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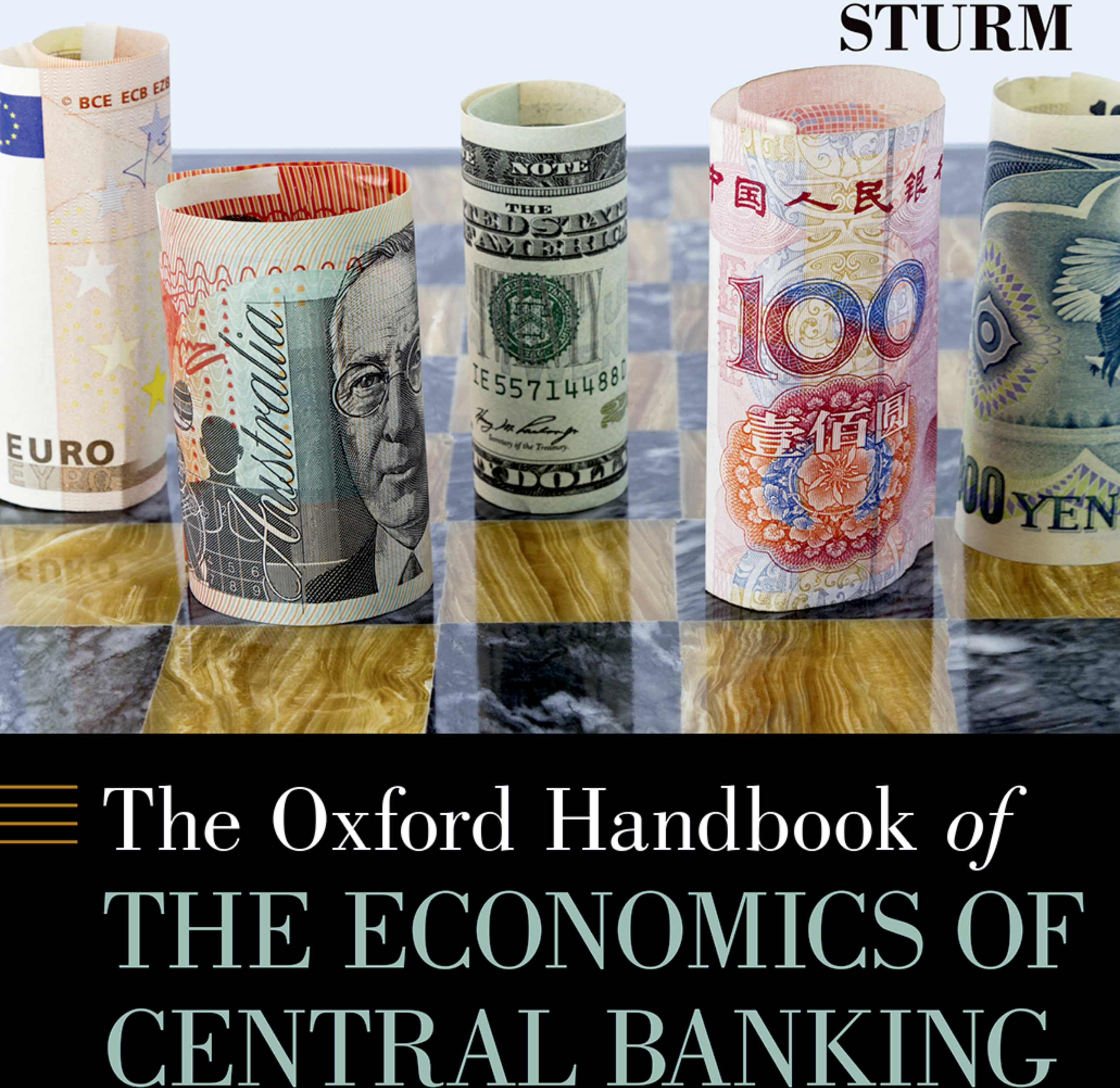

The Oxford Handbook *of* THE ECONOMICS OF CENTRAL BANKING

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To David Mayes, a dear colleague, a dedicated policymaker,
and a good friend to many

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CHAPTER 1

CENTRAL BANKING'S LONG MARCH OVER THE DECADES

DAVID G. MAYES, PIERRE L. SIKLOS, AND JAN-EGBERT STURM

1.1 Introduction

In a speech delivered at the beginning of 2000, Mervyn King, former governor of the Bank of England (BoE), argued that a "successful central bank should be boring" (King 2000, 6), a statement that has often been repeated to highlight aspirations once held by many central bankers. In other words, monetary policy should be an uncontroversial, predictable technical exercise whose objectives have general support across society and the political spectrum. The new century's arrival, several years into a period that came to be called the "Great Moderation" (Bernanke 2004), supposedly coincided with central banks being at the apogee of their power and influence among public institutions, their reputation celebrated as the outcome of good policy practices supported by convincing theory.

As we approach the end of the second decade of the twenty-first century, much has changed in the world of central banking, and yet some important elements remain just as they were before the events that began in 2007 and are now referred to as the great financial crisis or the global financial crisis (either way, GFC). The GFC produced an outpouring of new research, memoirs, and personal accounts, which asked how it came to be that modern finance produced such a large financial crisis and where we could go from here. King himself, looking back on his years in central banking (King 2016), argues that what ails the financial system remains firmly in place and that a new and possibly even larger crisis is in the offing. Others (e.g., El-Erian 2016) underscore that in spite of the GFC, monetary authorities around the world remain "the only game in town."

And yet there are equally powerful signs that many things are changing, and it remains unclear whether the accomplishments of central banks trumpeted almost two decades ago will become just another phase in the history of central banks. Where once policy rules were supposed to provide guidance and educate the public about how and why central banks change the stance of monetary policy, these are now replaced by a more artful view of how policy is set. Indeed, several central banks no longer rely on a single policy instrument, a policy interest rate, to signal the stance of policy. Instead, a complex mix of forward guidance, expressions of bias about the likely future direction of interest rates, not to mention the creation of a large number of new policy instruments, have now entered the vocabulary of central banking. Most of these, originally labeled unconventional monetary policies (UMP), have been in place and used for a decade. Today it is no longer obvious that the proliferation of instruments can still be thought of as unconventional.

Next, the belief that good practice in monetary policy goes hand in hand with the maintenance of financial stability is being replaced with experimentation about how achieving a monetary policy objective aimed at keeping inflation under control can operate in parallel with the desire to maintain financial system stability. The shift is more than technical, since also at stake are the institutional role of central banks and their relationship with other public agencies that are responsible for regulating and supervising the financial system.

Added to the above list of forces buffeting the central banking institution is pressure to revisit the widely accepted view that monetary policy should aim for low inflation. While few doubt the wisdom that the control of purchasing power is a sensible objective, a growing number of voices, including some emanating from some central banks, are saying that low inflation, that is, inflation rates in the vicinity of 2 percent per annum,[1] too often brings about the possibility that interest rates will also remain too low for too long. Indeed, there is a worry that central banks will more frequently face the so-called zero lower bound (ZLB) for nominal interest rates, especially if inflation rates also remain low for long, whether due to secular stagnation or demographic factors. This has not prevented some central banks from breaching this fictitious lower limit, with the result that we are now witnessing several examples of central banks maintaining negative interest rates, with the profession now asking, where is the effective lower bound? As this is written, the resistance to targeting higher inflation rates has been successful, but the topic has not been removed from consideration as one way to reform popular inflation-control regimes currently in place.[2]

Any list of forces making central banking less boring over the past decade would not be complete without mention of the tension between the precrisis consensus about certain truths regarding what drives the transmission mechanism of monetary policy and emerging challenges to these views. These tensions have now spilled over into rethinking how monetary policy interacts not only with the financial sector but with the real economy as well. As a result, as this volume goes to press, we find ourselves facing a new conundrum of sorts. Whereas there was little opposition to reducing central bank policy rates quickly as the effects of the GFC were beginning to be keenly felt,

central banks especially are equally keen to delay a return to more "normal" policy rates for fear of derailing a relatively weak recovery in economic growth. As a result, we are seeing a battle of those who would prefer to "lean against the wind" against the "data-dependent" view that growth beyond capacity together with higher inflation is just what economies need at the moment (e.g., see Svensson 2016; Filardo and Rungcharoenkitkul 2016). In any case, the emergence of macroprudential policies can deal with some of the distortionary consequences of interest rates that are too low for too long even if there is scant evidence that this is the case (e.g., see Lombardi and Siklos 2016 and part V of this volume).

The experience of the last decade is also producing new research that seeks to improve models used in policy analysis not only by explicitly incorporating a nexus between the real and financial sectors but also by allowing for better ways to select among competing models in order to improve the quality of policy advice.

Ordinarily, a *Handbook* is intended to provide a reference of received knowledge in a particular field. If the foregoing interpretation of the state of central banking is reasonably accurate, then the time is surely appropriate to provide an account not only about where we are but, equally important, also where central banking might be headed. In other words, this *Handbook* is more than just a compendium of what central banking can do and has done but is also an attempt to lay out the unanswered questions about existing monetary frameworks. The hope is that readers will obtain a glimpse of the sentiment expressed earlier, namely, that changes are afoot in the role and place of central banks in society.

This book is divided into seven parts with titles that are self-explanatory: Central Bank Governance and Varieties of Independence; Central Bank Financing, Balance-Sheet Management, and Strategy; Central Bank Communication and Expectations Management; Policy Transmission Mechanisms and Operations; The New Age of Central Banking: Managing Micro- and Macroprudential Frameworks; Central Banking and Crisis Management; and Evolution or Revolution in Policy Modeling?

To make clear that the book represents a beginning and not the end of an era in the study of central banks, the following pages provide a summary of some of the key contributions of each chapter along with related ideas and topics that could not be covered in such a vast area of study.

1.2 Part I: Central Bank Governance and Varieties of Independence

Much of the good fortune that allowed central bankers to extol their success at stabilizing inflation, if not relegating business cycles to history, was arguably due to acceptance of the idea that the monetary authority ought to be independent within government and not subject to the kind of political pressure that might lead to exploiting the short-run

trade-off believed to exist between inflation and real economic activity or unemployment. This was accomplished by granting central banks autonomy via legislation, that is, by granting de jure independence or, rather, by appointing a central banker who is relatively more conservative about inflation than politicians concerned about reelection and shielded from political pressure to loosen monetary policy when this undermines the aim of achieving low and stable inflation. By the early 2000s, and in spite of several criticisms that the link between inflation and central bank independence (CBI) was weak, acceptance of CBI as the sine qua non of good institutional structure became common and was no longer widely debated.

