9] The Council also periodically voted on separate proposals concerning administrative and long-term strategic monetary policy issues, and before 2002 occasionally took separate votes on other auxiliary policy instruments (mainly the Lombard and Rediscount rates).

[10] A potential problem with this coding scheme would be that the proposals that contained changes to the reference rate also tended to contain alterations to auxiliary policy instruments (usually the Lombard rate and Rediscount rate). However, the reference rate is described by the Bank itself as the policy instrument "reflecting the current policy stance of the NBP" (National Bank of Poland 2000 p.8) and by Kokoszcynski (2002 p.212) as the Bank's "major instrument" for conducting monetary policy. Given the primary importance of the reference rate, it appears reasonable to assume that a Council member's vote on the proposals in question was driven primarily by the reference rate alternatives embodied within that proposal. Furthermore, in all but 11 of the 104 meetings in the sample, any reference rate-related proposals that also contained provisions for auxiliary policy rates always specified equivalent percentage point changes to the reference rate and other auxiliary policy rates. Also, on the handful of occasions where votes were taken separately on auxiliary policy instruments, patterns of voting behaviour were the same as those for votes regarding reference rate alterations in the same meeting.

'Multi-proposal' meetings

In 19 meetings more than one proposal concerning the reference rate was put to vote on the Council. For these 'multi-proposal' meetings I treat each member's vote on each proposal as a separate observation, since each vote on a different proposal provides extra information as to a member's underlying rate preferences in a meeting.[11] In all but six of the nineteen 'multi-proposal' meetings, the votes of each individual Council member across the different proposals were consistent with sincere voting and single-peaked preferences on the reference rate dimension. For example, a member who voted 'yes' for a defeated proposal to raise the reference rate by 0.50pp in a meeting also voted 'yes' when faced with a proposal to raise the reference rate by 0.25pp.

However, in the remaining six 'multi-proposal' meetings, at least one Council member votes in favour of the status quo when a proposal is made for a moderate cut in the reference rate but also votes in favour of a separate proposal for a more drastic cut in the reference rate.[12] Such observations pose a problem in terms of inferring a member's preferred reference rate in a meeting since, on face-value, he or she apparently prefers to lower the reference rate and maintain the status quo reference rate at the same time.

Examination of the voting records revealed that when a member exhibits this prima facie inconsistent behaviour, one of two situations holds. In the first, the drastic cut that the member supports is defeated by a Council majority and the moderate cut is passed despite his or her opposition. In the second situation, the moderate rate-cut proposal is defeated with the help of the member's objection, and the proposal for a more drastic rate-cut subsequently receives support. That is, in neither situation does the member's vote against the moderate rate-cut lead to the maintenance of the status quo reference rate as the policy-meeting

---

[11] However, in the statistical model below, the meeting-effect term used to capture time-varying conditions are constrained to be equal for all proposals voted on in the same meeting.

[12] The meetings in question took place in February, June and October 2001, and January, April and May 2002.

outcome. Thus, I posit that in the first situation the member in fact prefers the moderate cut to the status quo reference rate, but can demonstrate his or her dissatisfaction that the more drastic cut was not undertaken by voting against the moderate rate-cut proposal in the knowledge that the moderate cut will receive majority-support. In the second situation I posit the member prefers the moderate cut to the status quo, but votes against the moderate cut in the knowledge that a more drastic cut would subsequently receive majority support. As a result, for both types of situation I code the members as supporting the moderate rate-cut proposal as well as the more drastic rate-cut proposal.

This is perhaps a strong assumption, but the reader should note that it need only be imposed for 18 observed votes cast by 5 individuals in a total of 6 meetings. Furthermore, I also re-ran the statistical analysis below on voting data where these 18 voting observations are not re-coded. The results of this analysis were substantively the same and in the same order of magnitude as those presented below.

'No-proposal' meetings

Finally, there are also a substantial number of Council meetings in the sample time-period where the record indicates that no proposal to change the reference rate was put to a vote. These 'no-proposal' meetings make up 46 of the 104 meetings observed in the sample. In all 46 of these meetings, the Monetary Policy Council maintained the reference rate at its current level.

One option would be to discard no-proposal meetings as irrelevant. But as scholars of legislative politics have shown, in contexts where votes are not recorded for a subset of legislative decisions, severely biased inferences can result when researchers analyse recorded votes only and fail to model the processes which lead to the non-recording of votes for some decisions (Carrubba et al. 2008; Hug 2009). Moreover, in the present context no-proposal

meeting observations do contain information regarding the reference-rate preferences of Council members, to the extent that a lack of proposed alterations to the reference rate indicates that all Council members were satisfied with the current status quo reference rate (such an interpretation seems reasonable, given that the voting records reveal there were also numerous meetings where proposals to alter the reference rate are put to the council and defeated in a majority vote). If this interpretation holds, then discarding no-proposal meeting observations may well lead to an overestimation of disagreement on the NBP Council since, by definition, these no-proposal meetings are the ones where members did not choose to formally record disagreement with each other. Such a potential bias is particularly important given that the focus of this paper is the extent to which the partisan background of NBP Council members is associated with heterogeneity in their preferred interest rates. A method that conservatively estimates disagreement on the NBP provides a sterner test of this proposition than one which overstates disagreement.[13]

In light of these considerations, for each no-proposal meeting I code each member present at the meeting as having preferred the status quo reference rate to either a 25 basis point increase or a 25 basis point decrease in the reference rate. The two alternatives are chosen to reflect the fact that the NBP only ever alters the reference rate in discrete increments of 25 basis points or multiples of this during the sample period. Further details regarding how these observations enter the statistical model are provided below.

To summarise, the NBP Monetary Policy Council voting data contains 1239 member-vote observations on 21 individuals. These are observed across 104 meetings: 46 of these are 'no-proposal meetings' where all members are coded as preferring the status quo reference rate; 39 of these contained a single proposal to change the reference rate; and 19 of these contained

---

[13] An alternative approach might be to model the agenda-setting process in Council meetings. However, such an approach is beyond the confines of this paper.

at least two proposals to change the reference rate. In total there are 79 observed pairwise votes on proposals to change the reference rate, and 46 no-proposal meeting observations which each provide a single 'inferred' reference rate voting observation for sitting Council members.

4.5 A model for the latent preferred reference rate of NBP Council members

The preferred NBP reference rate of member i at time t is denoted $y_{i,t}^*$ and is modelled as

$$y_{i,t}^* = \alpha + \eta_i + \zeta_t + \varepsilon_{i,t} \qquad (1)$$

$$\varepsilon_{i,t} \sim Logistic(0,s).$$

Thus members' preferred policy rates are composed of a time-varying component, ζ_t, a time-invariant member-specific component, η_i, and a grand mean, α. The observation-specific error term, $\varepsilon_{i,t}$, has a logistic distribution with mean zero and scale s.

The time-varying component of equation (1), ζ_t, captures meeting-specific conditions that influence preferred reference rates at time t and is modelled hierarchically as

$$\zeta_t \sim N(\beta_1 \, cpi_{t-1} + \beta_2 \, iip_{t-1} + \rho \, sqrr_t \,, \, \omega^2), \quad t = 1, ..., 103 \qquad (2)$$

where cpi_{t-1} is annual national inflation measured on the consumer price index, iip_{t-1} is trend-corrected annual growth in industrial production (excluding construction)[14] and $sqrr_t$ is the status-quo reference rate at the start of each meeting.

The specification for the conditional mean of ζ_t draws on Besley et al's (2008) specification of reaction functions for individual Bank of England members: central bankers are allowed to respond systematically to inflation and growth in the manner of a Taylor rule reaction function (Taylor 1993) augmented with the status-quo reference rate ($sqrr_t$) that

---

[14] These variables were collected from the websites of the Central Statistical Office of Poland and Eurostat , respectively.

114

captures monetary policy inertia. Both the annual inflation and annual production variables are lagged by one month in order to better reflect the data actually available to the Monetary Policy Council at the time of each meeting (see Sirchenko 2008 for a discussion of this in the Polish context). Maria-Dolres (2005) also finds that such a backward-looking specification for central bank behaviour best describes the interest rates set by the NBP.

In addition to this systematic relationship with observed economic conditions, the random element of ζ_t captures un-observed meeting-specific shocks that shift preferred reference rates up or down across all Council members.[15] The parameter ω measures the variability of the meeting-effect about its conditional mean. Note also that ζ_t does not contain an intercept term, as the model intercept is included at the data-level (i.e. in equation (1)) as α.

The member-specific component of equation (1) is simply defined as a varying intercept,

$$\eta_i \sim N(0, \sigma^2), \quad i = 1,..,21. \tag{3}$$

The η_i are the key parameters for the purposes of this paper, as each one captures the average deviation of an individual member's preferred reference rate from the Council average, given meeting-specific effects ζ_t. Note that the σ parameter measures the extent to which there is heterogeneity in members' preferred reference rate when faced with the same economic situation. The member-specific intercepts η_i are used as a measure of the time-invariant relative monetary policy preference of a member.

---

[15] Note that the meeting-effect ζ_t is assumed to be common across all members sitting on the Council in meeting t, so the parameters capturing reactions to economic conditions (β_1, β_2, and ρ) are common across all members, while ω^2 represents the variability of meeting-effects about this regression line. One avenue for future research may seek to relax this assumption and estimate member-varying coefficients for inflation and production.

Linking latent preferred reference rates and observed voting records

As discussed above, the latent preferred reference rate defined in equation (1) is not observed

directly, but rather is partially observed via the voting record of Council members in each

meeting. In order to make inferences about $y_{i,t}^*$ and its constituent parameters based upon

NBP voting records I operationalise spatial model of voting (e.g. Hinich and Munger 1997).

To deal with the aforementioned occurrence of 'no-proposal' meetings, where no proposal to

alter the reference rate is put forward, the link between the observed voting records and $y_{i,t}^*$ is

specified in two differing forms depending on whether or not proposals were recorded in a

meeting.

First, consider any meeting t where the Council records indicate that one or more

proposals to alter the reference rate were submitted to members and voted upon. For each

meeting within this set, there may be multiple rounds of pairwise votes, so I index rounds of

pairwise voting across all meetings by $j = 1,...J$, where each j corresponds to one particular

round of voting in one particular meeting t.[16] Each unit of observation is a member's

observed vote choice $y_{i,j}$ between two observed reference rate alternatives, denoted r_j^l and

r_j^h, where $r_j^l < r_j^h$ for any pairwise voting round j. Let $y_{i,j} = 0$ if i votes for the lower rate

alternative, r_j^l, and $y_{i,j} = 1$ if i votes for the higher rate alternative, r_j^h.