Beyond awarding sole authority over the day-to-day operations of central banks, there were two other powerful forces at play during the 1990s and 2000s. Along with autonomy, both central bankers and politicians came to the conclusion that the objectives of monetary policy ought to be clearly and simply stated. Moreover, the lessons from the "great inflation" of the late 1960s through the early 1980s convinced policymakers and the public that low and stable inflation was the best, if not the only, objective that monetary policy should aim for. Armed with theory and empirical evidence, central banks, first in advanced economies and later in emerging-market economies, were assigned a mandate to control inflation. To be sure, there were considerable differences around the world in how explicit this mandate would be, as well as in how accountability for failing to reach an inflation objective would be penalized. Nevertheless, on the eve of the GFC, a significant majority of the global economy would adopt a policy strategy of this kind.

It also became more widely acknowledged that a successful central bank ought to deliberate policy options via a committee structure. Not only would this ensure that diverse opinions could be heard inside the central bank, but in the presence of adequate transparency, it also would reassure the public that the individuals put in charge of monetary policy would be accountable for their decisions. However, the committee structure also raises many challenges. If the committee is too large, decisions risk taking too long; if the members of the committee are too much alike in their thinking about monetary policy, then the much-vaunted diversity necessary to air differing opinions is lost; finally, and depending on how votes are counted and on the manner in which motions are presented, not to mention whether committee members are individually accountable or the committee as a whole must answer for decisions taken, there is always the possibility that free riders or followers of the majority will not be willing to offer the necessary counterweight to the need for diverse thinking inside the committee.

Chapter 2, by Eijffinger, Mahieu, and Raes, wades into the question of what we can learn by analyzing monetary policy committees (MPCs) and how they make decisions. Whereas economists often consider the number of dissenting voters in a committee, the distribution of voting over time given the extant macroeconomic environment, and the information content of policy reaction functions, the chapter argues that there is something to be learned from models (in this case, spatial voting models used in political science) to study votes taken by legislatures or in judicial decisions. Using data from Sweden's Riksbank, Eijffinger, Mahieu, and Raes are able to rank members of its policymaking committee not only according to whether they are hawkish or dovish but

also by when their positions change over time. After all, there is no reason an individual needs to wear the hawkish or dovish label at all times, although this is clearly possible. Moreover, this kind of analysis also permits the creation of categories of central bankers over time according to whether they lean more heavily toward tightening or loosening monetary policy.

Of course, any model, no matter how enlightening it is about the positions taken by individual committee members, must confront the trade-off that inevitably exists between realism and complexity. The same is true of the spatial voting models of the variety used by Eijffinger, Mahieu, and Raes. Their work also underscores how important it is for outsiders to obtain the necessary information not only about how voting is conducted inside committees but also about the content of the deliberations, even if these are finely worded via the publication of minutes of central bank policymaking committees. Sadly, comparatively few central banks make this kind of information available. Indeed, the chapter by Eijffinger, Mahieu, and Raes also highlights the likely pivotal role played by the committee structure (e.g., central bank insiders versus outsiders), the size of the committee which adds complexity to the policymaking process, and the numerous biases and other phenomena (e.g., groupthink, voting order, the precise wording of any motion) that complicate our understanding of the value of committee-based monetary policy decisions (see also Maier 2010). As the authors themselves acknowledge, there is a dearth of comparative analyses as the extant literature tends to adopt the case-study approach. Finally, while an examination of decisions by MPCs is essential, the authors point out that even more can be learned from the successes and failures of committees by contrasting their activities with those that shadow them by providing a second opinion about the appropriate stance of monetary policy (e.g., see Siklos and Neuenkirch 2015).

The contribution by Masciandaro and Romelli, chapter 3, deals with the issue of CBI, reminding us that it is easy to fall into the trap of assigning too much emphasis to de jure independence, not only because de facto independence is more relevant to an assessment of the success of monetary policy but also because de facto independence changes over time, rising and falling as other macroeconomic and institutional factors put pressure on central bank behavior. The authors also go back to first principles by asking what is the state of the art regarding what makes a central bank autonomous. It is clear that CBI need not be sui generis as it is often portrayed in the vast literature on the consequences of providing autonomy to a central bank. Ultimately, a central bank must respond to public opinion, directly or indirectly, and this will affect the effort central bankers exert in delivering the monetary policy that society demands.

CBI, if properly used by central banks, appears to be a persistent phenomenon. That is, once CBI is obtained, it is likely to be maintained over time but will also be significantly influenced by real economic outcomes. For example, variables such as the unemployment rate are more significant, in a statistical sense, in influencing CBI than inflation. Polity also plays an important role in enshrining the role of CBI. In particular, democratic institutions foster more central bank autonomy.

It is, of course, as critics would point out, always difficult to boil complex relationships down to a coefficient, especially when the variables cannot be measured precisely.

Perhaps more important, while there are both good theoretical and empirical reasons to support some form of central bank independence, the concept ought to be elastic enough to permit the monetary and fiscal authorities to coordinate their policies during crisis times. The events surrounding the GFC make clear that monetary policy should support a fiscal expansion intended to cushion the significant contraction that followed the near collapse of the global financial system in 2007. That said, supporters of CBI would point out that an accommodative policy can, in principle, also provide an incentive for the fiscal authorities to delay necessary structural reforms. Indeed, the most serious critics of quantitative easing (QE) would highlight the failure of fiscal policy to take advantage of extraordinarily loose monetary policies to put in place investments that are likely to boost future productivity.

Beyond these questions are a couple of additional complications raised by an analysis of the kind offered by Masciandaro and Romelli. Since most economies are open, how do globalization and exchange-rate regimes enter the picture when thinking about the role of CBI? Since textbook depictions of the differences between fixed and floating exchange rates may not be accurate in a world where trade flows and financial flows operate simultaneously, there is a need to consider these influences more seriously. Next, policy has waxed and waned between being forward-looking, when inflation was under control and inflation objectives were met on average, and a tendency to be backward-looking because central banks were hesitant to remove policy accommodation until there was sufficient data to convince them to change course. How these attitudes toward the setting of the stance of monetary policy interact with how we think about the concept of CBI also needs more research.

Both CBI and the manner in which central bank decisions are delivered raise issues about the governance of central banks. There is, of course, a large literature on corporate governance where, for example, the long-term interests of shareholders play a critical role. However, in chapter 4, Capie and Wood ask who are the shareholders of central banks. The answer is government. However, governments change every few years in a democratic society, and there is really no equivalent at the central banking level of an annual shareholders meeting. Moreover, even if, technically speaking, the government has controlling interest in the shares of the central bank, in spirit it is the public to whom most central banks ultimately feel responsible.

Complicating matters, as Capie and Wood remind us, is that many of the original central banks were private institutions. It is only over a considerable period of time that central banks became the public institutions we know them as today. Hence, the authors suggest that it is useful to draw parallels and lessons from corporate governance for the governance of central banks. The BoE and the Reserve Bank of New Zealand (RBNZ) serve as the case studies. The BoE is one of the oldest institutions of its kind, while the RBNZ is a relatively young institution. More important, perhaps, New Zealand is the archetypical small open economy, while the same is not true of the United Kingdom. Capie and Wood conclude that small open economies, by their nature, need to be flexible since they are subject to numerous external shocks. As a result, in such societies, a premium is placed on protecting the central bank from the vagaries of undue political

interference while demanding that there should be clarity of purpose and an accountable set of objectives.

It is useful, of course, to consider the governance of central banks in relation to models used in the private sector. Nevertheless, whereas private concerns are expected to maximize profits, the objective function of central banks is more complicated and more difficult to observe. It is also the case that legal tradition plays a role. The Anglo-Saxon approach inherent in the histories of the two central banks considered in chapter 4 is not necessarily portable to other parts of the world with different legal traditions. Next, it is commonplace to examine the relationship between the government and the central bank as one where the former is the principal and the latter acts as the agent. However, there are other ways of thinking about these two organizations, for example, through the prism of preferences for inflation versus real economic outcomes, that is, via the belief that political cycles exist. Finally, when private corporations tinker with governance, it is almost exclusively because of an economic imperative. In the realm of central banking, reforms are often prompted by political considerations. Indeed, Capie and Wood recognize that crises play an important role in the evolution of governance structures over time but that how these reforms are implemented is likely also to be influenced by the resilience and transparency of political institutions.

1.3 Part II: Central Bank Financing, Balance-Sheet Management, and Strategy

Before the GFC, it was very difficult to get academics to show any interest in central bank balance sheets. Since then, the ballooning of these balance sheets in the central banks of the main Western countries has become one of the most important issues on the agenda. Part II of this book focuses on its study. Chapter 5 by Reis and chapter 6 by Cukierman cover part of this topic. Cukierman, in particular, explains how the balance-sheet increase emerged initially, as central banks hurried to fill the gap caused by the virtual closure of wholesale markets. Then, as the zero interest bound was reached, central banks expanded their balance sheets further, trying to drive down interest rates farther out along the yield curve and in markets for other financial instruments, as part of a program to try to increase monetary policy's contribution to the recovery of the real economy and to get bank lending restarted in particular.

However, while the history of how central banks got into this territory in the first place is of great interest in its own right, the major current concern is over how this will all develop in the future. How can central banks move to an orderly system where economies are growing, interest rates are back to the levels that were normal in the decades before the GFC, and inflation remains firmly under control? The Bank of Japan (BoJ) and the

European Central Bank (ECB) are still in the expansionary phase, and the BoE is debating whether it has reached the turnaround point. Of the major central banks that expanded their balance sheets in a significant way, only the Federal Reserve has embarked on the process of the return toward some sort of new normality, and that is still rather hesitant and without a clear long run.

It is tempting to argue by analogy that these banks are facing the same sort of problem that homeowners face when they discover rotting timber beams. They must rush around and support the house in the short run, put up scaffolding, remove the rotten timber, determine the causes of the rot, put those right, replace the timber, make other adjustments to strengthen the building, repair the damage, and only then can the supports and the scaffolding be removed in the expectation that the house will survive for the indefinite future, provided it is carefully maintained. However, part of the fear is that the building will never be the same again. Perhaps the supports are still needed; removing the scaffolding may reveal other problems.

It is not a simple matter just to reverse the flow of purchases, nor is there any indication that the rate of reabsorption should be the mirror image of the increase. In the first place, the banking system needs to return to proper stability with greater capital and a confidence that the atmosphere that led to the excesses before the crisis will not return. That will provide an environment for markets to operate normally again and for the central bank to bow out of the system, except for its continuing safety-net role. (At least they have had the opportunity to demonstrate the great strength of that net.) In the second place, monetary policy needs to return toward normality. Over the last decade, the fear has been of deflation, and the ECB's raising of interest rates in 2011 turned out to be premature, to say the least. In the recovery period, inflation will again be the concern. Although all the main countries may be in reasonably similar parts of the cycle, if they act at different times, this has an effect on the exchange rate, which, outside the United States and to an extent the euro area, also has an impact on the inflation rate, as it is an important channel in the inflationary process. Indeed, monetary policy in China is also part of that particular equation. A falling exchange rate in a period of slack demand does not have its usual inflationary impact and is therefore not such an unattractive policy and indeed leads to competitive downward pressure, as was experienced in the 1930s after the 1929 crash.

A third complication is the distortions in behavior that the unusual period of low interest rates and quantitative expansion has led to. The most obvious example is the recovery in real estate prices and other asset prices, which are now back to historically high levels and ratios in many countries. Unsustainably high asset prices were an important part of the sharp downturn in the GFC. Central banks are, not surprisingly, cautious about triggering another cycle of financial difficulty just as their economies appear to be exiting from the last one. Indeed, the most critical judgment of the consequences of QE and very low interest rates comes from Schnabl (in chapter 19), who sees them as sowing the seeds for increasing instability, not as solving the problems of the past.

For this reason, Cukierman, in chapter 6, puts all of the issues together, including these macroprudential concerns. Central banks and other macroprudential authorities

have sought to drive a wedge between general inflation in the consumer price level and inflation in asset prices, especially real estate, by using tools that impact sectoral lending and borrowing. Such concerns are not unique to central banks that have encountered the ZLB. Even in Australia and New Zealand, where interest rates have been low but not extreme, house prices have taken off, and by some counts, the Auckland housing market has shown the greatest tension in terms of debt-to-income ratios. In that case, a raft of constraints, limiting investment from overseas, restricting loan-to-value ratios, and increasing capital requirements, do appear to have cooled the market. Although experience elsewhere, such as in Hong Kong, suggests that such periods of cooling may still be temporary if the underlying constraints on supply from the availability of building land and the pressure on demand from immigration continue.

The nature of the balancing act in trying to return to normality without causing worse problems is therefore considerable. Indeed, there is a fourth concern that relates more directly to the management of the central bank's balance sheet, namely, that as interest rates rise, asset prices will fall and central banks could realize losses if they sell assets below purchase cost.

In one sense, this can be avoided if assets are held to maturity and central banks manipulate the term structure of their holdings appropriately so that they can still sell enough assets to absorb the required amount of liquidity from the financial system and banks in particular.

Reis also looks at the economy-wide concerns in chapter 5 but from a different perspective. He notes that in QE, the central bank is in effect assisting fiscal policy. On the one hand, the state is seeking to expand the economy in the post-GFC downturn by running large deficits and raising substantial new debt to finance them. The central bank, on the other hand, is buying this debt on secondary markets and giving financial institutions the resources to buy further new debt, when it is issued, with the resulting proceeds. This sounds like an unbelievable money machine, and at some point, the process does have to come to an end before the system explodes. Central banks can become insolvent when they go beyond the point where the state can borrow the money to bail them out. In the meantime, however, as both Reis and Cukierman point out, the central bank could, in effect, issue helicopter money, as in a depressed environment the inflationary consequences are not apparent. However, here, too, there is a limit to how much the printing press can be used before confidence is lost and hyperinflation ensues. In any case, giving money directly to people would be a highly politicized decision and not something a central bank would do without the direct encouragement of the government.

Reis takes the issues a step further by considering the extent to which the central bank can redistribute resources within a financial area, as the ECB has done since the sovereign debt crisis struck in 2010. Clearly, simply redistributing seigniorage dividends in a manner different from the capital key is not going to be politically possible, but in 2014, the ECB did agree to pay back to Greece the extra revenue it was earning from holding high-interest Greek government debt. It is perhaps more interesting to look at how the ECB has effectively been able to redistribute through emergency liquidity assistance to

the Greek banking system and through allowing major imbalances to build up in the TARGET2 system. The ECB has thus been able to push the envelope quite considerably beyond simply buying securities in secondary markets, and with the option to undertake "outright monetary transactions," it can do so further.

Central banks have not reached the end of what they could do with their balance sheet to assist monetary policy and economic recovery. For example, while forward guidance is normally used simply to indicate what expected economic outcomes would imply for the setting of monetary policy under prevailing policy, it could be used to indicate that central banks will permit higher inflation for a while in the interests of recovery.

A more drastic move discussed by Cukierman is to alter the role of cash so that effectively it can also attract a negative interest rate to drive down the short-run base of the entire system. At one extreme, the central bank could simply end the use of notes and coins except for trivial transactions and replace them with a digital equivalent whose value can fall. At the other extreme, notes could be dated so that they have to be exchanged at regular intervals or see their value fall. Either way around this seems to be in the realm of the theoretically possible rather than the politically likely. However, as we discuss later in this chapter, the introduction of digital currency (without any implication that its value might be written down) is a much more reasonable possibility into which a lot of practical research is being undertaken at present. Other theoretically possible changes in the role of the central bank are also discussed by Cukierman, such as the introduction of some version of the Chicago Plan where commercial banks have a 100 percent reserve requirement. But unwinding at least some of the central banks' unusual balance-sheet position derived from the GFC seems more likely than further steps into more extreme territory.

Ultimately, the concern for both Reis and Cukierman is that the deeper the involvement with semifiscal issues, the more likely it is that the independence of the central bank will be compromised. On the one hand, the solvency of the bank may become an issue with its expanded balance sheet, while on the other, the fiscal authority is so stretched that it might feel it needs to constrain the central bank's shrinkage of its balance sheet in the interests of its own stability. As Cukierman points out, with the expanding role of the central bank in the field of financial stability and macroprudential policy, it increasingly needs to be closely involved with the other main public sector actors, particularly the ministry of finance.

Chapter 7, by Thornton, is a longer-term review of monetary policy strategies over the last one hundred years or so and hence is somewhat separate from the others, except insofar as it also obviously covers the balance-sheet expansions of recent years. It provides a very interesting history of the debate about how monetary policy can affect inflation and aggregate output in the economy, where new ideas have emerged as existing theories appeared to be contradicted by actual behavior, with the insights of John Maynard Keynes and William Phillips being interesting examples. A second level of debate has been over which transmission mechanisms are leading to the effect. To some extent, the experience may well have been that a change in policy led to a change in behavior. Goodhart's law is a helpful case in point; as soon as money targeting became

popular in the 1980s, what appeared to have been a stable money demand relationship evaporated, leading to the adoption of inflation targeting with a much more pragmatic approach to the relationships but with a firm emphasis on looking forward rather than correcting previous errors. As Gerald Bouey, governor of the Bank of Canada, put it in 1982, "we did not abandon a monetary target, it abandoned us" (Crow 2013, 40).

The general philosophy behind inflation targeting is very simple: if inflation looks as if it is going to rise above acceptable levels, you should tighten monetary policy, and similarly, if it looks as if it is going to fall, you should loosen. However, there has been considerable debate and very extensive modeling effort to try to make policy more accurate. In chapter 7, Thornton contrasts interest-rate targeting with money targeting and forward guidance, and it is this last that links his work very firmly with the other two chapters in this part of the book. He is critical of forward guidance not simply because it is state contingent, which means that it is still difficult for people to form a view of what will happen in the future, but also because much of its rationale depends on how expectations of the term structure of interest rates are formed. He then goes on to contrast inflation targeting with nominal income targeting and QE, again providing a link with the two earlier chapters.

As with forward guidance, Thornton is very critical of QE and memorably remarks that "Bernanke (2014) quipped that 'the problem with QE is that it works in practice but doesn't work in theory.' The problem, of course, is that if it doesn't work in theory, it won't work in practice, either." As a result, Thornton's conclusion about the appropriate monetary policy strategy is rather negative. Thus far, all models are too simplistic to explain what the optimal reaction should be, and hence central banks tend to take a rather pragmatic approach. While QE and forward guidance may be the latest policies, it is clear from Thornton's conclusion that he expects the lessons of time will be rather negative in their regard as well.

1.4 Part III: Central Bank Communication and Expectations Management

Whereas in the 1970s and 1980s it was considered that monetary policy is most effective when it is as opaque as possible, attitudes have certainly changed in recent decades. Nowadays, it appears that central bankers can hardly be too transparent and too open in order to be successful. Exemplary in this context are two quotes from Alan Greenspan and Ben Bernanke. While speaking to a Senate committee in 1987, Greenspan stated, "Since becoming a central banker, I have learned to mumble with great incoherence. If I seem unduly clear to you, you must have misunderstood what I said."[3] Whereas to Greenspan obfuscation was key, the opposite holds for his successor, Bernanke: "As a general matter, the more guidance the central bank can provide the public about how

policy is likely to evolve (or about the principles on which policy decisions will be based), the greater the chance that market participants will make appropriate inferences—and thus the greater the probability that long-term interest rates will move in a manner consistent with the outlook and objectives of the monetary policy committee."[4]

As these quotes indicate, the transition toward more, transparent communication set in well before the GFC. Nevertheless, the latter did change communication policies of most central banks significantly. The three chapters in this part of the book look into today's role of central bank communication and transparency in the conduct of monetary policy. Chapter 8 gives a survey of the different ways in which central banks communicate nowadays and how successful they have been. Subsequently, chapter 9 provides a more in-depth analysis regarding one particular communication channel of the US Federal Reserve, the Federal Open Market Committee (FOMC) postmeeting statements. Chapter 10 is devoted to measuring and comparing the degree of transparency of central banks around the world.

As argued by de Haan and Sturm in chapter 8, central banks communicate in different dimensions to the public. It can be on the objectives of monetary policy, on strategy and the decision-making process, on (upcoming) macroeconomic conditions, or on actual or future policy decisions. Openness on each of these dimensions can be translated into degrees of transparency. In line with this, Dincer, Eichengreen, and Geraats distinguish in chapter 10 among political, operational, procedural, economic, and policy transparency.