I model the utility that member i derives from a given reference rate alternative r_j as a

quadratic loss function that declines in the absolute distance between the reference rate

alternative and member i's latent preferred rate in the meeting where r_j is proposed,

$$U_i(r_j) = - \left(y_{i,t(j)}^* - r_j\right)^2. \tag{4}$$

Thus, i votes for the higher alternative r_j^h if

---

[16] Thus, though one meeting t may feature a number of voting rounds, any given voting round j is associated
with only one meeting t (i.e. t is uniquely determined by j, though the inverse is not true). As a result, in what
follows, the subscript $t(j)$ is intended to denote the meeting t in which the voting round j occured.

$$U_i(r_j^h) \geq U_i(r_j^l).$$

Plugging in equations (4), then (1), and re-arranging, we can re-write this condition as

$$-\left(y_{i,t(j)}^* - r_j^h\right)^2 \geq -\left(y_{i,t(j)}^* - r_j^l\right)^2$$

$$y_{i,t(j)}^* \geq \tfrac{1}{2}\left(r_j^h + r_j^l\right)$$

$$\varepsilon_{i,t(j)} \geq \tfrac{1}{2}\left(r_j^h + r_j^l\right) - \left(\alpha + \eta_i + \zeta_{t(j)}\right).$$

Further, by the definition of $\varepsilon_{i,t}$ in (1), the probability that the condition holds is

$$Pr\left[\varepsilon_{i,t(j)} \geq \tfrac{1}{2}\left(r_j^h + r_j^l\right) - \left(\alpha + \eta_i + \zeta_{t(j)}\right)\right]$$

$$= Pr\left[\varepsilon_{i,t(j)} < \left(\alpha + \eta_i + \zeta_{t(j)}\right) - \tfrac{1}{2}\left(r_j^h + r_j^l\right)\right]$$

$$= logit^{-1}\left[\frac{\left(\alpha + \eta_i + \zeta_{t(j)}\right) - \tfrac{1}{2}\left(r_j^h + r_j^l\right)}{s}\right]$$

Thus the probability that member i votes for the higher reference rate alternative can be modelled in terms of the binary logistic regression

$$Pr[y_{i,j} = 1] = logit^{-1}\left[\frac{\left(\alpha + \eta_i + \zeta_{t(j)}\right) - \tfrac{1}{2}\left(r_j^h + r_j^l\right)}{s}\right]. \qquad (5)$$

Usually in models of legislative voting behaviour, the latent threshold parameter (above which a realization of the unobserved latent dependent variable must fall in order to observe a one rather than a zero on the observed binary dependent variable) is a "difficulty" parameter to be estimated. However, the term for the latent threshold in equation (5) - i.e. the term $\tfrac{1}{2}\left(r_j^h + r_j^l\right)$ - is observed in the data as the numerical midpoint between the two reference rate alternatives. That is, in the parlance of spatial voting and ideal point estimation, we can directly measure the 'cutpoint' between any two alternatives being voted upon on an interest rate metric. This is analogous to the situation exploited by Krehbiel and Rivers (1988) in their study of minimum-wage voting in the US Congress. As they note, such information identifies the latent scale of the choice model, allowing the researcher to

make meaningful statements about the magnitude of latent parameters.[17] In the application

presented here, the scale of the latent parameters is defined in terms of reference rate

percentage points.

Now, consider any meeting t where the Council records indicate that no proposal to

alter the reference rate was voted upon by members. For each meeting t within this second

no-proposal set, there is only one observation of each current NBP Council member per

meeting. I label each of these member-meeting observations a 'no-proposal observation'. I

assume that where a no-proposal observation occurs, the latent reference rate, $y_{i,t}^*$, of member

i at meeting t satisfies

$$(sqrr_t - 0.125) \leq y_{i,t}^* < (sqrr_t + 0.125). \tag{6}$$

The terms on far left and far right hand-side of (6) correspond, respectively, to the midpoint

between the status quo reference rate and an alternative that is 0.25 percentage points lower,

and the midpoint between the status quo reference rate and an alternative that is 0.25

percentage points greater. Thus equation (6) represents a situation where i's latent preferred

reference rate is closer to the status quo rate than to either of the closest possible alternative

reference rate settings (provided interest rates are altered only in 0.25 percentage point

increments or multiples of this, as is standard currently in monetary policy). In other words, I

assume that if no proposals are observed in a meeting, then all members sitting on the

Council in that meeting preferred the status quo reference rate $sqrr_t$ to either a decrease of

0.25 or an increase of 0.25 in the rate. The probability of such a condition being satisfied can

be expressed in terms of the parameters used to model the latent preferred reference rate:

$$Pr[\text{no-proposal observation}] = \text{logit}^{-1}\left[\frac{(sqrr_t + 0.125) - (\alpha + \eta_i + \zeta_t)}{s}\right] -$$
$$\text{logit}^{-1}\left[\frac{(sqrr_t - 0.125) - (\alpha + \eta_i + \zeta_t)}{s}\right]. \tag{7}$$

---

[17] It also allows the estimation of the latent residual-variance parameter s, which normally has to be fixed ex ante for purposes of identification.

Estimation

Equations (2), (3), (5) and (7) jointly define my statistical model of NBP Council voting. I estimate this model using Bayesian MCMC (Markov Chain Monte Carlo) methods, whereby an MCMC sampler iteratively updates the estimates of the model parameters.[18] After a sufficient number of iterations (or burnin period) the vector of parameter estimates yielded during a given iteration represents a draw from the joint posterior distribution of the model parameters.[19] Because the MCMC method yields a sample from the posterior distribution of all parameters in the statistical model, it is straightforward to make statistical inferences about any auxiliary quantity of interest that is a function of the model parameters. The posterior distribution of the auxiliary quantity can be generated by calculating and storing its value for each sampled vector of model parameters (Treier and Jackman 2008 p.210). This feature of MCMC estimation is particularly useful for the purposes of this paper. For example, it allows us to examine the posterior distribution of the position of the pivotal voter on the NBP Council.[20]

---

[18] The MCMC sampler was run in JAGS from R using the rjags package (Plummer 2009). Initial values for model parameters were based on the results of previous trial runs of the sampler. A single chain was run for 750,000 iterations, with the first 250,000 discarded as burnin. The chain was thinned by a factor of 25, leaving a sample of 20,000 draws from the posterior distribution to be used for inference. Standard convergence tests recommended by Jackman (2009) showed no indication of non-convergence in any parameter estimates, and that the chain had run for a satisfactory number of iterations to make reliable inferences regarding the 95 per cent credible interval of model parameters.

[19] For more details see Gelman et al. (2003), Gill (2008), and Jackman (2009).

[20] In specifying priors for the model parameters I endeavoured to keep these priors uninformative and let the data speak. However, in order to run the MCMC sampler efficiently and avoid crashes, the priors for some parameters were narrowed to restrict resulting estimates to a reasonable range. In these cases, priors were based on trial runs of the sampler. For the uniform priors for variance parameters, I was careful to check that the marginal posterior density of these parameters did not place any substantial probability weight close to the prior bounds. Specifically, the priors for the model parameters were set as follows:

$$\alpha \sim N(0,1)$$
$$\beta_1 \sim N(0,1)$$
$$\beta_2 \sim N(0,1)$$
$$\rho \sim Unif(-0.999, 0.999)$$
$$\omega \sim Unif(0, 0.5)$$
$$\sigma \sim Unif(0, 0.5)$$
$$s \sim Unif(0, 1)$$

When estimating the model I had to drop voting observations for January 2000, because the CPI inflation series used is only recorded from January 2000 onward (recall that CPI is lagged by one month in the model). Therefore, the model is estimated based on voting observations in 103 NBP Council meetings.

Model estimates

Before examining estimated member-specific intercepts in the next section, the remainder of this section discusses the overall results for the hierarchical model of NBP Council voting. First, the fit of the model seems relatively good. Even with a relatively demanding predicted probability threshold of 0.7 the model correctly classifies 77 per cent of observed-proposal voting observations and 91 per cent of no-proposal observations.

Table 4.2 summarises the results for the model. The first column of Table 4.2 contains the mean of the marginal posterior density for each parameter, while the second column contains corresponding 95 per cent credible intervals.

[TABLE 4.2 ABOUT HERE]

The parameter estimates for β_1 and β_2, which measure the average response of NBP members' preferred reference rates to increases in inflation and output respectively, are positive and statistically distinguishable from zero according to 95 per cent credible intervals. This is consistent with a Taylor Rule-type reaction function where central bankers tighten monetary policy in order to mitigate increases in inflation and output, and vice versa. The estimate for ρ indicates high inertia in reference rates, though it is statistically distinguishable from unity according to its 95 per cent credible interval.

Looking at the estimates for the variance parameters, we see that the magnitude of the variation of meeting-effects about their conditional mean (a linear function of observed economic variables) is reasonably large in substantive terms: ω, the standard deviation of

120

meeting-effects about their conditional mean, has a posterior mean of 0.21 reference rate percentage points. Furthermore, the magnitude of the variation in member-specific intercepts appears to be substantively significant: σ, the standard deviation of member-specific intercepts about their mean value (which is constrained to zero in the model), has a posterior mean of 0.08 reference rate percentage points. In the next section I turn to look at these estimated member intercepts in more detail, examining whether they are consistent with the partisan background of NBP appointees.

4.6 Partisan appointments and NBP member revealed monetary policy preferences

In this section I test for partisan patterns in appointments to the NBP Council. To do this I use the estimated member-specific intercepts from the reference rate voting model estimated in the previous section as a measure of appointees' revealed monetary policy preferences.

Patterns in revealed monetary policy preferences

Before assessing whether partisan patterns exist, Figure 4.1 simply plots the revealed monetary policy preferences for each of the twenty-one NBP Council members since 1998. These are the estimated member-specific intercepts, or η_i terms, in the latent preferred reference rate model described in the section 4. Recall that these member intercepts represent the average differences in the latent preferred reference rate of different Council members when faced with the same economic conditions. Member-specific intercepts are measured on a reference rate scale and are zero-centred, since they represent deviations from the Council's mean response to economic conditions. The points in Figure 4.1 represent the median of the

posterior density for the member-specific intercept, while the thick and thin black lines

represent the fifty per cent and ninety-five per cent credible intervals for each member effect,

respectively.

[FIGURE 4.1 ABOUT HERE]

Figure 4.1 suggests that, controlling for economic conditions, there is substantively

meaningful heterogeneity across Council members in terms of preferred reference rates. For

example, it suggests that on average, Miroslaw Pietrewicz prefers a reference rate

approximately 20 basis-points lower than Marek Dabrowski. Furthermore, comparing

marginal ninety-five per cent credible intervals, the eight members with the lowest estimated

member-specific intercepts are statistically distinguishable from the eight members with the

highest estimated member effects.

But do the revealed monetary policy preferences of NBP Council members' exhibit

patterns consistent with partisan appointments? Figure 4.2 allows us to begin to assess this

question. It again graphs mean revealed monetary policy preference of each Council

member, together with ninety-five per cent credible intervals. But it also indicates the

political party or party coalition responsible for appointing each Council member, together

with the left-right economic policy classification of the appointing actor(s), as coded in Table

4.1.

[FIGURE 4.2 ABOUT HERE]

Figure 4.2 provides support for a partisan theory of NBP Council appointments. First,

those members appointed by parties that are left-of-centre on economic policy tend to prefer a

reference rate that is lower than those members appointed by parties that are right-of-centre

on economic policy. Five of the six members appointed by economically right-of-centre

parties have a median estimated member effect that is lower than all twelve members

appointed by economically left-of-centre parties. That is, faced with similar economic

conditions, right-of-centre party appointees to the NBP Council tend to prefer higher reference rate than left-of-centre party appointees to the NBP Council.

However, Figure 4.2 also shows that the remaining right-of-centre appointee, Janusz Krzyzewski, has a median estimated intercept lower than that of four left-of-centre appointees. Furthermore, the average latent preferred reference rate of four left-of-centre party appointees (namely, Filar, Noga, Wasilewska-Trenkner and Wojtyna) are statistically indistinguishable from the right-of-centre appointees in terms of ninety-five per cent credible intervals. These qualifications to the general observed pattern are consistent with the contention of Lohmann (1997) and Morrris and Keech (1997) that political parties face the possibility that appointee's may not turn out to be 'perfect agents' once on the Council.

Further examination of Figure 4.2 reveals some other noteworthy results. Consistent with partisan appointments, two of the NBP Presidents that were appointed as a result of bargaining between left-of-centre and right-of-centre parties (Gronkiewicz-Waltz and Balcerowicz) are estimated to be relatively centrist in terms of average relative preferred reference rate. However, Skrzypek's revealed preference for a relatively low reference rate might be something of a surprise, given that he is also classed as being appointed as a result of bargaining between left-of-centre and right-of-centre parties. Given the relative strength of the PIS party in Skrzypek's appointing coalition (PIS held the Polish Presidency and were the largest party in the Sejm majority coalition) and the right-of-centre economic policy score they are assigned in Table 4.1, the partisan appointments logic would lead us to expect relatively restrictive monetary policy preferences for Skrzypek. It may be that the true economic policy stance of the PIS is inadequately measured in Table 4.1. However, taking these measures as given for the purposes of this paper, we must deem Skrzypek's estimated monetary policy preferences to represent another qualification to the general support for partisan appointments in the data.