Although the increased independence of central banks all around the world has been a clear driver of higher accountability standards and thereby increased reporting on and openness of objectives, strategies, and procedural aspects, in practice most of the interest rests on transparency and communication directly related to active and future monetary policy and the underlying economic motivation thereof. As indicated by the above quote from Bernanke, this kind of communication is expected to make monetary policy more effective and has, according to many, turned into a separate instrument of central banks to reach their objectives. Besides almost directly controlling short-term interest rates through, for example, short-term open market operations, communication can influence expectations about future short-term interest rates, thereby affecting long-term interest rates. This instrument gains in value especially when facing the effective lower bound of short-term interest rates, where traditional tools become ineffective.

This so-called forward guidance comes in different shapes and forms, and de Haan and Sturm discuss their pros and cons. Although the academic-oriented literature suggests that it would be most effective if central banks would commit, this is not what is actually observed. Although clear statements about the future policy path are likely to have a stronger impact than more cautious ones, a central bank fears a loss in credibility when changes in economic conditions force it to deviate from such an announced path. Furthermore, history has shown that it is very difficult, if not impossible, to formulate waterproof state contingency. Nevertheless, there is general agreement that forward guidance did and does have a substantial effect on interest-rate expectations.

Furthermore, it plays an important role in UMP instruments that have been introduced during and after the GFC also to alleviate reaching the effective lower bound. Through the so-called signaling channel, in which the central bank usually communicates about their size and duration, the effectiveness of these asset purchase programs is boosted. Without proper communication, the stimulating impact of such programs might be offset by expectations of higher policy rates.

A final broad topic discussed in chapter 8 is the management of inflation expectations. Communication helps to anchor inflation expectations and in that way supports changes in nominal short-term interest rates to reflect changes in real rates. This allows the economy to return to its long-run path faster. Whereas studies using inflation forecasts in general find that explicit inflation targets do help anchor inflation expectations, studies focusing on the general public's knowledge of central bank objectives and firms' and households' inflation expectations come to more sobering conclusions.

Chapter 9, by Davis and Wynne, zooms in on communication of the US FOMC. Over recent decades, the FOMC has stepped up communication substantially. For instance, in 1994, it started to release statements immediately after a policy meeting in which policy rates were changed. Since 1999, these statements have been issued after every scheduled meeting. In December 2004, the release of the minutes of these meetings was moved forward and now occurs three weeks after the meetings to which they refer. Following other major central banks, the chairman nowadays holds press conferences at regular intervals. Furthermore, members of the Federal Reserve Board of Governors and the individual Federal Reserve Bank presidents now release their economic forecasts four times a year as part of a regular Survey of Economic Projections.

Davis and Wynne concentrate on the FOMC postmeeting statements and document how these have become longer, more detailed, and more complex over time. Whereas in the early years these statements only contained a vague description of the policy actions of the Federal Reserve, they nowadays contain an assessment of the economy, a balance of risks, a forecast, and what sometimes can be interpreted as commitments on future policy actions. In that sense, these statements have turned into a policy instrument affecting expectations and thereby financial markets. To test the latter, the authors use daily financial market data and estimate a daily time series of US monetary policy shocks. They also characterize some of the linguistic features of these statements and show that these features correlate with the identified monetary policy shocks. Especially during the period in which the federal funds rate reached its effective lower bound (December 2008–December 2015), the absolute size of the monetary policy shocks increased on statement days and are a function of the length and the complexity of the FOMC statements. When controlling for the actual policy change, a similar relationship is also shown to exist for the period before that: the impacts of the FOMC's policy statements have increased as they got longer and more complex.

Chapter 10 broadens the scope again and looks at transparency in the world. Transparency is a commitment device disciplining central banks in their communication. It serves as a mechanism for accountability, a necessary condition for central bank independency. It forces independent central bankers to explain how their actions are

consistent with their mandates. It thereby enhances the credibility of the central bank and increases the effectiveness of the policy decisions made.

Dincer, Eichengreen, and Geraats's main contribution is producing and publishing a new transparency index covering a panel of 112 central banks for the years 1998 through 2015. The new index combines and extends the work of Eijffinger and Geraats (2006) and Dincer and Eichengreen (2008, 2014) by being more granular and thereby more focused while capturing developments in the postcrisis world. As mentioned earlier, it distinguishes among the political, economic, procedural, policy, and operational dimensions of transparency. As the new data show, central banks vary substantially across these different dimensions. From the point of view of the central bank's ability to effectively pursue its mandate, it is important to understand to what extent and in what respects more transparency along these different dimensions is always and everywhere beneficial.

The chapter focuses on procedural and policy transparency. Regarding the first, a key aspect is the release of voting records and minutes without undue delay. Its desirability is discussed. With respect to policy transparency, the chapter analyzes its evolution in the wake of central banks' postcrisis experiments with unconventional policy measures and forward guidance. During the eighteen years covered, the index reveals a rise in monetary policy transparency throughout the world, irrespective of the level of economic development of the country and the monetary policy framework of its central bank. This trend has weakened in the wake of the GFC. With policy rates near the effective lower bound, the use of forward guidance, on the other hand, has increased substantially. Central bank communication can be fraught by complications. This may be part of the explanation for why the trend toward greater transparency has slowed rather than accelerated following the crisis. The chapter presents some case studies illustrating that attempts to increase openness can be taken too far.

Although these three chapters are able to cover a lot of relevant material and arguably the core of topics related to central bank communication, gaps remain. They do not deal with discussions about how to translate the language of central bankers appropriately so as to be able to use it in empirical analyses. Text analysis is a rich and vastly expanding research area. More in-depth analyses on other major central banks and/or different forms of communication would also have been a natural way to extend this part of the book. Another example of a natural way to extend this part is to realize that since the GFC, central banks have moved away from institutions mainly concentrating on price or inflation stability toward those in which financial stability has become another key task. Although the complications for communication strategies that accrue are touched on in chapter 8, a more detailed analysis on its (future) consequences also for policy transparency would certainly have been insightful. Finally, although all three chapters ultimately are interested in how central banks influence expectations, each takes the expectation formation process for granted. The role of the media in this transmission process and how individuals form their expectations are largely still open questions.

1.5 Part IV: Policy Transmission Mechanisms and Operations

Having instruments to carry out monetary policy requires knowledge of how these instruments affect the working of the economy. Economic theory distinguishes many different transmission channels. This part of the book is not intended as an overview but rather as a discussion of some of these transmission channels or ways in which monetary policy operates in practice—also in light of the GFC. From today's perspective, it looks very much as if this crisis has also had a lasting impact on the ways monetary policy actions are transmitted into the economy. This part consists of four chapters, highlighting such aspects in different ways and from different angles.

Not only does the real estate sector play an important role in most financial and economic crises, but it is also the sector through which most of the commonly distinguished transmission channels work. Arguably, no other sector is more sensitive to changes in interest rates or balance sheets. That said, cycles observed in construction are often not in sync with macroeconomic cycles—a reason it might not always be straightforward for central banks to meet the objectives of monetary and financial stability simultaneously. Although this is increasingly recognized by policymakers, this new stylized fact has not yet been fully digested and incorporated by economic research.

Chapter 11, by Sinclair, deals with these and related issues by setting up a small model that links house prices and quantities using stock-flow concepts, and explores how these variables are shaped over time. In that setup, it looks at how monetary and financial variables interact with the construction sector and analyzes what role the government should play to keep the financial system stable. Land and real estate are notoriously immobile, but bubbles created in this market are foremost national problems that need national solutions. Macroprudential instruments, such as ceilings on loan-to-value ratios for lending on real estate, maximum mortgage durations, and refined minimum capital ratios on banks, can all help to prevent bubble formation in real estate markets and thereby financial instability. Allowing flexibility in these instruments might circumvent potential conflicts with monetary stability objectives. Looking at it from this angle, Sinclair recognizes that what is nowadays often labeled the financial cycle might differ substantially from the regular business cycle, thereby strengthening the case of viewing macroprudential policy as providing a necessary set of additional instruments to cope with the ever-increasing complexity of the world. What is not discussed and therefore left for future research is the role of demographics and the impact of secular stagnation on real interest rates and housing prices.

Gambacorta and Mizen focus in chapter 12 on the most traditional of all transmission channels, the interest-rate channel. After summarizing its theoretical foundations, the chapter reviews the literature on the pass-through of policy into lending and deposit rates. It is thereby realized that the environment has turned more complex since the GFC and not only that other channels specific to the banking system impinge on

this traditional transmission channel but also that the necessity to look into the different funding sources to understand the cost of bank funding has become more important. The so-called bank lending channel and the bank capital channel are discussed from this angle, as is the influence communication has on expectations about policy rates. Although the chapter also considers forward guidance, it does not go into issues related to the effective lower bound and whether there is a difference in this respect between policy and retail rates.

Despite concerns about a weakening of monetary transmission, most research still points toward a strong and robust relationship between policy and retail rates. The role played by lending standards in determining the strength or weakness of the interest-rate channel is potentially important but it not touched on in this chapter. Further and future institutional changes, for instance, along this dimension, will likely continue to alter the banking system and thereby influence the transmission process of monetary policy. The chapter argues that this is perhaps most evident in Europe, where the emerging banking union will trigger more cross-border banking competition.

Digging deeper into the interest-rate transmission channel, chapter 13, by Fuerst and Mau, deals with the term premium, its variability, and the role monetary policy plays in this. The effective lower bound on short-term policy rates triggered the introduction of new instruments aimed at directly affecting returns on long-term bonds and thereby the term premium. In an environment in which balance sheets of many major central banks are likely to remain large for a long time, the question emerges of to what extent the term premium should remain an input, or even target, for monetary policymakers. To answer this, Fuerst and Mau use a dynamic stochastic general equilibrium (DSGE) model in which either Epstein-Zin (1989) preferences separate risk aversion from intertemporal substitution elasticities or—following Carlstrom et al (2015)—asset markets are segmented such that short and long bonds are priced by different (constrained) agents. Whereas in the first case, the term premium should not directly concern policymakers, in the second one, there is a clear role for monetary policy to smooth fluctuations in the term premium. The latter model can be calibrated such that it matches the empirical mean and variability in the term premium. This does not appear possible when using the first model. The authors therefore conclude that there are significant welfare gains to a central bank smoothing the term premium. Long-term bond yields can be decomposed into average expected future short rates and term premiums. Taking the conclusions of this chapter at face value requires policymakers to distinguish between these different components in order to measure the not directly observable term premium. As with discussions involving potential growth and the non-accelerating inflation rate of unemployment (NAIRU), this is likely to pose policy issues that require further research.