I also conduct a more formal statistical test for partisan appointments to the NBP Council. To do this, I examine the posterior density of the difference between the mean member-specific intercept of left-party appointees and the mean member-specific intercept of right-party appointees.

It is relatively straightforward to generate this posterior density from the MCMC sample generated during model estimation, since that sample represents 20,000 draws from the joint posterior density of the model parameters. Specifically, for each draw k from the joint posterior density, $k = 1, ..., 20,000$: first, take the twenty-one η_i values drawn at k for all NBP Council members; second calculate *meanleft1*, the mean of the η_i values drawn at iteration k for all left-of-centre party Council appointees; third, calculate *meanright1*, the mean of the η_i values drawn at iteration k for all right-of-centre party Council appointees; finally, store the value of the difference *meanleft1 - meanright1*. This yields 20,000 samples from the posterior density of *meanleft1 - meanright1*. I also generated a sample from the posterior density of *medleft1 - medright1*, the difference between the median member-specific intercept of left-party appointees and the median member-specific intercept of right-party appointees.

It is necessary to check that this test is robust to the economic left-right coding of Skrzypek's appointing coalition, which as discussed in section 4.3 is not straightforward. Therefore, I repeated the above procedures, but included Skrzypek as a right-of-centre party appointee rather than classifying him as left-right compromise (reflecting the possible weight of the PIS in his appointment). The resulting quantities are labelled *meanleft2 − meanright2* and *medleft2 − medright2*.

Figure 4.3 provides a summary of the posterior density of all four measures of the difference between the latent preferred reference rates of NBP Council members appointed by economically left-of-centre and right-of-centre parties. These measures are all on a

reference rate scale. Again, the point represents the median of the posterior density, and the thick and thin lines the fifty per cent and ninety-five per cent credible intervals, respectively.

[FIGURE 4.3 ABOUT HERE]

Examination of Figure 4.3 shows that according to all four measures, the difference in the latent preferred reference rate of left-of-centre and right-of-centre Council appointees is clearly distinguishable from zero and of the expected sign. For example, there is a ninety-five percent posterior probability that the measure *meanleft1-meanright1* lies between -0.13 and -0.08. That is, controlling for economic conditions, an NBP Council member appointed by an economically left-of-centre party can be expected to have a latent preferred reference rate that is between 8 and 13 basis points lower than an NBP Council member appointed by an economically right-of-centre party. Thus, this more formal test provides further evidence in support of a partisan theory of central bank appointments.

Appointments and shifts in the position of the pivotal voter on the NBP Council

To what extent did the ability to appoint NBP Council members enable Polish political parties to influence monetary policy outcomes? It may be that politicians rationally appoint individual central bankers who have similar monetary policy preferences to themselves, but that they are unable to alter the preferred monetary policy of the pivotal voter on a central bank committee (Krehbiel 2007; Rohde and Shepsle 2007). In order to address this issue, I use my reference rate voting model estimates to assess changes in the monetary policy preferences of the pivotal voter on the NBP Council over time.

Again using the MCMC sample produced during model estimation, I generate the posterior density of the change in the position of the pivotal voter on the NBP Council following appointments. The position of the pivotal voter on the Council for a given composition of ten members is measured as follows. For a given draw *k* from the joint

125

posterior density of the reference rate voting model parameters, take the ten η_i values drawn

at k that correspond to the ten individuals that make up the Council composition. The NBP

President has the casting vote in the event of a tie on the Council, which is equivalent to the

NBP President having two votes on the Council. Therefore count his or her η_i value drawn at

k twice, so that there are effectively eleven η_i values. Now, arrange all eleven η_i values and

store the median value. When this process is repeated across all 20,000 MCMC draws, the

resulting vector of length 20,000 represents a sample from the posterior density of the

position of the pivotal voter on the Council.

I classify three general 'appointment episodes' that have occurred since February

1998, when the inaugural Monetary Policy Council first sat. This inaugural Council

consisted of six appointees from economically right-of-centre parties, three appointees from

economically left-of-centre parties, and one left-right compromise appointee (Gronkiewicz-

Waltz). The first appointment episode occurred in January 2001, when NBP President

Gronkiewicz-Waltz (who had resigned) was replaced by Balcerowicz, another left-right

compromise appointee. The second appointment episode occurred between August 2003 and

February 2004 and involved nine appointments to the Council. During this second episode,

the six-year terms of the nine initial rank-and-file Council members ended, allowing the

economically left-of-centre SLD and PSL the opportunity to appoint nine new Council

members (the start-date for this episode is August 2003 because the death of Krzyzewski in

this month led to the temporary appointment of Czekaj by the SLD, who was re-appointed for

a full six year term in January 2004). The third appointment episode occurred in January

2007, when the Balcerowicz's term as NBP President ended and Skrzypek was appointed to

replace him by a coalition of the economically right-of-centre PIS party and the left-of-centre

SLP and PLR parties.

Figure 4.4 summarizes the posterior density of the change in the monetary policy preference of the pivotal voter on the NBP Council following each of these three appointment episodes. These measures are all again on a reference rate scale. Again, the point represents the median of the posterior density, and the thick and thin lines the fifty per cent and ninety-five per cent credible intervals, respectively.

[FIGURE 4.4 ABOUT HERE]

Figure 4 provides qualified support for a theory of partisan appointments to the NBP Council. First, there appears to have been no distinguishable change in the position of the pivotal voter on the Council resulting from the replacement of Gronkiewicz-Waltz with Balcerowicz. This is in line with a logic of partisan appointments, since both were appointed by the same coalition of parties.

Second, according to Figure 4 the replacement of nine members between August 2003 and February 2004 appears to have produced a negative shift of approximately 4 reference rate basis points in the monetary policy preference of the pivotal voter on the Council. This is again in line with a logic of partisan appointments, since this appointment involved the replacement of six economically right-of-centre appointees and three economically left-of-centre appointees with nine economically left-of-centre appointees. The partisan appointment logic would predict a negative change in the position of the pivotal Council voter in this situation.

Note however, that though the change in the position of the pivotal voter is in the expected direction and is marginally distinguishable from zero in terms of its ninety-five per cent credible interval, it is also relatively small in substantive magnitude. This suggests that politicians may be relatively constrained in their ability to move the pivotal voter on the NBP Council. One important constraint likely stems from the fact that the NBP President, who has disproportionate voting powers on the Council, is appointed according to a different

procedure and happens to follow a different appointment cycle to rank-and-file Council

members. As a result of this, during the August 2003 to February 2004 appointment episode

the left-of-centre SLD/PSL coalition did not have the opportunity to replace the sitting NBP

president and so a left-right compromise appointee continued to effectively exercise two

votes on the Council. If one considers that this institutional constraint operates in addition to

the aforementioned inability of parties to appoint perfect agents to the Council, then the small

shift in the position of the pivotal voter on the Council during this appointment episode is less

surprising. Thus this result can perhaps be interpreted as evidence that institutional design –

here, disproportionate voting power for a committee member who is appointed via an inter-

institutional compromise and according to a different appointment cycle to other members –

can work to condition the impact of political appointments on monetary policy committees,

even in the presence of partisan motivations (Lohmann 1997; Morris 2000). More generally,

this finding accords with theoretical work suggesting that appointments to multi-member

decision-making committees can only have a limited impact on the pivotal voter (Krehbiel,

2007; Rohde and Shepsle, 2007).

Third, according to Figure 4.4, the replacement of Balcerowicz by Skrzypek as NBP

President in January 2007 produced a surprising negative shift in the monetary policy

preference of the pivotal voter on the NBP Council. This shift is at odds with the logic of

partisan central bank appointments, though is unsurprising when we look at Skrzypek's

relatively dovish monetary policy preference estimate in Figure 4.1. Given the measures of

party's economic policy stance used here, the partisan appointments logic would predict that

the pivotal voter on the Council should have remained relatively unchanged after this

appointment. This result thus represents another qualification to the general support for

partisan appointments in the data. Generally, it appears that Skrzypek's appointment is an

important outlier to a trend that is mostly consistent with partisan appointments.

4.7 Conclusion

This paper has examined whether, in the context of a legally highly independent central bank, politicians attempt to exert an indirect partisan influence on monetary policy through central bank appointments. To do this it has analysed appointment and voting patterns in the previously unstudied case of the Monetary Policy Council of the National Bank of Poland. The Polish case provides an opportunity for a relatively clean test of the behavioural assumption underlying theories of partisan central bank appointments: specifically, that compared to parties to left-wing economic policy preferences, parties with more right-wing economic policy preferences seek to appoint central bankers who prefer a relatively restrictive monetary policy.

To test this assumption, I coded a new dataset on monetary policy voting behaviour in the NBP Council. I then derived and estimated a novel Bayesian hierarchical choice model to measure the revealed monetary policy preferences of Council members based on their relative voting behaviour. These measures, together with measures of the economic policy preferences of appointing actors, were used to assess whether the revealed monetary policy preferences of Council members were consistent with the logic of partisan central bank appointments.

My results provide qualified evidence of partisan appointments to the NBP Council. First, in line with the partisan appointments logic, Polish central bankers appointed by parties with right-of-centre economic policy preferences tended to prefer a more restrictive monetary policy. Controlling for economic conditions, right-of-centre Council appointees on average preferred a reference rate that is approximately ten basis points higher than left-of-centre appointees. Such differences are substantively meaningful in terms of their magnitude. Thus

this paper provides support for the partisan theory of central bank appointments, and the motivational assumptions of partisan business cycle theories more generally.

Second, I found heterogeneity in the revealed monetary policy preferences of both right-of-centre and left-of-centre Council appointees, and individuals appointed as a result of a left-right compromise. One particularly prominent outlier from this general pattern was the current NBP President, Slawomir Skrzypek. Thus it appears that central bankers are not perfect agents of their political principals, even in the Polish context where parties are relatively unconstrained in most appointments.

Third, examination of changes in the policy preference of the pivotal voter on the NBP Council suggests that politicians have been able to move the pivotal voter on the Council, but that their ability to do so has been limited. In two of the three main appointment episodes examined since 1998, the change (or lack of change) in the preference of the pivotal voter on the Council are consistent with the partisan appointments logic. However, where the preference of the pivotal voter changes, the magnitude of the change is small substantively. Possible reasons for the limited impact on the position of pivotal voter may include: the inability of parties to appoint perfect agents to the Council; or the specific institutional context of the NBP Council, where the NBP President holds disproportionate voting power and happens to be appointed according to a different cycle than that of rank-and-file Council members. This relates to the central bank independence literature. Even though politicians seek to make partisan appointments, their inability to appoint perfect agents, together with institutional features such as different appointments cycles for powerful committee positions, appear to insulate monetary policy from political influence at least to some extent.

In closing, it is worth noting that while the focus of this paper has been partisan influences on monetary policy via central bank appointments, the evidence presented here also has implications for more general research on partisan economic cycles in post-

Communist Eastern European countries. For example, my headline finding – that economically right-wing parties appoint central bankers who prefer more restrictive monetary policies – contrasts somewhat with Tavits and Letki (2009), who examine cross-country data for Eastern Europe and find that economically right-wing governments implement *less* restrictive fiscal policies than their economically left-wing counterparts. This rather stark disagreement in conclusions may in part be due to differences in time-periods analysed. To elaborate, Tavits and Letki explain their counter-intuitive results as being a product of the particular political circumstances that arise during transitions from Communism to democracy, and these contextual factors could reasonably be expected to play a stronger role in determining political behaviour during the immediate post-Communist transition period than in later years. Whereas Tavits and Letki analyse fiscal policies in Eastern Europe over a period (1989-2004) that includes these immediate post-Communist transition years, this paper has focused on Polish monetary policy-making only from 1998 onwards (i.e. after the NBP Council was established). In this sense, perhaps the evidence presented in this paper indicates that a more conventional partisan pattern in macroeconomic policies had taken hold in Poland by the beginning of its second decade of post-Communist politics.

Summary of NBP Monetary Policy Council members, 2000-2008

NBP Council Member	First Meeting	Last Meeting	Appointing Institution(s)	Appointing Party(s)	Party L-R Economic Score of Appointing Party(s)	L-R Economic Classification of Appointing Party(s)
Dariusz Kajetan Rosati	Feb-98	Jan-04	Pres	SLD	8.27	Left
Grzegorz Wojtowicz	Feb-98	Jan-04	Pres	SLD	8.27	Left
Wieslawa Ziolkowska	Feb-98	Jan-04	Pres	SLD	8.27	Left
Hanna Gronkiewicz-Waltz (Ch)	Feb-98	Dec-00	Pres & Sejm	SLD & (AWS, UW)	10.60	L-R Compromise
Janusz Krzyzewski	Feb-98	Jul-03	Sejm	AWS	11.76	Right
Jerzy Pruski	Feb-98	Dec-03	Sejm	AWS	11.76	Right
Marek Dabrowski	Feb-98	Jan-04	Sejm	UW	16.81	Right
Boguslaw Grabowski	Feb-98	Dec-03	Senate	AWS	11.76	Right
Cezary Jozefiak	Feb-98	Dec-03	Senate	UW	16.81	Right
Wojciech Laczkowski	Feb-98	Dec-03	Senate	AWS	11.76	Right
Leszek Balcerowicz (Ch)	Jan-01	Dec-06	Pres & Sejm	SLD & (AWS, UW)	10.60	L-R Compromise
Jan Czekaj*	Aug-03	-	Sejm	SLD	8.27	Left
Miroslaw Pietrewicz	Jan-04	-	Sejm	PSL	7.42	Left
Halina Wasilewska-Trenkner	Jan-04	-	Senate	SLD	8.27	Left
Marian Noga	Jan-04	-	Senate	SLD	8.27	Left
Stanislaw Owsiak	Jan-04	-	Senate	SLD	8.27	Left
Andrzej Slawinski	Feb-04	-	Pres	SLD	8.27	Left
Andrzej Wojtyna	Feb-04	-	Pres	SLD	8.27	Left
Dariusz Filar	Feb-04	-	Pres	SLD	8.27	Left
Stanislaw Nieckarz	Feb-04	-	Sejm	SLD	8.27	Left
Slawomir Skrzypek (Ch)	Jan-07	-	Pres & Sejm	PIS & (PIS, SRP, LPR)	12.17	L-R Compromise

Source: Appointment details collected from NBP website and contemporary newspaper reports. Party left-right economic scores based on the privatization dimension scores in Benoit and Laver's (2006) expert survey data. Party left-right economic classifications based on author's own coding, described in main text.

Party key: AWS = Solidarity Electoral Action, LPR = League of Polish Families, PIS = Law and Justice, Union
PSL = Polish Peasants' Party, SLD = Democratic Left Alliance, SRP = Self-Defence of the Republic of Poland, UW = Freedom Union.

* Czekaj appointed to fill temporary vacancy caused by death of Krzyzewski, and is subsequently appointed for second term. Though NBP Council membership is generally non-renewable, members can be re-appointed if initially appointed to serve out his or her predecessor's term.

Table 4.2

Summary of parameter estimates for NBP hierarchical voting model

Parameter	Posterior Mean	95% Credible Interval
α	-0.08	[-0.22, 0.06]
β_1	0.10	[0.07, 0.13]
β_2	0.02	[0.01, 0.03]
ρ	0.94	[0.93, 0.96]
ω	0.21	[0.18, 0.24]
σ	0.08	[0.05, 0.11]
s	0.03	[0.027, 0.034]
Total N	1229	
Members	21	
Meetings	103 (incl. 45 no-proposal meetings)	
Voting rounds	125 (incl. 45 no-proposal meetings)	

Figure 4.1

Estimated NBP Member–Specific Intercepts
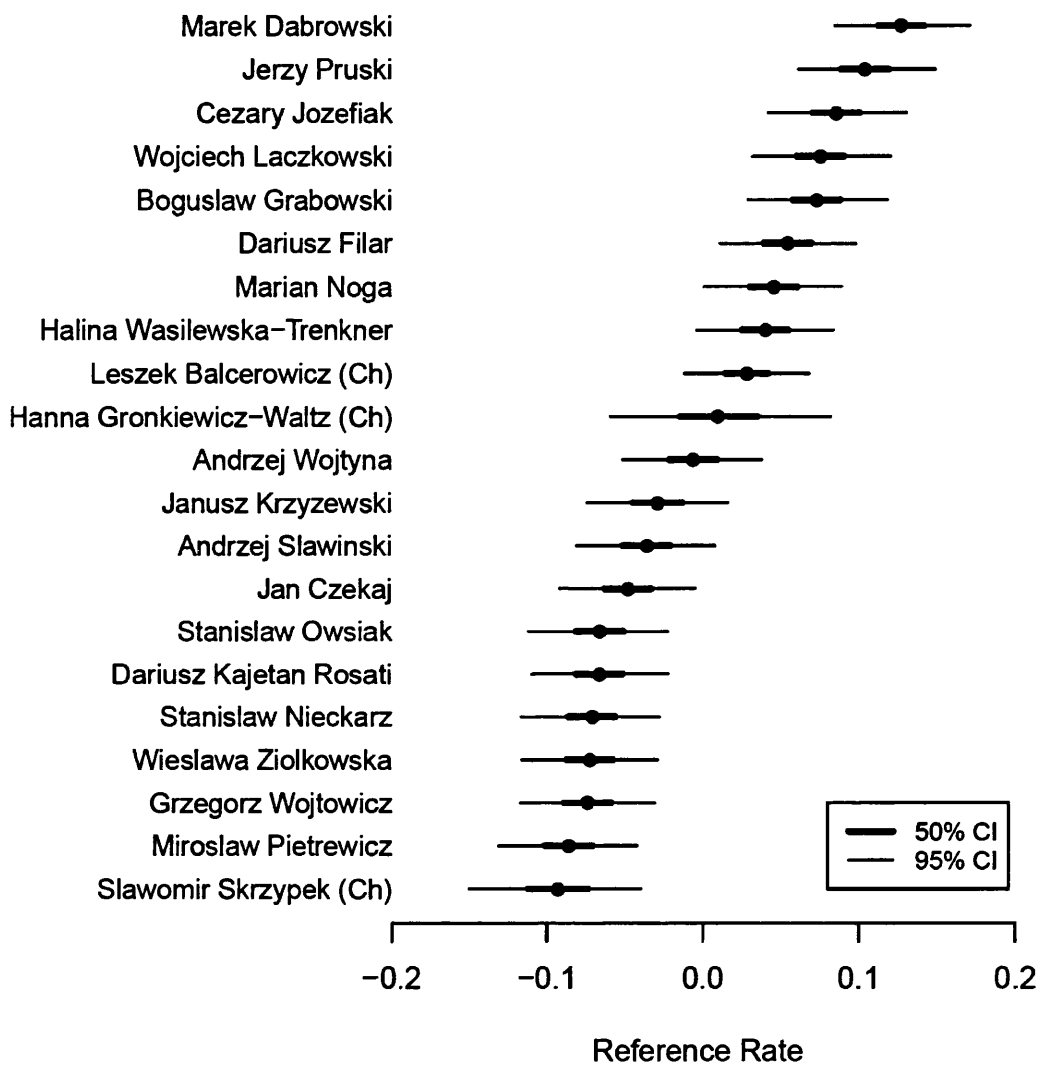
Figure 4.2

Estimated NBP Member-Specific Intercepts by Appointing Party
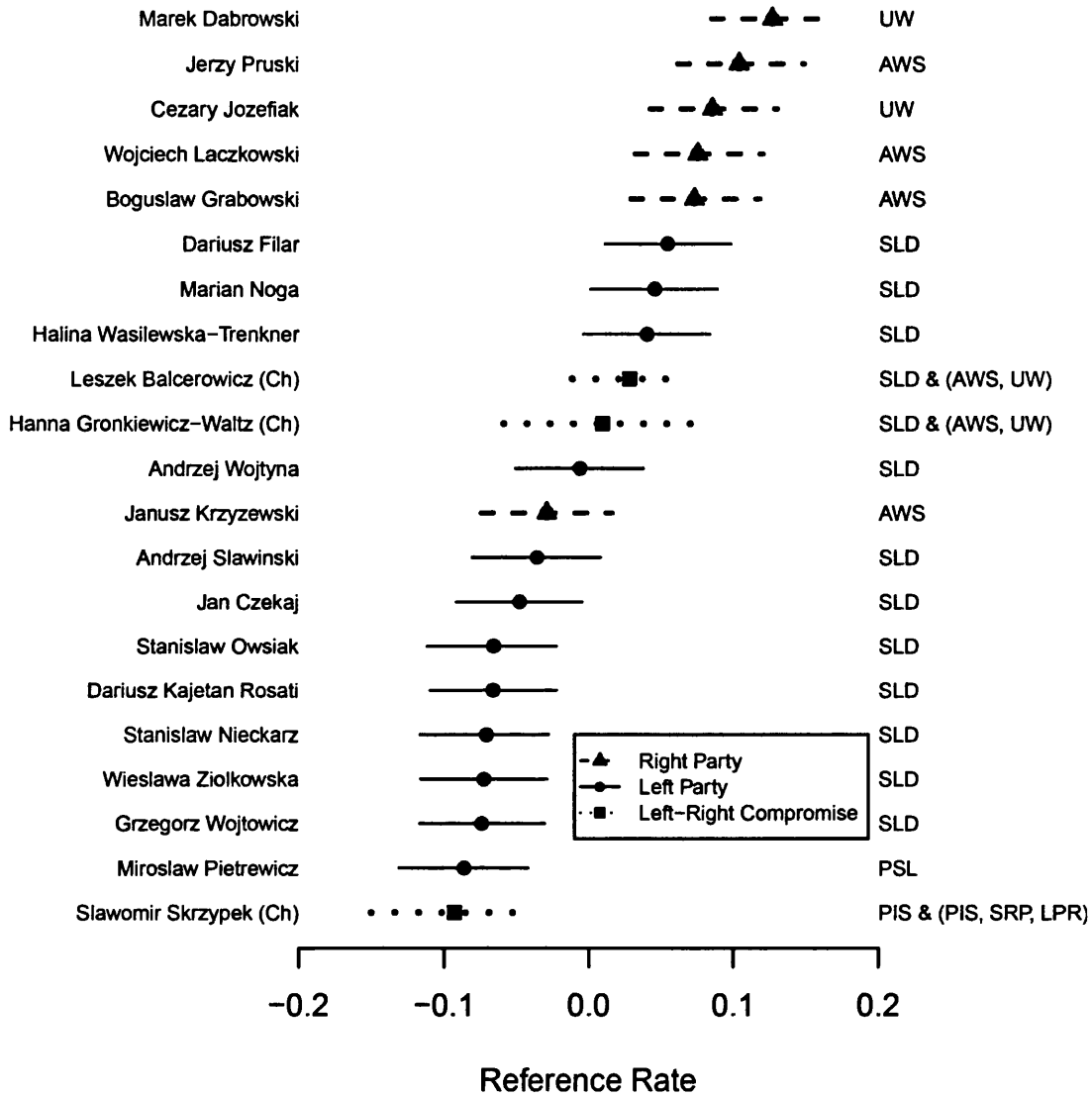
Reference Rate