In chapter 14, Toporowski looks into the buying and selling of financial assets by the central bank as a way to implement monetary policy. He first takes a historical perspective and documents the use of open market operations as an alternative to interest-rate policy when that policy cannot be used and as a supplement to such policy when it appears to be ineffective. In the modern world, the chapter argues, it is important to

distinguish between reverse purchase (or sale) agreements and "outright" purchases (or sales) of securities. Whereas the former agreements have the attraction that they allow central banks to inject (or withdraw) liquidity over a fixed time horizon, without committing to provide such reserves in the future and thereby potentially removing incentives to sound bank management, they ceased to have enough of an impact after the GFC. This caused a dramatic switch to outright purchases. Whereas prices at or near the bottom of the market have allowed central banks to earn capital gains, they also—given the thin capital base central banks work with—substantially increased the risks in their balance sheets. It is furthermore argued that the effectiveness of open market operations depends not only on the state of the economy but also on the complexity and liquidity of the financial system.

1.6 Part V: The New Age of Central Banking: Managing Micro- and Macroprudential Frameworks

Perhaps nothing symbolizes the changes in central banking since 2007 better than the recognition that micro- and macroprudential concerns are not easily separable. The veritable explosion of academic work over the past decade has at least provided the necessary ingredients to equip policymakers with the "known knowns" as well as the "unknown unknowns," to use the expression made famous by former US defense secretary Donald Rumsfeld. This much becomes clear after reading the four chapters in this part. Nevertheless, several complications arise in the "new era" of central banking that policy or the profession have not yet fully grasped. First, there is some vague acknowledgment that monetary and financial stability go hand in hand. However, while there used to be widespread agreement about what constitutes good conduct in monetary policy, there was and continues to be a lack of clarity about what constitutes financial stability. About the best that can be said is that when it comes to financial stability, we know it when we see it.

Adding to the difficulties is that monetary policy involves, for the most part, monitoring easily observed policy instruments such as an interest rate, as is the case with the main objective of monetary policy, namely, a form of price stability.[5] In contrast, measuring the quality and effectiveness of micro- and macroprudential regulations and policies is proving to be exceedingly difficult and subject to a number of different interpretations (e.g., see Barth, Caprio, and Levine 2013; Lombardi and Siklos 2016; and references therein). Second, before the crisis, there was some consensus about the desirability of assigning micro- and macroprudential authority to separate institutions even if some coordinating mechanism would be required to ensure that the objective of financial stability is met. While the capacity of a particular country to support several institutions is one determinant, the notion that a central bank may be open to a moral

hazard type of dilemma by becoming responsible for supervising and regulating banks as well as being accountable for macroprudential objectives led several countries to assign the relevant responsibilities to separate institutions.

It was never made clear by governments that devised such arrangements whether these institutions would be equal or whether the central bank was first among equals, especially since many central banks (e.g., the US Federal Reserve) were born out of a need to maintain some form of financial system stability. Moreover, it was often more of a hope and a prayer that separate micro- and macroprudential regulators would cooperate in, if not coordinate, their responses when crisis conditions emerged. The experience of the former Financial Services Authority (FSA) vis-à-vis the BoE is likely the case study par excellence of the failure of two critical institutions to operate in tandem in a time of need.

Davis, in chapter 15, considers the broad sweep of financial regulation and supervision and the role of the central bank over time and across several economies. He concludes that the wheel has turned so that, like the proverbial pendulum, we are "back to the future" (Masciandaro 2012). This means that what was long ago thought of as the core function of a central bank, namely, the maintenance of financial system stability, lost during an era when not only could monetary policy assist with ensuring calm financial conditions but deregulation also was believed to lead to economic salvation, is now being returned to the portfolio of responsibilities that central banks acquired in the aftermath of the GFC. It comes as no surprise, as Orphanides (2013) and others (e.g., Siklos 2017) have pointed out, that central banks risk being overburdened. While some are willing to see the return of responsibility for financial stability as almost natural, given the historical origins of many central banks, others highlight the increased complexity of financial systems and the growth of government as two factors that ought to make policymakers wary of making central banks even more powerful than they currently are. Even if we accept that central banks should be given more responsibilities, the difficult choice of deciding how much relative weight to put on monetary stability versus financial stability has yet to be addressed. Moreover, if the public is unable to observe how much emphasis a central bank places on one set of responsibilities over another, then much of the progress in central bank transparency and accountability may well be lost.

Taylor, Arner, and Gibson begin chapter 16 by arguing that the emphasis in central banking toward the maintenance of price stability meant that monetary authorities around the world effectively shied away from worrying about financial stability, which, according to a former central banker, is part of the "genetic code" of central banks. Supported by economic theory, this created conditions that were ripe for a large financial crisis. Focusing on governance arrangements among large systemically important economies (the United States, the United Kingdom, and the euro area), the authors consider how the GFC changed institutional arrangements leading to a much greater emphasis on the control of systemic risks. Their tour d'horizon tends to find favor with the so-called single-peak arrangement (see Haldane 2009) of the BoE wherein separate but largely equal bodies are responsible for both monetary and financial stability policies

but are housed under one roof. In contrast, recent reforms in the United States have resisted giving the Fed sole responsibility over financial stability, while the euro area's response is not only a work in progress but, as this is written, resembles a hybrid of the US and UK responses to the GFC. Nevertheless, it may be somewhat of an exaggeration to conclude, as the authors seem to suggest, that a "new macroprudential consensus" has been reached as none of the current systems has been tested by a financial crisis.

Llewellyn, in chapter 17, makes two interesting observations. First, regardless of one's assessment of the effectiveness of regulatory changes since the GFC, they amount to substantial changes of an order that we have not seen for decades. Second, policymakers have woken up to a recognition that reducing bank failures is not a sufficient end in itself for financial regulation. It is equally, if not more, important to minimize the social costs of financial instability. Indeed, the chapter goes on to explain how the previous focus on bank failures is incapable of being met without proper recognition of the social aspects of financial regulation. In other words, regulation cannot be exogenously determined without considering the process by which it is enforced. Indeed, over and above these elements, policymakers, regulators, and supervisors have paid insufficient attention to the "culture" of banks, and this is an aspect that also contributes to the endogeneity of bank regulatory structures observed globally. It is clearly essential to recognize that the scope and structure of regulation of the financial system are not independent of other institutional arrangements in different financial systems. Nevertheless, beyond corporate culture, there is also political culture to consider, and it is unclear how the nexus between the two complicates recommendations for regulations intended to mitigate the likelihood of future financial crises. All of the problems highlighted by Llewellyn are otherwise known as leading to the problem of regulatory arbitrage, and as the chapter suggests, we simply do not have a comprehensive set of tools and policies to mitigate attempts to exploit the financial system that contribute to creating conditions for the next financial crisis. There is an urgent need to develop a strategy. As in other areas, a successful strategy will have to be calibrated so that it recognizes country-specific factors.

Dwyer's chapter 18 moves away from solely considering the institutional consequences of the shift toward greater emphasis on financial stability through macroprudential regulation to also ask, through the lens of macroeconomic consequences, whether there are good grounds for thinking that existing macroprudential regulations will be successful. The chapter reviews what we know, including several historical lessons, and concludes that emerging regulatory regimes are built on shaky foundations. Dwyer reminds us not only that there is a fallacy in believing that there exists a perfect regulatory structure designed by government that can prevent the worst effects of a financial crisis, something that economists have known for decades, but also that the "time inconsistency" that plagues monetary policy exists in a fashion when macroprudential policies are examined. In other words, it is not enough to design a macroprudential policy strategy. Instead, a successful policy aimed at maintaining financial system stability must also provide the right incentives so that regulators and policymakers can maximize the likelihood that the best solutions are adopted. Throwing cold water on the ability of existing

macroprudential strategies to prevent the next financial crisis is possibly a valid conclusion. The harder task, left out of the existing literature, is to find concrete solutions to the incentive compatibility problem highlighted in Dwyer's contribution. Moreover, designing clear rules of conduct for macroprudential regulation is clearly important, but there is an equally critical need to acknowledge and build in escape clauses and directives so that the scope for discretion is understood by all. This is perhaps as important as the design of incentives that Dwyer emphasizes, as Tucker (2016) has emphasized (see also Siklos 2017).

1.7 Part VI: Central Banking and Crisis Management

Before the GFC, most of the major central banks were largely content with the crisis-management arrangements they had in place. However, once the crisis struck, it became clear that all of the regimes in place had difficulties, many of them catastrophical. There has therefore been a dramatic flurry of activity over the ensuing decade to try to improve such systems, which is yet to be completed. Even without any new measures, the existing changes will not be fully implemented until the mid-2020s.

The principles of good crisis management were well known before the GFC, but fortunately, most schemes had not been vigorously tested. The United States, for example, had had to handle many individual bank failures, including a major concentration of them in the savings and loan crisis of 1986–1995, which led to the improvement in systems, in particular through the Federal Deposit Insurance Corporation Improvement Act of 1991. But these were failures of more than one thousand small institutions, and even though in total the losses were considerable at $160 billion, they were not sufficient to result in a recession. The Nordic crises of 1989–1993 and the Asian crisis of 1997 were, however, rather more dramatic and resulted in significant changes. Nevertheless, part of the reason for the catastrophic nature of the GFC is that on the one hand, the Nordic countries actually managed to handle their crises rather well, while on the other, the Asian countries have made themselves far less vulnerable to the problem in the first place. This provided the opportunity for central banks to be at worst complacent and at best overconfident about their ability to handle any new crisis.

The story told in the three chapters of this part of the book, therefore, only begins in the 1980s.

In chapter 19, Schnabl explains the evolution of central bank crisis management of the period by reference to Austrian business cycle theory. He shows that the approach has been asymmetric and as a result has increased instability. Mayes, on the other hand, looks in chapter 20 at the lessons learned over the period and how they are being implemented, before making a critical appraisal of how they might work in the future. Honohan, Lombardi, and St. Amand's chapter 21 takes a more prescriptive approach and

sets out not just what is being done but also what needs to be done in the light of experience to ensure a well-run system.

Crisis management is inherently asymmetric. Although planned for, it is only actuated when needed or thought likely to be needed. In good times, central banks focus on crisis avoidance, although both the system and individual institutions must be structured so as to make efficient crisis management possible. There is some degree of symmetry in macroprudential measures in that they are strengthened as the economy expands and builds up pressures but are released in the downturn. However, that symmetry is somewhat limited. It is rather like the principles behind the "Greenspan standard," whereby monetary policy leans against the wind as the economy grows faster but not to the full extent of the inflationary threat, because the authorities can respond very vigorously when the bubble bursts and (it was thought) avoid a recession. The reasons for not intervening fully on the upside were twofold. First, it might very well be that there had been technical or other innovations that permitted a higher noninflationary growth rate, and it would be a really bad idea to nip that growth in the bud and prevent it from emerging. Second, if the central bank pulled the plug, even where warranted, the blame for causing the downside would fall on it. If some other event intervened, then the bank would only be responding to the pressures and hence largely avoiding the responsibility.