Figure 4.3

Average differences in revealed monetary policy preferences by appointing party
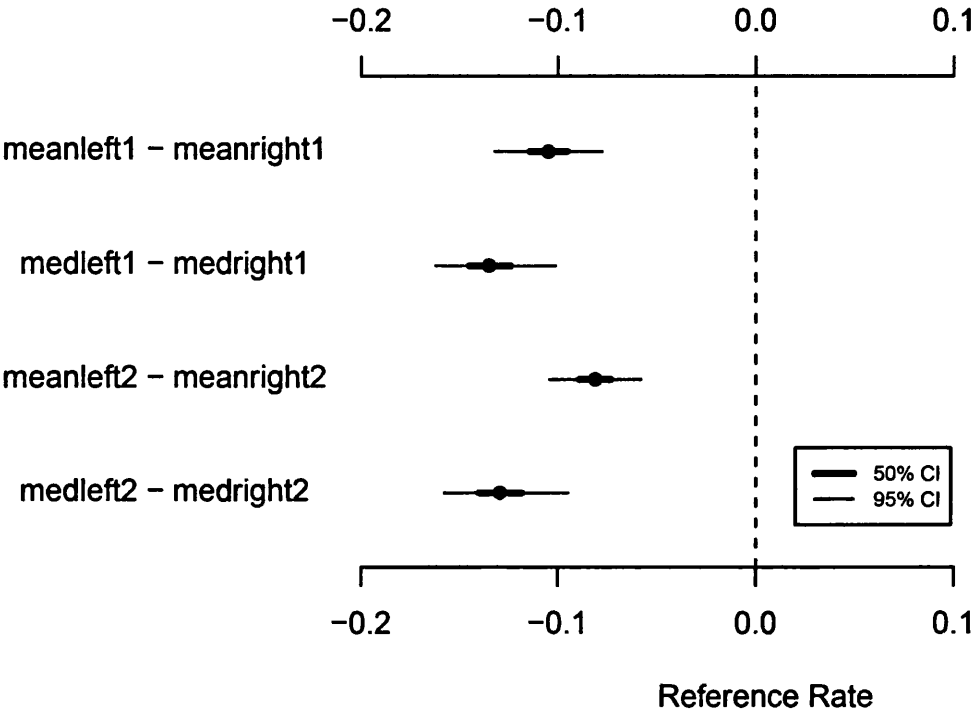
Note: for details of the variable construction, see text (page 126).

Figure 4.4

Confidence intervals for change in pivotal voter on NBP Council after key appointment

episodes

Note: See text (page 127-128) for details of how the change in pivotal voter is calculated

5 Critical discussion and conclusion

The introduction to this thesis argued that political scientists are compelled to study the political economy of monetary policy because monetary policy has such important economic consequences. The papers that followed have made two types of contribution to the study of this subject:

i. *Substantive* – providing new insights into the political, economic and institutional processes that interact to generate monetary policy outcomes

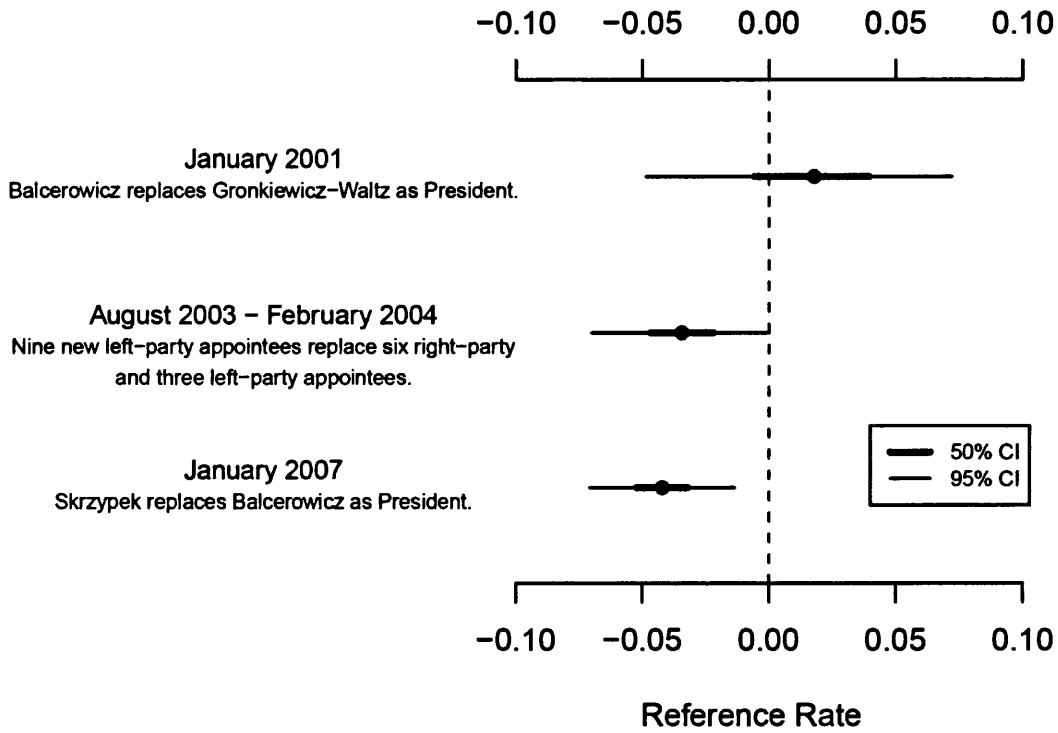ii. *Methodological* – introducing powerful new empirical techniques to the study of these processes, and employing these to generate new and improved measures of key theoretical variables.

In this concluding discussion I summarise each of these contributions in turn and consider how future research can build on the work presented in this thesis.

Substantive contributions of this thesis

Concentrating first on *substantive* contributions, the three papers in this thesis have not attempted to develop a grand over-arching account of the political economy of monetary policy. Rather, their purpose has been to address specific key substantive questions through rigorous empirical enquiry, and in doing so to provide some of the foundations upon which a more general understanding of this topic can be developed. The first paper did this by refining our knowledge of the levels of central bank independence that have prevailed in different countries during different time periods. It challenged previous assumptions about which observable institutional characteristics of central banks, and which gradations of these characteristics, are strongly related to underlying levels of central bank independence. It also

showed that, given the data on central bank characteristics currently available in a codified format, we can only measure levels of central bank independence with a large degree of uncertainty. Finally, it suggested that, once appropriate techniques were employed to account for this uncertainty, regression results strengthen our confidence in previous research which suggested that central bank independence has a negative impact only when there are sufficient veto players in a political system.

Though we may use statistical techniques to correct for it in subsequent analysis, the striking scale of the uncertainty surrounding CBI scores in the first paper is nevertheless a signal that the institutional indicators upon which the scores are based provide only limited useful information concerning the latent concept being measured. Furthermore, the scale of measurement uncertainty was particularly high for countries with extremely low or high latent levels of central bank independence – in other words, existing institutional indicators are even less informative for distinguishing between 'low-CBI' countries or between 'high-CBI' countries. This is important because, following the widespread reforms to increase central bank independence over the past two decades (see Chapter 1), today there are many countries to which the 'high-CBI' label applies. If we want to examine whether the degree of political influence on monetary policy varies among this growing proportion of high-CBI countries – and to examine the causes and consequences of any such variation – then we need to develop a more fine-grained understanding of how the interaction between politicians, central bankers and institutional rules shapes monetary policy outcomes.

The second and third papers in my thesis addressed this task. Both focused on countries with relatively high levels of formal central bank independence (according to the key criteria identified in Chapter 2) and examined how politicians in such countries might attempt to exert an indirect influence upon monetary policy via appointments to central bank monetary policy-making committees. By using innovative techniques to assess patterns in

the monetary policy preferences of central bank appointees, both papers yielded new insights as to the motivations of politicians when making central bank appointments. Chapter 3 provided evidence that when a government is able to make unilateral central bank appointments it does not appear to use this power to induce a straightforward *electoral* cycle in monetary policy, but that it may condition its appointment strategy on fiscal policy constraints. In contrast, Chapter 4 provided clear evidence that politicians do attempt to exert a *partisan* influence on monetary policy: parties further to the right in terms of economic ideology tend to appoint central bankers with more restrictive monetary policy preferences.

In addition, by looking at how appointments have shifted the preference of the pivotal voter on a central bank committee, both papers begun to map the extent to which politicians have been successful influencing monetary policy via appointments. There was in fact clear evidence in Chapters 3 and 4 that politicians have been able to shift the pivotal voter on central bank committees with their appointments. But results also suggest that the magnitude of these shifts is limited by politicians' inability to appoint entirely reliable agents *ex ante*, and by key institutional features of committees such as staggered appointment cycles and dispersal of appointment powers for key committee positions.

By providing new empirical insights into the motivations of politicians when making central bank appointments, and by beginning to map how these may translate into political influence on monetary policy, the second two papers in my thesis aid the development of a richer account of the political economy of monetary policy in high-CBI countries. In terms of immediate implications for the literature, the evidence presented in these papers can provide an empirical basis for the behavioural assumptions scholars choose to make about political actors when constructing theoretical models of the monetary policy-making process. Making accurate assumptions about the motivations of politicians is particularly important if researchers want to use theoretical models to examine the likely consequences of different

institutional designs for central bank appointment procedures, and in turn make practical recommendations for central bank reforms based on their conclusions (e.g Waller 1998). The evidence presented in Chapters 3 and 4 suggests that these scholars are on firmer empirical ground when assuming that politician's central bank appointments are driven by partisan motivations rather than by an electoral cycle.

Chapters 3 and 4 also raise important issues that merit further investigation in future work. For example, results in Chapter 4 suggested that when a chief-executive of a central bank holds a casting vote on an even-numbered central bank committee – as is the case in Poland – then the rules under which this chief-executive is appointed are especially important in conditioning political influence on monetary policy. Existing theoretical models of political committee appointments do consider even-numbered committees (in as far as the committees they model are even-numbered when vacancies arise) but do not model the political consequences of handing a casting vote to a certain committee member (e.g. Waller 1998; Rohde and Shepsle 2007; Krehbiel 2007). From the perspective of central bank design, it would be interesting to investigate these consequences in future work.

Another example is Chapter 3's suggestive evidence that politicians' incentives regarding central bank appointments may be conditional on fiscal policy. Though political economists have so far theorised about fiscal policy incentives conditional on monetary policy constraints (Alesina and Tabellini 1987; Agell et al. 1996; Clark and Hallerberg 2000), they have not devoted the same attention to politicians' interactions with a central bank in a situation where it is fiscal policy that is constrained. The results in Chapter 3 suggest that this could be a fruitful direction for future work. It is also particularly relevant in the current global political context, where central bank appointments are made by governments that face severe pressure to reduce budget deficits.

Methodological contributions of this thesis

The three papers in this thesis also make significant *methodological* contributions to the study of the political economy of monetary policy. Indeed, one of the primary purposes of each paper has been to generate new and improved measures of theoretically important latent variables that are difficult to characterize empirically. Thus, the first paper provided a new set of measures of central bank independence levels for seventy countries across four decades. In addition, the second and third papers provided new measures of the monetary policy preferences of appointees to central bank monetary policy-making committees in the UK and Poland respectively, and of the preferences of the pivotal voter on these committees. It was argued in each paper that these new measures improve on existing ones because (1) they make full use of available observable information in a more principled and appropriate manner, and (2) are accompanied by uncertainty estimates which allow us to account for our inability to measure latent concepts without error when we make inferences. By generating these measures, the three papers in this thesis have provided political scientists and economists with new data that can be used to more effectively test theories concerning the impact of central bank independence and the politics of appointments to central banks or independent agencies more generally.

Furthermore, in the process of producing these new measures this thesis has also introduced Bayesian measurement models, estimated via Markov chain Monte Carlo (MCMC) algorithms, to the study of the political economy of monetary policy. This is in itself a significant methodological contribution because, as the various applications presented throughout this thesis demonstrate, there are a number of key advantages to using the Bayesian approach to measurement modelling. For one, it enables the straightforward estimation of sometimes complex statistical models linking observed information to unobserved quantities of interest. For example, in Chapter 2 the use of the Bayesian

measurement approach permitted uncomplicated estimation of a model that properly

accounted for the categorical nature of observed central bank independence indicators, in

contrast to previous measurement approaches that forced researchers to wrongly treat these

indicators as continuous. Also, in Chapter 4 the Bayesian approach permitted the estimation

of a non-standard vote-choice model that incorporated extra observable information to

identify latent cutpoints between proposals and that simultaneously handled response

observations of a different categorical nature (voting observations from single-proposal,

multi-proposal, and no-proposal meetings). By making more complex models easier to

estimate, the Bayesian measurement approach enables those studying the political economy

of monetary policy to make less restrictive assumptions, and frees them from having to

discard as much useful information, as would be the case when operating with standard

measurement models.

Another key advantage of the Bayesian measurement approach relates to the fact

that estimation via MCMC yields a set of draws from the joint posterior density of model

parameters, in contrast to the single point estimate and standard error estimate for each

parameter that maximum likelihood methods yield. As a result of this feature, and as

demonstrated throughout Chapters 2 to 4, it is relatively easy to use MCMC output to make

inferences regarding auxiliary quantities of that are of critical theoretical interest. This allows

researchers to test theories of the political economy of monetary policy head-on, rather than

having to rely on primary parameter estimates to test theories indirectly. For example, in

Chapter 3 it was straightforward to calculate the posterior probability that a new Bank of

England appointee was more hawkish than their predecessor based on the number of

posterior draws in which the ideal point parameters for the new appointee was greater than

that of their predecessor. Also, both Chapters 3 and 4 showed that it was relatively easy to

generate a posterior distribution for the ideal point of the pivotal voter on a monetary policy-

making committee using sampled values of the ideal points of individual committee members. These auxiliary quantities made it possible to draw direct inferences regarding key outcomes of central bank appointment episodes.

Overall then, the Bayesian measurement approach employed throughout this thesis represents a new, powerful and flexible methodological tool for scholars of the political economy of monetary policy. Moreover, each paper in this thesis has demonstrated how to tailor general Bayesian measurement models to the particular data encountered in this field of study so that researchers can utilise relevant information in as principled and efficient manner as is possible.

It should also be emphasised that the methodological innovations in this thesis were not related exclusively to Bayesian measurement models. Chapter 2 introduced simulation extrapolation (SIMEX) procedures to the study of the political economy of monetary policy. The specific 'heteroscedastic-SIMEX' technique presented provides researchers with an easy-to-implement method to correct for observation-specific uncertainty in measurements when these measurements themselves are inputs in subsequent regression analysis. Not only does this technique enable researchers to properly utilise the inherently noisy monetary policy-related measures generated in this thesis, but it can also be usefully applied in a number of other political science contexts. For example, legislator ideal points (Clinton et al. 2003), levels of democracy (Treier and Jackman 2008), and party ideologies (Benoit et al. 2009) are all measured with observation-specific uncertainty. When scholars run regression with these measurements as input variables and do not account for the associated measurement uncertainty in these variables, biased inferences are likely to result.

Directions for future research

Of course, there are limitations to each paper in this thesis, and these in turn provide opportunities for future work. One principle limitation is the quality and quantity of data available for analysis. For example, in Chapter 2 item discrimination parameter estimates indicated that some existing indicators of central bank independence, as currently coded, do not appear to yield useful information regarding underlying levels of central bank independence. As argued in that paper, these results suggest that we could improve our information on levels of central bank independence if – based on substantive theoretical and empirical findings concerning the avenues through which politicians may influence central bankers – we re-designed some indicators so that they capture more relevant aspects of central bank law, and collected data on additional indicators. In undertaking such endeavours, an advantageous feature of the Bayesian ordinal IRT method presented in Chapter 2 is that the item-parameter estimates it yields provide us with a guide as to which indicators, and which indicator-categories, are candidates for re-design or otherwise may be dropped from the analysis all together.

In addition, in future work it would be extremely informative to extend the temporal coverage of the central bank independence measurements presented in Chapter 2 by using Crowe and Meade's (2008) new data, which updates Cukierman et al's (1992) central bank independence indicators up to the 2000s. Applying the ordinal IRT approach to this data would enable us to properly account for measurement error when assessing the extent to which central bank independence levels have increased across countries in the last two decades. Once the Crowe and Meade (2008) data is available in its fully disaggregated form, it will be possible to carry out this extension.

Turning to the second and third papers in this thesis, our ability to use central bank voting records to test theories of central bank appointments is also limited at present by data

considerations. Ideally (from a researcher's perspective at least), we would like to be able to observe (1) a long series of monetary policy votes by many central bank appointees, (2) each of whom are appointed by clearly defined political parties with (3) varying economic ideologies, (4) at different times in the electoral cycle. Unfortunately, as discussed in Chapters 3 and 4, the number of countries that publish central bank voting records is small – at the time of writing, only seven OECD countries publish contemporary central bank voting records (Germany also publishes these records, but only after a thirty year lag) – and, in all but the US, voting records have only been published for less than fifteen years.

Compounding these constraints, the onset of severe global financial crisis in late 2008 renders voting data collected in the years immediately afterward difficult to analyse. Not only is it of questionable validity to compare policy-making in such extreme circumstances with that in the 'normal times' which came before. But also, in most countries during the last two years there has also been very little variation in central banker voting behaviour, because even the most hawkish central bankers tended to unanimously agree that a drastic loosening of policy was appropriate. To use an educational testing analogy, test-takers (central bankers) all responded in the same manner after being assigned extremely easy items (the monetary policy choices on offer given the extreme economic circumstances), so the observed responses to these items do not enable us to distinguish between test-taker abilities (preferences).

The inevitable consequence of all of these data constraints is that it is difficult to locate cases where we can clearly identify political actors responsible for appointments, and where there is variation on key political variables. Among the cases currently available for study, Chapters 3 and 4 analyse the two where we come closest to satisfying as many as possible of the criteria laid out above. But, as central bank voting records accumulate over the coming years, and as more countries choose to publish these records in the interests of

transparency, we will have richer data with which to test theories of central bank appointments. For example (and as noted in Chapter 3), following the recent election of a Conservative-Liberal Democrat government in the UK, in a number of years it will be possible to estimate the monetary policy preferences of central bankers appointed under this new government and compare these with the preferences of central bankers appointed under the previous Labour government. The general accumulation of central bank voting data, and any future reforms to appointment procedures in countries, should allow us to more directly test how institutional rules condition politicians' ability to influence monetary policy via central bank appointments. Whatever opportunities arise, papers two and three have presented powerful and flexible methodologies that will enable us to analyse new central bank voting data.

Furthermore, as more data on central bank voting becomes available for analysis it may be possible to estimate more advanced voting models in future work. One possibility would be to estimate a variant of the dynamic Bayesian ideal point model developed by Martin and Quinn (2002) for the US Supreme Court. This would allow us to explicitly test the assumption made in Chapters 3 and 4 that bankers' monetary policy preferences are fixed over time, as some authors have argued that such preferences evolve as central bankers accumulate experience on a monetary policy-making committee (Hansen and McMahon 2008). Another possible modelling extension would include the direct incorporation of individual background characteristics into statistical models of monetary policy voting. This type of information could be integrated into hierarchical voting models as a predictor of monetary policy preference parameters, allowing us to examine whether, for example, the career background of a central banker matters for their outlook on policy. These types of extensions would allow us to explore new substantive questions and to check the robustness of the substantive inferences drawn in this thesis.

Finally, before closing this discussion it should be noted that the three papers in this thesis are not just of relevance for researchers studying the political economy of monetary policy, but for political scientists more generally. In particular, questions relating to the levels of political influence on central banks and the consequences of this influence can be seen in the context of the broader study of delegation to and bureaucratic control over regulatory agencies (McCubbins and Schwartz 1984; Epstein and O'Halloran 1999; Huber and Shipan 2002; Gilardi 2002; Thatcher and Stone Sweet 2003; Alesina and Tabellini 2007, 2008).[1]

From this broader perspective, Chapter 2's investigation of levels of central bank independence provides us with new empirical evidence concerning the extent of delegation to a particular type of regulatory agency across different countries, and new evidence regarding the possible consequences of this delegation. In doing so it also demonstrates new methodological tools which political scientists can use to better measure and analyse levels of delegation in contexts other than central banking. For example, the Bayesian ordinal IRT and heteroscedastic SIMEX methods are of great relevance for recent work aimed at constructing indices of regulatory independence for a variety of type of agency, such as competition agencies, media regulators and financial regulators (Gilardi 2002; Hanretty and Koop 2009).

Furthermore, Chapters 3 and 4 show that even given the current data limitations discussed above, central bank committees provide political scientists with an unusually information-rich environment in which to study appointments as a mechanisms through which political principals may exert influence over agents to whom policy decision-making responsibility has been delegated (Rohde and Shepsle 2007; Krehbiel 2007). This is because in the central bank committee context we often observe a lot of information about the substantive nature of the proposals voted upon by appointees. We know the levels of the

---

[1] See Chapter 1 of Huber and Shipan (2002) for a particularly comprehensive and enlightening review of this literature.

interest rate they vote upon, and the economic conditions at the time of their vote. This proposal-specific information helps us estimate and identify the latent preferences of appointees more confidently and efficiently (Clinton and Meirowitz 2001; Quinn et al. 2006). Contrast this with voting on courts or legislative committees, where each proposal voted upon tends to be of a different substantive nature to the last. Other scholars have begun to develop ways of incorporating proposal-specific information in these settings (Clinton and Meirowitz 2001; Quinn et al. 2006). But, as demonstrated in the third paper of this thesis, voting in central bank committees is particularly amenable to such methodological refinements.

References

Adam, Christopher, David Cobham and Eric Girardin (2005) "Monetary Frameworks and

   Institutional Constraints: UK Monetary Policy Reaction Functions 1985-2003",

   Oxford Bulletin of Economics and Statistics, Vol. 67, No. 4, p.497–516.

Agell, Jonas, Lars Calmfors and Gunnar Jonsson (1996) "Fiscal policy when monetary

   policy is tied to the mast", *European Economic Review,* Vol. 40, p.1413 – 1440.

Alesina, Alberto, Nouriel Roubini and Gerald D. Cohen, (1997), *Political Cycles and the*

   Macroeconomy, Cambridge, MA: MIT Press.

Alesina, Alberto, and Jeffrey Sachs (1988) "Political Parties and the Business Cycle in the

   United States, 1948-84", *Journal of Money, Credit and Banking,* Vol. 20, No. 1,

   p.63-82.

Alesina, Alberto and Andrea Stella (2010) "The politics of monetary policy", NBER

   Working Paper Series, No. 15856.

Alesina, Alberto and Lawrence H. Summers (1993) "Central bank independence and

   macroeconomic performance: some comparative evidence" *Journal of Money,*

   Credit, and Banking Vol. 85, No. 2, p.151-162.

Alesina, Alberto and Guido Tabellini (1987) "Rules and discretion with noncoordinated

   monetary and fiscal policies", *Economic Inquiry,* Vol. 25, No. 4, p.619 – 630.

Alesina, Alberto and Guido Tabellini (2007) "Bureaucrats and politicians? Part I: a single

   task", *American Economic Review,* Vol. 97, p.169-179.

Alesina, Alberto and Guido Tabellini (2008) "Bureaucrats or politicians? Part II: multiple

   tasks", *Journal of Economic Perspectives,* Vol. 92, p.426-447.

Alpanda, Sami and Adam Honig (2009) "The impact of central bank independence on

   political monetary cycles in advanced and developing nations", *Journal of Money,*

Credit, and Banking, Vol. 41, No. 7, p.1365-89.

Alpanda, Sami, and Adam Honig (2010) "Political monetary cycles and a *de facto* ranking of

central bank independence", *Journal of International Money and Finance*,

forthcoming.