Schnabl interprets crises entirely in the framework of monetary (mis)management and views the Greenspan standard approach, which he regards as a general characterization of monetary policy over the last thirty to forty years, not just something relating to the United States, as a progressive deviation from a sustainable policy. It is not so much that the low inflation environment that has prevailed, with its apparent stability, has driven equilibrium real interest rates down but that the asymmetric policy is destabilizing. These outcomes are particularly strong in the post-GFC era but also acted as a fundamental cause of the crisis itself in the early 2000s. The excessively low interest-rate regime is cemented by a perception that sustainable growth rates in the economy have fallen, leading people to believe that they represent a lower equilibrium rather than the conditions for the next destabilizing financial cycle. The cycle Schnabl describes has both real, money and credit-driven components. Thus, there is both excessive investment and a boom in credit and asset prices generated by the excessively low interest rates.

What makes the whole of this process worse is that deregulation of the financial system internally allows the cyclical process to be more dynamic and removing financial barriers internationally increases its contagion around the world in what Schnabl calls "wandering bubbles." One country's low rates cause its exchange rate to fall and gives it a competitive advantage, which leads other countries to respond. This cycle can be seen clearly in the 1980s, beginning with the Japanese both in the run-up to their crisis and in the response to it.

Schnabl's chapter feeds through to the other two chapters in this part of the book when he refers to the behavior of the supervisory authorities once banks get into trouble. The banks themselves will be faced by a build-up of nonperforming loans in the crisis. The obvious response is to try to build a bridge over the initial period of difficulty by

advancing more to the distressed borrowers so they can service what they have already borrowed. This contributes to the asymmetry of the cycle, as does the next step of bailing out the banks to stop them from failing and worsening the credit crunch. Thus, little action is taken in the upturn to moderate the excesses, while vigorous action is taken in the downturn to avoid the consequences of those excesses being realized. It thereby sets the grounds for a progressive amplification of these cycles and at the same time encourages the decline in trend productivity because the inefficient are kept in business. Schnabl's view of the future is doubly pessimistic. Indeed, the perspective is even worse, as this asymmetry contributes to increasing inequality, favoring those who can acquire assets that benefit from the approach and harming those who suffer from the slower growth and lower and more precarious incomes. The consequences are reflected in higher debt ratios all around, for countries and for households, both of which will push the system closer to unsustainability and collapse, assisted by growing debt service ratios. As Honohan, Lombardi, and St. Amand put it, "Overzealous crisis management can unwittingly sow the seeds of the next crisis."

The other two chapters are generally more optimistic in tone, although neither suggests that it is possible to get to some nirvana without the cycles and crises. They focus in particular on the lessons learned as a result of the GFC. The most important is that the authorities have to be able to handle problems in failing institutions promptly and at low cost without a simple taxpayer bailout. Moreover, that ability to handle the problem—to the detriment of the existing owners, management, and creditors of the institution—needs to be thoroughly credible. In that way, owners and managers should want to run their businesses more prudently, but if danger threatens, they will want to make sure they can organize a private-sector solution that maximizes the value for them and increases the chances of retaining their jobs.

The asymmetry of the process is clear. Action when a bank fails cannot be avoided, but in allowing pressures to build up and in intervening early to head off more serious problems, there is a choice, and the tendency in the past has been toward forbearance. Even with compulsory early intervention and prompt corrective action in the United States, problems have been allowed to mount, and the adverse signals have been disregarded. Indeed, as Mayes points out, crises normally occur because collectively people talk themselves out of the need to act (part of the "this time is different" syndrome highlighted by Reinhart and Rogoff 2009). Honohan, Lombardi, and St. Amand argue cogently against the dangers of "groupthink" that ostracizes those who try to question the general feeling. The system therefore always has to be able to cope with missed opportunities and unexpected shocks. As they put it, "In short, what is needed for good central bank crisis management is preparedness and a willingness to take quick and decisive action."

If anything, there is a tendency to spend too much effort on problem avoidance, because the costs of a crisis are so high that even small chances of reducing their occurrence comes out well in cost-benefit analysis. However, the costs of crises are only borne if they occur, but the costs of the avoidance measures are borne all the time—even if there is nothing to avoid. Using macroprudential tools will help in limiting asset price

bubbles and credit expansions. The capital and liquidity buffers currently in the process of implementation are intended to be large enough that the systemically important banks in the global financial system would not become insolvent in the face of shocks of the size experienced in the GFC. As a result, attention has now passed to the process of recapitalization, which is to be achieved by "bailing in" the creditors. Large institutions cannot be allowed to stop working, or they risk bringing the whole of the rest of the financial system down with them because of their degree of interconnection. The resolution method therefore needs to be able to remove the owners and senior management and recapitalize the institution while it continues to function.

Although a longtime advocate of bailing in, from the times before the term had been coined, Mayes is cautious about whether it can be used in all circumstances and, indeed, whether such an ability makes crises more or less likely. If the threat of a bail-in panics holders of such instruments in all banks and not just those in trouble, then it could trigger a market crisis of its own. Much of the debate in practice is going to be over who will be bailed in. As has already been seen in the case of Italy, in 2016, the government preferred to use a preventive bailing out of Banca Monte dei Paschi di Siena rather than let retail holders of bonds be bailed in. Similarly, in the cases of Veneto Banca and Banca Popolare di Vicenza, in 2017, where the same technique could not be used as the ECB had determined the banks had failed, it preferred to inject taxpayer funding into the resolution of these two banks rather than let such bondholders bear the losses. The list of who can be bailed in without severe wider consequences worse than having a bailout may not be long enough.

However, the main point that Mayes addresses in chapter 20 is that despite the advances being made in resolution tools, coordination among the authorities, and macroprudential preparedness, the tools and responsibilities are primarily national, while the major financial institutions in the world being regulated are international. At worst, a national authority on its own does not have the resources or the powers to handle a major insolvency without a disorderly resolution, as illustrated by Iceland and Cyprus, among others. At best, the problem is that the authorities in the various countries, although willing, are unable to cooperate sufficiently and fast enough to address the problem in time. Hence, the favored international solutions have tended to go for either putting the responsibility on the home country of the institution for solving the entire problem itself (labeled single point of entry) or making sure that each country is able to solve the problems in its own jurisdiction irrespective of the degree of cooperation from the other (multiple point of entry). Australia and New Zealand have followed that route, while the United States and the United Kingdom have chosen the single point of entry. As with all recovery and resolution plans, they are only plans and can only be tested in artificial circumstances.

Despite these differences of opinion, Honohan, Lombardi, and St. Amand point out that a considerable "transnational epistemic community" has been established which has agreed on the principles of how the problems should be resolved. The Bank for International Settlements (BIS) and the Financial Stability Board (FSB) have been the major forums for these agreements.

A clear theme that runs through the changes since the GFC broke out is that in general, the role of the central bank has increased. Central banks have frequently become the resolution authority, as in the United Kingdom, and have also become responsible for macroprudential supervision. If the central bank is already the supervisor of individual institutions, then this a very major concentration of power in the system. This can effectively force the central bank into being a more political body, as demonstrated by the ECB in the case of the Irish and Greek crises explored in both chapter 20 and chapter 21. It certainly propels the central bank into having a much closer relationship with the government as wider issues may need to be borne in mind when resolving a bank or lending to it when it faces an indistinct combination of liquidity and solvency problems. Honohan, Lombardi, and St. Amand put it even more strongly: "central bankers are inherently political actors." Thus, the idea of the central bank being able to take a step back from the political pressures and apply a purely technical solution based on rules laid down in advance and clear evidence of the likely outcomes is obviously at variance with reality. The system may therefore change again if crises are perceived to generate conflicts between the central bank and the government—something that becomes more likely when the central bank has a range of objectives, some of which may conflict. It is inherent that problems may occur outside the central bank's traditional field of direct responsibilities—as was seen with investment banks and the American International Group (AIG) in the United States during the crisis. As the guardian of financial and macroprudential stability, the central bank has to act even if this has repercussions later. Similarly, when encountering the effective lower bound or the crisis of confidence in the euro area, the central bank has to step outside the traditional box and lend under conditions it would not previously have countenanced and challenge the limits of its powers.

The euro area in particular is operating with a new set of largely untried institutions and, indeed, legislation, with a new Bank Recovery and Resolution Directive, a new Single Resolution Board, new arrangements for pooling funds with the Single Resolution Fund, in addition to the new supervisory role for the ECB. How well this will work out in practice remains to be seen.

Communication plays a critical role in crisis management. Handled badly, it can result in a bank run, as in the case of Northern Rock. The central bank will only be successful in many of its actions if it is credible and if those involved believe the policy will work. Confidence is crucial, and what swings that may be relatively small errors and successes, which may even be due to factors outside the central bank's control. As Honohan, Lombardi, and St. Amand point out, the central bank and the government need to act in concert for the credibility to hold. But there are strong incentives for each party to try to place the risks involved on the other. Thus, the central bank making losses due to a marginal bank failing may look much better to the government than if the same losses are occurring directly on its books from the issuing of a guarantee. Without government endorsement, central bank actions can lack legitimacy.

Argument from examples is always helpful, and chapter 21 explores the cases of Indonesia in 1997, Argentina in 1989 and 2001, the United Kingdom with Northern Rock

in 2007 and the Royal Bank of Scotland and Lloyds/Halifax Bank of Scotland in 2008, Ireland in 2008–2010, and the euro area in 2010–2012. These illustrate both the mistakes that can be made and the measures that can be successful. With a long enough list of experience, central banks ought to be able to do better at crisis management in the future. As Honohan, Lombardi, and St. Amand conclude, good crisis management requires boldness and decisiveness, but their examples show weakness, delay, insufficiency, and a lack of preparedness. Maybe the next time will be different.

1.8 Part VII: Evolution or Revolution in Policy Modeling?

It should be clear by now that whereas the conduct of central banking rests on a heavy dose of judgment, the success of monetary policy prior to the GFC is also due in no small part to improvements in modeling. One does not have to go back far in time to find dissatisfaction with large-scale macroeconomic models that central banks and statistical agencies began to construct in the 1960s and 1970s, that is, during the heyday when economists thought that economic policy could safely deliver the economy to a particular point on the Phillips curve. It took Sims's work (Sims 1980), among others, to bring attention to the "incredible" restrictions built into early large-scale models. Nevertheless, these large models developed decades ago at least had the virtue of making clear that understanding how economies evolve over time is potentially a complex task. Estimating the impact of certain policies precisely is also hazardous and subject to considerable model uncertainty.

The first two chapters in this part of the book approach deeper questions about models that central banks use as inputs into the decision-making process. In chapter 22, Goodhart, Romanidis, Tsomocos, and Shubik build on Shubik's important contributions in the role that default plays in our understanding of macroeconomic outcomes. It might seem obvious that the failure of financial transactions or the breakdown of certain financial relationships is an ever-present phenomenon in most economies. Hence, this possibility ought to be a concern to central banks. However, in the rush to apply simple models to explain the evolution of key macroeconomic variables, together with the firm belief that financial markets are efficient and do not represent a threat to the real economy, models that ignored financial frictions were almost completely ignored by central banks. This lacuna continued even as monetary authorities in advanced economies began to develop models based on sound microeconomic principles. These were introduced not because their developers believed that markets were literally frictionless and that heterogeneity in individual behavior was not a fact of life. Instead, these assumptions seemed to get in the way of understanding how economies respond to shocks from the real economy or from external factors.

The models of the kind described above came to be called DSGE models, and since the GFC, these have often been singled out as one of the culprits in the failure of economics to "see the crisis coming." The focus of chapter 22's attack on the DSGE approach is the role of default as the principal form through which financial frictions throw "grease in the wheels" of financial markets. The chapter devotes considerable attention to how badly DSGE can mislead policymakers who ignore frictions, especially ones related to default, at their peril. Equally important, recognition of these frictions forced the monetary authority to contemplate in any formal framework developed to analyze the impact of shocks or policies to consider the trade-offs between monetary and financial stability, including the much-discussed contention by some that a lesson learned from the GFC is that "leaning against the wind" (LAW) may be a less successful policy than previously believed. As this is written, the debate about when or when not to LAW continues, but it remains largely a battle of ideas at the theoretical level, a point noted at the outset of this chapter. At the more practical level, LAW has fewer proponents, with central banks resorting to "data dependence" to avoid using policy rates to tighten, aided by low inflation and less than impressive real economic growth. The difficulty is not only that data dependence is a potentially overly flexible means by which not to take a stand until it is possibly too late but also that it relegates the economic outlook to becoming far less important to setting the current stance of monetary policy. It is worth recalling that central banking advocates of inflation control used to place heavy emphasis on the economic outlook in deciding how to set policy rates today. The authors of chapter 22 do not take a stand on the LAW debate, while the next chapter, by Binder, Lieberknecht, Quintana, and Wieland, sees the existing evidence as indicative that LAW policies are not particularly effective. Nevertheless, even these authors likely admit that the jury remains out on this question.

The recognition that financial frictions matter is far from new. Indeed, what we now call financial frictions were well known even during the 1950s. It is just that observation rendered these unimportant from a macroeconomic perspective, especially during the period of the Great Moderation. This view, of course, is no longer tenable. Nevertheless, it is also the case that economists in central banks quickly recognized the need to introduce such frictions, together with an acknowledgment that economic agents are heterogeneous. What remains unclear is how best to model financial frictions and even how heterogeneous agents' expectations should adjust in such an environment or in response to economic shocks. Equally clear, as chapter 22 stresses, is that the dimension of more suitable models for monetary policy analysis must increase substantially.

Chapter 23 adopts a different strategy vis-à-vis an assessment of the popularity of DSGE modeling in central banks. The authors' approach centers on the empirical performance of various models. They make a plea for more explicit recognition of model uncertainty and the need for model diversity since no one model will outperform all others at all times. The authors demonstrate that this kind of diversity is essential not only for providing an estimate of how much model uncertainty exists at any given moment but also because the success or failure of various models over time provides

a mechanism for policymakers to learn how to improve them for policy analysis and forecasting.

Although, as shown in chapter 23, there continues to be, at least empirically, a preference for models that retain a New Keynesian flavor, this is in part because models that attempt to combine what is useful from finance and the recognition that financial frictions are important have not been confronted with data to the same degree as the models that reached a peak in their popularity around the time of the onset of the GFC. Matters become even cloudier when these more sophisticated models that are necessary for a postcrisis world are confronted with the various creative interventions implemented by central banks since 2008, generally referred to as QE. Finally, chapter 23 confronts the modeling challenges created by the growing acceptance of so-called macroprudential instruments deployed to accomplish for financial stability what the central bank policy rate was able to do to deliver inflation stability. Unfortunately, there is a plethora of macroprudential policies, and together with the profession's inability to date to agree on how to define financial system stability, research on the appropriate mix of monetary and macroprudential policies is in its infancy (see Lombardi and Siklos 2016 and references therein). The age-old rules-versus-discretion debate, thought suspended for a time when the Taylor rule seemed an adequate depiction of how monetary policy can be carried out, has been revived. Once again, as this is written, we are a long way from achieving any new consensus on these questions.

All of the foregoing attempts to model economic activity and its dynamics stem from the need for central banks that aim to control inflation and, now, maintain financial system stability to provide an outlook for the economy. Despite the fact that a marked preference for "data dependence" to explain why central banks delay a return to historical norms for interest rates, financial markets, among others, continue to demand and expect central banks, in particular, to provide regular updates to their forecasts. As Siklos's chapter 24 points out, just as DSGE models were accused of neglecting important economic features, economists were fond of assuming that expectations could be treated as uniform or, rather, that in explaining the forward-looking nature of monetary policy, one needed only a single expectations proxy. Little effort was devoted to recognizing that there exists considerable diversity in expectations and that disagreement across forecasts can provide critical information about the appropriate conduct of monetary policy. Indeed, it is only comparatively recently that central banks themselves began to publish staff forecasts. Even fewer central banks publish the forecasts of members of their MPCs. Both, however, are critical ingredients for evaluating not only how clearly central banks see the economic outlook but also the extent to which households and professional forecasters might be influenced by such forecasts. Indeed, the importance placed by central banks on the need to "anchor expectations" is dependent on how the public in general interprets central bank forecasts.

Siklos's empirical evidence for nine advanced economies highlights the need not only to measure and determine the evolution of forecast disagreement but also to understand its determinants over time. Global factors matter greatly, it seems, and the selection of the benchmark against which to evaluate how much forecasters disagree is critical.

Other determinants considered include central bank communication and fluctuations in energy prices. The bottom line, however, is that economics would do well to borrow some aspects of how weather forecasts are generated. If model uncertainty is rife, then there are multiple paths for the economic outlook depending on the model that performs best for different forecast horizons. Nevertheless—and this is misunderstood by some central bankers—economists are unlikely to be able to entirely emulate weather forecasting for at least two reasons. First, it is unlikely, in spite of the tremendous growth in the amount of available data, that policymakers will be able to acquire the sheer volume of data employed in forecasting the weather. Second, and perhaps more important, economics cannot count on some of the physical laws that assist in narrowing the degree of model uncertainty around certain forecasts.

It is understandable that at a theoretical level, the search for a better or a new economic model continues, and many of the chapters in this book point this out in a variety of ways. Nevertheless, at an empirical level, there is no reason to restrict inference to one model. Indeed, developments in empirical modeling are especially helpful, because we are able to harness useful information from a large variety of models. Surely, this is a more appealing approach in conveying the uncertainty around forecasts than more traditional methods that rely on the measurement of uncertainty around forecasts from a single model. Although many central banks have or claim to have adopted such a strategy, either it has not been properly communicated or the benefits obtained from forecasts from diverse models have not yet been fully exploited.

1.9 Postscript: What's in Central Banking's Future? Fintech and the Central Bank

Like other financial institutions, central banks have been affected by the development of financial technology both in their own operations and in their regulation of the financial sector. Payment systems in particular have changed out of all recognition, with the ability to transact electronically in real time replacing batched paper-based transactions at the end of the day. Similarly, the rise of Internet banking and debit and credit cards has transformed how people behave. Mobile devices are providing a further step forward. The role of the central bank in the system has evolved steadily over the last fifty years in the face of these changes, but the process has been evolution rather than revolution.

In advance, all such innovations may make a dramatic impact on financial activity. Indeed, one might want to argue that without the improvements in financial technology, the GFC would have been less extreme. However, it is being argued that some of the ideas being developed at present in what is labeled "fintech" (not a new term) have the potential to disrupt how central banks behave in exercising their roles in the system as

providers of payment systems and currency, as regulators, and even in monetary policy. In other words, this will involve more than evolution. IMF (2017) provides a survey of the issues.

Maybe in practice, these ideas will not amount to much, but it is worth tracing how their potential might be realized in case they do have a substantial effect in the coming few years on the economics of central banking. Two that offer a particular possibility are (1) cryptocurrencies and (2) blockchain and related ledger systems, which between them could not merely transform how people transact but alter the role of the central bank in the economy markedly.

After a brief introduction to the technologies, we explore the implications for a central-bank-issued digital currency, monetary policy, payment and settlement, regulation, the encouragement of innovation, and the protection of consumers.

1.9.1 Cryptocurrencies and the Blockchain

These days, the vast majority of money is held in electronic (digital) form, whether as firms' and households' deposits in banks and other financial institutions or by those banks in deposits at the central bank. The amount held in physical currency (notes and coins) is trivial by comparison. The same disparity applies to transactions; the vast majority by value are also electronic, whether through credit and debit cards, Internet banking, or interbank transfers. Cash is still used in retail transactions, in part because its use is subsidized but also because nothing else is quite so convenient. It is also used in illegal and black-market transactions because of its anonymity, and this may account for the large number of high-value notes in circulation.

Cryptocurrencies offer a different way forward from just letting the use of cash wither away. They offer a means of payment using a digital currency that is highly protected so that users can be convinced that their balances cannot be attacked by others and that the instructions they give will be accurately executed. At present, there are around one thousand of these currencies, but most are very small, and only bitcoin is at all well known and used. Even so, the level of transactions as opposed to the theoretical value of the holdings is very small. People are holding the currency in the hope of making capital gains rather than because of the transactional advantages.