Arnone, Marco, Bernard J. Laurens and Jean-Francois Segalotto (2006) "The measurement

of central bank autonomy: survey of models, indicators and empirical evidence",

IMF Working Paper 227/06.

Bade, Robin and Michael Parkin (1977) "Central bank laws and monetary policies: a

preliminary investigation", unpublished, London, Ontario, Canada: University of

Western Ontario.

Bafumi, Jospeh, Andrew Gelman, David K. Park and Noah Kaplan (2005) "Practical Issues

in Implementing and Understanding Bayesian Ideal Point Estimation", *Political

Analysis*, Vol. 13, p.171-187.

Banaian, King (2008) "Measuring central bank independence: ordering, ranking or scoring?",

in Banaian, King, and Bryan W. Roberts Jr., eds, *The Design and Use of Political

Economy Indicators*, New York: Palgrave.

Banaian, King, Richard C. K. Burdekin, and Thomas D. Willett (1995) "On the political

economy of central bank independence" in Hoover, Kevin D. and Steven M. Sheffrin

(eds.) *Monetarism and the methodology of economics: essays in honor of Thomas

Mayer*, Hants UK: Edward Elgar.

Banaian, King, Richard C. K. Burdekin, and Thomas D. Willett (1998) "Reconsidering the

principal components of central bank independence: the more the merrier?" *Public

Choice*, Vol. 97, p.1-12.

Barro, Robert J. and David B. Gordon (1983) "Rules, Discretion and Reputation in a Model

of Monetary Policy", *Journal of Monetary Economics,* Vol. 12, p.101-121.

Battuaz, Michela, Ruggero Bellio and Enrico Gori (2008) "Reducing measurement error in

    student achievement estimation", *Psychometrika*, Vol. 73, No. 2, p.289-302.

Bean, Charles and Nigel Jenkinson (2001) "The formulation of monetary policy at the Bank

    of England" *Bank of England Quarterly Bulletin*, Winter 2001.

Beattie, Alan (2000) "Professor puzzled over losing Bank policy job", *The Financial Times*,

    10 June 2000, p.4.

Beck, Nathaniel (1982) "Presidential influence on the Federal Reserve in the 1970's".

    American Journal of Political Science, Vol. 26, p.415-45.

Benoit, Kenneth and Michael Laver (2006) *Party Policy in Modern Democracies*, London:

    Routledge.

Benoit, Kenneth, Michael Laver and Slava Mikhaylov (2009) "Treating words as data with

    error: uncertainty in text statements of policy positions", *American Journal of*

    Political Science, Vol. 53, No. 2, p.495-513.

Berger, Helge and Ulrich Woitek (2005) "Does conservatism matter? A time-series approach

    to central bank behaviour" *The Economic Journal*, Vol. 115, p.745-766.

Berger, Helge and Ulrich Woitek (1997) "How opportunistic are partisan German central

    bankers: Evidence on the Vaubel hypothesis", *European Journal of Political*

    Economy, Vol. 13, p.807-821.

Bernanke, Ben S. and Alan S. Blinder (1992) "The Federal Funds Rate and the channels of

    monetary transmission", *American Economic Review*, Vol. 82, No. 4, p.901-921

Bernhard, William, and David Leblang (2002) "Political parties and monetary commitments"

    International Organization, Vol. 56, No. 4, p.803–30.

Besley, Timothy, Neil Meads and Paolo Surico (2008) "Insiders Versus Outsiders in

    Monetary Policy-Making", *American Economic Review*, Vol. 98, No. 2, p.218-213.

Bhattacharjee, Arnab and Sean Holly (2005) "Inflation Targeting, Committee Decision

making and Uncertainty: The Case of the Bank of England's MPC", *CDMA Working Paper 05/03*, University of St. Andrews.

Bhattacharjee, Arnab and Sean Holly (2006) "Taking Personalities out of Monetary Policy Decision Making? Interactions, Heterogeneity and Committee Decisions in the Bank of England's MPC", *Working Paper Series 0612,* University of St Andrews.

Bland, J. Martin and Douglas G. Altman (1983) "Comparing methods of measurement: why plotting difference against standard method is misleading", *Lancet*, Vol. 346, p.1085-1087.

Bland, J. Martin and Douglas G. Altman (1995) "Measurement in medicine: the analysis of method comparison studies" *The Statistician*, Vol. 32, No.3, p.307-317.

Blinder, Alan S. (2005) "What Have We Learned Since October 1979?" *Federal Reserve Bank of St. Louis Review,* Vol. 87, No. 2, p.277-282.

Blinder, Alan S. (2007) "Monetary Policy by Committee: Why and How?" *European Journal of Political Economy* 23: 106–123.

Brooks, Robert, Mark N. Harris and Christopher Spencer (2007) "An Inflated Ordered Probit Model of Monetary Policy: Evidence from MPC Voting Data" *MPRA Paper 8509*, University Library of Munich.

Brumm, Harold J. (2000) "Inflation and central bank independence: conventional wisdom redux", *Journal of Money, Credit and Banking*, Vol. 32, No. 4, p.807-819.

Campillo, Marta and Jeffrey A. Miron (1997) "Why does inflation differ across countries?" in, Romer, Christina D. and David H. Romer (eds.) *Reducing Inflation. Motivation and Strategy*. Chicago: University of Chicago Press.

Carroll, Raymond J., David Ruppert, Leonard A. Stefanski, and Ciprian M. Crainiceanu (2006) *Measurement error in nonlinear models: a modern perspective"*, 2nd edition, Boca Raton, FL: Chapman & Hall/CRC.

Carrubba, Clifford, Matthew Gabel and Simon Hug (2008) "Legislative voting behaviour, seen and unseen: a theory of roll-call vote selection", *Legislative Studies Quarterly*, Vol. 33, No. 4.

Chang, Kelly H. (2001) "The President versus the Senate: Appointments in the American system of separated powers and the Federal Reserve", *Journal of Law, Economics and Organization*, Vol. 17, No. 2, p.319-55

Chang, Kelly H. (2003) *Appointing Central Bankers: The Politics of Monetary Policy in the Unied States and the European Monetary Union,* Cambridge: Cambridge University Press.

Chappell, Henry .W. Jr., Rob Roy McGregor and Todd Vermilyea (2005) *Committee Decisions on Monetary Policy: Evidence from Historical Records of the Federal Open Market Committee.* Cambridge, MA: MIT Press.

Clarida, Richard, Jordi Gali and Mark Gertler (1999) "The science of monetary policy: an new Keynesian perspective", Journal of Economic Literature, Vol. 37, p.1661–1707.

Clark, William Roberts, and Mark Hallerberg (2000) "Mobile capital, domestic institutions, and electorally induced monetary and fiscal policy", *American Political Science Review,* Vol. 94, Issue 2, p.323– 46.

Clinton, Joshua. D. and Adam Meirowitz (2001) "Agenda Constrained Legislator Ideal Points and the Spatial Voting Model", *Political Analysis*, Vol. 9, No. 3,

Clinton, Joshua, Simon Jackman, and Douglas Rivers (2004) "The Statistical Analysis of Roll Call Votes" *American Political Science Review*, Vol. 98, p.355-370.

Cox, Nicholas J. (2004) "Speaking Stata: Graphing agreement and disagreement", *The Stata Journal*, Vol. 4, No. 3, p.329–349.

Crosby, Mark (1998) "Central bank autonomy and output variability", *Economic Letters*, Vol. 60, p.67–75.

Crowe, Christopher and Ellen E. Meade (2008) "Central bank independence and

transparency: evolution and effectiveness", *European Journal of Political Economy* ,

Vol. 24, p.763-777.

Cukierman, Alex, (1992) *Central bank strategy, credibility and independence*, Cambridge,

MA: MIT Press.

Cukierman, Alex (2008) "Central bank independence and monetary policymaking

institutions – past present and future", *European Journal of Political Economy*, Vol.

24, p.722–736.

Cukierman, Alex and Francesco Lippi (1999) "Central bank independence, centralization of

wage bargaining, inflation and unemployment: theory and some evidence,"

European Economic Review, Vol. 43, p.1395–1434.

Cukierman, Alex, Steven B. Webb and Bilin Neyapti (1992) "Measuring the independence of

central banks and its effect on policy outcomes", *The World Bank Economic Review*,

Vol. 4, No. 3, p.353-398

Cusack, Thomas R. (2001) "Partisanship in the setting and coordination of fiscal and

monetary policies", *European Journal of Political Research*, Vol. 40, p.93-115.

Davies, Howard and David Green (2010) *Banking on the future: the fall and rise of central

banking*, Oxford, UK: Princeton University Press.

de Haan, Jakob, Erik Leertouwer, Erik Meijer and Tom Wansbeek (2003) "Measuring central

bank independence: a latent variables approach", *Scottish Journal of Political

Economy*, Vol. 30, No. 3, p.326-340.

Edmunds, Timothy (1999) "The Monetary Policy Committee: theory and performance"

House of Common Library Research Paper 99/17, February 1999.

Epstein, David and Sharyn O'Hallorann (1999), *Delegating powers: a transaction cost

approach to policymaking under separate powers*, Cambridge, UK: Cambridge

University Press.

Eijffinger, Sylvester and Eric Schaling (1993) "CB autonomy in twelve industrial countries",

    Banca Nazionale del Lavoro Quarterly Review Vol 184, p.49-89.

Franzese, Robert J. Jr. (2002) "Electoral and partisan cycles in economic policies and

    outcomes", *Annual Reviews of Political Science,* Vol. 5, p.369-421.

Friedman, Benjamin M. (2001) "Monetary Policy" *International Encyclopaedia of the Social*

    and Behavioural Sciences, Oxford: Elsevier Science.

Friedman, Benjamin M. (2008) "What objectives for monetary policy?", in Touffut, Jean-

    Phillippe (ed.), *Central Banks as Economic Institutions,* Cheltenham: Edward Elgar.

Fox, Jean-Paul (2005) "Multilevel IRT using dichotomous and polytomous response data",

    British Journal of Mathematical and Statistical Psychology, Vol. 58, p.145-172.

Fox, Jean-Paul (2010) *Bayesian item response modelling: Theory and applications,* New

    York: Springer-Verlag.

Fox, Jean-Paul and Cees A.W, Glas (2003) "Bayesian modelling of measurement error in

    predictor variables using item response theory", *Psychometrika,* Vol. 68, No. 2,

    p.169-191.

Fuhrer, Jeffrey C., 1997, "CB Autonomy and inflation targeting: monetary policy paradigms

    for the next millennium?" *New England Economic Review,* Vol.1–2, pp. 19–36.

Gascoigne, Jamie and Paul Turner (2004) "Asymmetries in Bank of England monetary

    policy" *Applied Economics Letters,* Vol. 11, p.615-618.

Gelman, Andrew, John B. Carlin, Hal S. Stern and Donald B. Rubin (2003) *Bayesian Data*

    Analysis 2nd edition. London: Chapman & Hall/CRC

Gerlach-Kristen, Petra (2006) "Monetary policy committees and interest-rate setting"

    European Economic Review, Vol. 50, p.487–507.

Gerlach-Kristen, Petra (2007) "Outsiders at the Bank of England" unpublished mimeo.

Gilardi, Fabrizio (2002) "Policy credibility and delegation to independent regulatory agencies: a comparative empirical analysis", *Journal of European Public Policy*, Vol. 9, No. 6, p.873-893.

Gill, Jeff (2008) *Bayesian Methods: A Social and Behavioural Sciences Approach*, 2nd edition. London: Chapman & Hall/CRC

Goodhart, Charles A.E. (2005) "The Monetary Policy Committee's reaction function: an exercise in estimation" *Topics in Macroeconomics*, Vol. 5, No. 1, Art.18.

Grilli, Vittorio, Donarto Masciandaro and Guido Tabellini (1991) "Political and monetary institutions and public financial policies in the industrial countries". *Economic Policy*, Vol. 13, p.341-392.

Gustafson, Paul (2003) *Measurement error and misclassification in statistics and epidemiology: impacts and Bayesian adjustments*, Boca Raton, FL: Chapman & Hall/CRC.

Hallerberg, Mark (2002) "Veto players and the choice of monetary institutions", *International Organization*, Vol. 52, p.775-802.

Hanretty, Chris and Christel Koop (2009) "Measuring regulators' statutory independence", unpublished mimeo, European University Institute, Florence, Italy.

Hansen, Stephen and Michael F. McMahon (2008) "Delayed doves: MPC voting behaviour of externals" *CEP Discussion Paper No. 862*, Centre For Economic Performance.

Harris, Mark N. and Christopher Spencer (2007) "Policy choices and reaction functions of Bank of England MPC members" unpublished mimeo.

Havrilesky, Thomas (1987). "A partisanship theory of fiscal and monetary regimes". *Journal of Money, Credit and Banking*, Vol. 19, p.83-101

Havrilesky, Thomas, & John A. Gildea (1992), "Reliable and unreliable partisan appointees to the Board of Governors". *Public Choice*, Vol. 73, p.397-417.

Hayo, Bernd and Stefan Voigt (2008) "Inflation, central bank independence, and the legal

system", *Journal of Institutional and Theoretical Economics*, Vol. 164, No. 4, p.751-

777.

Henisz, Witold J. (2000) "The institutional environment for economic growth", *Economics

and Politics*, Vol. 12, No. 1, p.1-31.

Hibbs, Douglas A. (1977) "Political Parties and macroeconomic policy", *American Political

Science Review*, Vol. 71, No. 4, p.1467-1487.

Hinich, Melvin J. and Micahel C. Munger (1997) *Analytical Politics*. Cambridge: Cambridge

University Press.

Hix, Simon, Bjørn Høyland and Nick Vivyan (2010), "From doves to hawks: a spatial

analysis of voting in the Monetary Policy Committee of the Bank of England",

European Journal of Political Research, forthcoming.

HM Treasury (2007) *Public Finances Databank.* accessed 27 June 2007.

Høyland, Bjørn, Karl Moene, and Fredrik Willumsen (2009) "The tyranny of international

index rankings", unpublished mimeo, University of Oslo, Oslo, Norway.

Hooghe, Liesbet, Ryan Bakker, Anna Brigevich, Catherine de Vries, Erica Edwards, Gary

Marks, Jan Rovny, Marco Steenbergen (2010), "Reliability and vailidity of

measuring party position: the Chapel Hill expert surveys of 2002 and 2006",

European Journal of Political Research, forthcoming.

Huber, John D. and Charles C. Shipan (2002) *Deliberate discretion? The institutional

foundations of bureaucratic autonomy*, Cambridge, UK: Cambridge University

Press.

Hug, Simon (2009) "Selection effects in roll call votes", *British Journal of Political Science*,

Vol. 40, p.225–235.

Jackman, Simon D., (2000a) "Estimation and inference are missing data problems: unifying

social science statistics via Bayesian Simulation", *Political Analysis*, Vol. 8, No. 4.

Jackman, Simon D. (2000b) "Estimation and inference via Bayesian simulation: an introduction to Markov chain Monte Carlo", *American Journal of Political Science*, Vol. 44, No. 2, p.369-398.

Jackman, Simon D. (2008) "Measurement" in Brady, Henry E., David Collier and Janet Box-Steffensmeier (eds), *Oxford Handbook of Political Methodology*, Oxford, UK: Oxford University Press, p.119-151.

Jackman, Simon D. (2009) *Bayesian Analysis for the Social Sciences*, Hoboken, NJ: Wiley

Jessee, Stephen A. (2010) "Partisan bias, political information and spatial voting in the 2008 Presidential election", *Journal of Politics*, Vol. 72, No. 2, p.327-340.

Johnson, Valen E. and James H. Albert (1999) *Ordinal Data Modelling*, New York: Springer-Verlag.

Keech, William R. and Irwin L. Morris (1997) "Appointments, Presidential power, and the Federal Reserve", *Journal of Macroeconomics*, Vol. 19, No. 2, p.253–267.

Keefer, Philip and David Stasavage (2003) "The limits of delegation: veto players, central bank independence and the credibility of monetary policy", *American Political Science Review*, Vol. 97, No. 3, p. 407- 423

Kokoszynski, Ryszard (2002) "Poland before the Euro", *Journal of Public Policy*, Vol. 22, No. 2, p.199-215.

Kotlowski, Jacek (2006). "Reaction functions of the Polish central bankers – a logit approach", Warsaw School of Economics Department of Applied Econometrics Working Paper No. 1-05.

Krehbiel, Keith (2007) "Supreme Court appointments as a move-the-median game" *American Journal of Political Science* Vol. 51, No. 2, p.231-240.

Kydland, Finn .E. and Edward C. Prescott (1977) "Rules rather than discretion: the

inconsitency of optimal plans" *Journal of Political Economy,* Vol. 85, No. 3, p.473-491.

Layard, Richard (1998), Foreword to Blinder, Alan S. *Central Banking in Theory and Practice,* Cambridge, Mass: MIT Press

Lohmann, Susanne (1997). "Partisan control of the money supply and decentralized appointment powers". *European Journal of Political Economy,* Vol. 13, p.225-246.

Lohmann, Susanne. (1998). "Federalism and Central Bank Independence: the politics of German monetary policy, 1957-1992." *World Politics,* Vol. 50, No. 3, p.401-446.

Lunn, David, Nicky Best, David Spiegelhalter, Gordon Graham and Beat Neuenschwander (2009) "Combining MCMC with 'sequential' PKPD modelling", *Journal of Pharmacokinetics and Pharmacodynamics,* Vol. 36, No. 1, p.19-38.

Maier, Philipp (2007) "Monetary policy committees in action: is there room for improvement?" Bank of Canada Working Paper 2007-6.

Mangano, Gabriel (1998) "Measuring central bank independence: a tale of subjectivity and its consequences", *Oxford Economic Papers,* Vol. 50, p.468-492.

Maria-Dolores, Ramon (2005) "Monetary policy rules in accession countries to EU: is the Taylor rule a pattern?" *Economics Bulletin,* Vol. 5, No. 5, pp.1-16.

Markowski, Radoslaw (2006) "The polish elections of 2005: pure chaos or a restructuring of the party system?", *West European Politics,* Vol. 29, No. 4, p.814-832.

Martin, Andrew D. And Kevin M. Quinn (2002) "Dynamic ideal point estimation via Markov chain Monte Carlo for the U.S. Supreme Court, 1953-99", *Political Analysis,* Vol. 10, No. 2, p.134-153.

Martin, Andrew D. and Kevin M. Quinn (2006) Package 'MCMCpack. *Technical Report.*

Martin, Andrew D., Kevin M. Quinn and Jong Hee Park (2009) *MCMCpack: Markov chain Monte Carlo (MCMC) package,* R package version 1.0-5, URL:

http://mcmcpack.wustl.edu.

McCubbins, Matthew D. and Thomas Schwartz (1984) "Congressional oversight overlooked: Police patrols versus fire alarms", *American Journal of Political Science*, Vol. 28, p.165-179.

Morris, Irwin L. (2000) *Congress, the president, and the Federal Reserve: the politics of American monetary policy-making*, Ann Arbor, MI.: University of Michigan Press.

Mueller, Dennis (2003) *Public Choice III,* Cambridge: Cambridge University Press.

National Bank of Poland (2000), *Monetary Policy Guidelines for Year 2000.* Official statement, English language version.

Nordhaus, William D. (1975) "The political business cycle" *Review of Economics Studies*, Vol. 42, p.169 – 190.

Oatley, Thomas (1999) "Central bank independence and inflation: corporatism, partisanship, and alternative indices of central bank independence," *Public Choice*, Vol. 98, p.399–413.

Plümper, Thomas and Vera E. Troeger (2006) "Monetary policy autonomy in European non-Euro countries, 1980–2005", *European Union Politics*, Vol. 7, No. 2, p.213-234.

Plümper, Thomas and Vera E. Troeger (2008) "Fear of floating and the external effects of currency unions", *American Journal of Political Science*, Vol. 52, No. 3, p. 656–676.

Plummer, Martyn (2009) *rjags: Bayesian graphical models using R*, R package version 1.0.3-9.

Posen, Adam (1993) "Why central bank independence does not cause low inflation: there is no institutional fix for politics", in O'Brien, Richard, ed. *Finance and the international economy"*, Oxford, UK: Oxford University Press.

Posen, Adam (1995) "Declarations are not enough: financial sector sources of central bank independence", *NBER Macroeconomics Annual Report 1995*, p.253-274.

Quinn, Kevin M. (2004) "Bayesian factor analysis for mixed ordinal and continous

responses", *Political Analysis*, Vol. 12, p.338-353.

Quinn, Kevin. M., Jong Hee Park and Andrew D. Martin (2006) "Improving judicial ideal

point estimates with a more realistic model of opinion content", unpublished working

paper.

Rogoff, Kenneth (1985) "The Optimal Degree of Commitment to an Intermediate Monetary

Policy Target" *Quarterly Journal of Economics*, Vol. 100, No. 4, p.1169-1189.

Rohde, David W., and Kenneth W. Shepsle (2007). "Advice and consent in the 60-vote

Senate", *Journal of Politics*, Vol. 69, p.664-677.

Romer, Christina D. and David. H. Romer (1989) "Does monetary policy matter? A new test

in the spirit of Friedman and Schwartz", in Blanchard, Oivier J. and Stanley Fischer

(eds.) *NBER Macroeconomics Annual 1989*, Cambridge, MA: MIT Press.

Romer, Christina D. and David. H. Romer (2004) "A new measure of monetary shocks:

derivation and implications", *American Economic Review*, Vol. 94, No. 4, p.1055-

1084.

Sikken, Bernd Jan and Jakob de Haan (1998) "Budget deficits, monetization, and CB

autonomy in developing countries", *Oxford Economic Papers*, Vol. 50, p.493–511.

Sirchenko, Andrei (2008) "Modelling monetary policy in real time: does discreteness

matter?", working paper, European University Institute, Florence.

Spencer, Christopher (2007) "The dissent voting behaviour of Bank of England MPC

members" unpublished mimeo, University of Surrey.

Spiegelhalter, David J., Andrew Thomas, and Nickey G. Best (1999) *WinBUGS Version 1.4*

Cambridge: MRC Biostatistics Unit.

Tavits, Margit and Natalia Letki (2009) "When left is right: party ideology and policy in

post-Communist Europe", *American Political Science Review*, Vol. 103, No. 4,

p.555-569.

Taylor, John (1993) "Discretion versus policy rules in practice". Carnegie-Rochester

Conference Series on Public Policy, Vol. 39, p.195-295.

Thatcher, Mark and Alec Stone Sweet (eds.) (2003) *The politics of delegation*, London:

Frank Cass.

Thornton, Philip (2000) "Rate Hawk Goodhart is Replaced by Academic" *The Independent*, 5

May 2000.

Tractenberg, Rochelle E., and Paul S. Asien (2009) "Agreement in cognitive and clinical

assessments in Alzheimer's disease", *Dementia and Geriatric Cognitive Disorders*,

Vol. 27, p.344-352.

Treier, Shawn and Simon D. Jackman (2008) "Democracy as a latent variable", *American*

Journal of Political Science, Vol. 52, No. 1, p.201–217.

Vaubel, Roland (1997) "The bureaucratic and partisan behaviour of independent central

banks: German and international evidence", *European Journal of Political Economy*,

Vol. 13, p.201-224.

Waller, C. J. (1998). "Appointing the median voter of a monetary policy board." Federal

Reserve Bank of Cleveland working paper 9802.

Way, Christopher (2000) "Central banks, partisan politics and macroeconomic outcomes",

Comparative Political Studies, Vol. 33, No. 2, p.196-224.