These currencies are private, in the sense that they are not issued by governments or central banks, and hence they require an open and verifiable approach to establishing transactions and the ownership of balances. This is where blockchain and other distributed ledger technologies come in. Each set of transactions in bitcoin needs to be verified before the system can move on, and this can be done by anyone with adequate computer power. These sets of transactions—blocks—are then linked to one another to provide a complete history of each unit of the currency. Since these histories, or ledgers, of transactions can be held anywhere, this is known as a distributed ledger technology. As long as the majority of these ledgers come up with the same blocks, the transactions are verified, and the single path up to the present is confirmed. Traditionally, ledgers have

been held centrally by a trusted counterparty such as a bank or a central bank. Thus, the user trusts the central counterparty rather than requiring multiple verification by independent sites.

Potentially, therefore, one or more cryptocurrencies could replace cash, card, and bank-related transactions if people had sufficient confidence in them. This, of course, is a concern to central banks, in that they do not have control over the system, and to the providers of existing transaction services, in that they might lose market share and see their profits fall. Indeed, many think that because of these two drawbacks, cryptocurrencies will never develop far; either they will be banned by the authorities, or the traditional providers will come up with effective competition, such as the ability to transact in real time at the retail level, which is currently being introduced. Not least among the concerns over bitcoin and related cryptocurrencies is that they are being used for money laundering, and they have a history of illegal involvement (Popper 2015).

However, currencies of this form do not have to be private. They could be issued by the central bank (Bech and Garratt 2017). This could be at the interinstitutional level (several central banks, including the Bank of Canada, appear to be considering this at present), which would mean that all financial institutions allowed into the system could transact with one another in central bank money. (Bott and Milkau 2017 offer a survey of the possibilities.) Or it could be at the retail level, which is a much more revolutionary idea. Barrdear and Kumhof (2016) have explored this in some detail, building on earlier work (Ali, Barrdear, Clews, and Southgate 2014a, 2014b). They suggest that the central bank could offer digital currency balances to people in return for government bonds. Thus, the digital currency would be entirely backed by these bonds. It is debatable how keen people would be to hold much in the way of such balances if they were not remunerated.

Any interest paid would be clearly below the bond rate and presumably below the rate offered on deposits by the commercial banks. In countries facing the effective lower bound, this is a somewhat academic debate at present. The government will clearly be a gainer in this arrangement, as the increased demand for bonds will lower the interest rate they have to pay on their debt. There is thus some attraction to the idea beyond the transactional benefits.

Whether the banks are losers will depend on the popularity of the system and the extent to which they lose profitable business; standard banking transactions are not where banks make their profits. (Offering subsidized transaction services helps retain customers for other products that are much more profitable.) Barrdear and Kumhof do not suggest that the central bank digital currency system should be the only one permitted. Banks could be expected to defend profitable lines of business, and the idea that there would be no improvement in the services they offer as a consequence seems very unlikely.

Some people have an extra item on their agenda: if the digital currency were to drive out cash (or if cash were to be withdrawn), then it would be possible in theory to offer negative interest rates (Rogoff 2017). However, there is no need to consider more extreme circumstances such as those to see digital currency playing a role in monetary

policy. While monetary policy under positive interest rates operates through overnight or other short rates, Barrdear and Kumhof (2016) point out that the digital currency supply could be affected by a form of open market operations. The central bank could offer to buy or sell government bonds as necessary to the holders of the central-bank-issued cryptocurrency and hence affect the money supply through a second route.

In the same way that digital or cryptocurrencies do not need to be private or dependent on the blockchain, blockchain or related ledgers could be used for transactions without the digital currency. Such applications can extend beyond immediate financial markets to real estate or, indeed, to what have become known as "smart contracts." Such smart contracts have clauses that can be triggered automatically by the appropriate change in the circumstances of the contracting parties, for example, if a balance falls below a particular level. However, one of the most popular financial market examples is securities (Mainelli and Milne 2016). Indeed, the technology is already being applied to crowdfunding and other start-ups where the costs of a full-scale launch on the market are prohibitive. Here, the requirements are very similar to those for a cryptocurrency. In the secondary market, shares may be traded in any fraction that makes sense, and on completion of the transaction, the name on the register needs to be transferred from the seller to the buyer. If one were optimistic, then all stages in the transaction could be completed together through a similar ledger technology. But the scope here for improvement in both costs and time taken is considerable. Whether one would actually want to go as far as the whole process taking place in real time is more debatable, as it would render market making of the traditional form impossible. Counterparties would actually have to have the securities they buy or sell and not merely need to be able to acquire them before the settlement date.

Blockchain-style technologies would work well in markets for less tradable securities or for crowdfunding and related funding schemes where the costs of transactions need to be very small and the parcels that are traded may be very small. Being able to deal directly with counterparties could cut costs and avoid the need to employ brokers. Regulators would have to decide on minimum standards.

1.9.2 A Proviso

The potential for an electronic approach to reduce transaction costs is clearly present. The highest costs come in cross-border transactions. Processing a small transfer between New Zealand and Australian banks, for example, costs 25 NZD at the originating end and 26 AUD at the receiving end before exchange-rate fees have been added. Thus, it probably makes more sense to gamble and put a couple of banknotes in the mail. These costs are particularly awkward for remittances where the recipient may not have a bank account. In Kenya, where it is more likely that people will have a phone than a bank account, you can pay in airtime. With bitcoin, there is no need to exchange the currency if the recipient can spend it directly—clearly something that could be achieved if the currency becomes more widely used.

However, it is widely thought that bitcoin will not succeed, first because of its anonymity (while the pseudonym of the owner is known, there is no requirement for the actual name to be revealed) but more seriously because the time it takes to complete a batch of transactions is too long at present to make it convenient. Widespread use would slow it down even further. Other cryptocurrencies may be able to get around this, such as Ethereum, and bitcoin itself has spawned a new, more efficient arm called Bitcoin Cash (*Economist* 2017).

Governance is also an issue. Bitcoin deliberately has open governance, but this makes taking decisions and changing the protocols hugely complicated. Others, Ethereum included, have more concentrated governance, so changes are practicable. There are other disadvantages to bitcoin—at present, it is mainly being hoarded rather than used, by a set of people who are hoping to see its value rise. Not only does this risk a bubble and a stability-threatening burst, but it makes it difficult to use for transactions if the value is not predictable in real terms. (Bitcoin builds this problem in as its ultimate supply is capped.)

Some jurisdictions, the Federal Reserve included, treat bitcoin and related cryptocurrencies as commodities. Thus, its use is more like a system of barter. Currently, this has tax advantages, as a swap is not treated the same way as a purchase from the point of view of tax liability.

It is therefore important to focus on the generality of how such currencies could be used rather than on the very specific case (Leinonen 2016).

1.9.3 Regulation and Innovation

Fintech innovations face a difficulty in that most of them are being initially advanced by start-ups and other small companies. They are also in a very competitive field, so it is difficult to know what will succeed. Many authorities therefore have decided to make the rules easier for bringing the product to market, provided that the overall size of the operation is small and the time period involved is relatively short. The Australian Securities and Investment Commission (ASIC), for example, has set up what is described as a "sandbox," where such innovations can be developed inside the boundary of official oversight but outside the panoply of full regulation. The idea is to allow fintech companies to get a start in the market. However, a second common route is for banks to buy up any promising ideas and then develop them themselves.

Consumers still need to be protected. And it is difficult to advertise clearly which products are subject to consumer claims and which are not because they are in the sandbox phase or outside the system altogether. There are clearly serious problems for redress in systems where the counterparties are anonymous (rather, pseudonymous, as only their pseudonyms are known). It has been possible to track down bitcoin transactors and for successful prosecutions to be brought for illegal transactions in the United States (Popper 2015). However, the costs of doing that for small claims would be prohibitive. This implies that any viable system is at least going to have to disclose the

names of the merchants so there can be redress and a reasonable opportunity to ensure that other trading regulations are upheld.

1.9.4 Where Do We Go from Here?

The direction these new technologies are most likely to take is toward making transactions simpler, easier, less costly, and faster. The format is difficult to judge, but there is a major vested interest for existing service providers to make sure that they dominate any such new system as well. Thus, it is not clear whether encryption or distributed ledger technology will be the key feature. Either way, the central banks will need to be alert to the more complex and less stable environment that these technologies can bring.

Of course, if they decide to be the supplier of the cryptocurrency themselves, then the impact on central banks' actions will be substantial and could change the role of the central bank in retail transactions markedly. Taking a much wider role as a provider would alter the balance of markets and would certainly generate a lot of controversy if banks and other private-sector providers felt their business was being eroded. Nevertheless, if that gave the central bank more policy tools, the change might be supported. Similarly, if a central-bank-issued digital currency provided an opportunity for reducing the costs of government funding, then the chance of introduction would be increased.

At some point, governments may feel that the central banks' responsibility should be reduced if fintech leads to yet another expansion of the central banks' powers. The digital currency could be issued by another agency if it is to be 100 percent backed by government bonds.

Notes

1. At least in advanced economies. The inflation target can be higher in emerging market economies. Siklos (2017, appendix) has an up-to-date listing of countries that have adopted inflation targets, including the start date and annual changes (if any) in the inflation target levels and ranges.
2. Instead, there may well be a resurgence of interest in price-level targeting. A few years ago, the Bank of Canada was actively pursuing this agenda. The GFC put paid to more serious consideration of this kind of policy regime being implemented in practice. However, former central bankers (e.g., Bernanke 2017) now see a version of price-level targeting as a means to escape the risks associated with the ZLB.
3. Quoted in *Guardian Weekly*, November 4, 2005.
4. Remarks by Ben S. Bernanke at the National Economists Club, Washington, D.C., December 2, 2004.
5. Arguably, the simplicity of evaluating monetary policy has taken a turn for the worse since QE and the willingness of some policymakers to permit inflation to be too high or too low for a time.

References

Ali, R., J. Barrdear, R. Clews, and J. Southgate. 2014a. "The Economics of Digital Currencies." *Bank of England Quarterly Bulletin* 54, no. 3: 276–286.

Ali, R., J. Barrdear, R. Clews, and J. Southgate. 2014b. "Innovations in Payment Technologies and the Emergence of Digital Currencies." *Bank of England Quarterly Bulletin* 54, no. 3: 262–275.

Barrdear, J., and M. Kumhof. 2016. "The Macroeconomics of Central Bank Issued Digital Currencies." http://www.bankofengland.co.uk/research/Documents/workingpapers/2016/swp605.pdf.

Barth, James R., Gerard Caprio Jr., and Ross Levine. 2013. "Bank Regulation and Supervision in 180 Countries from 1999 to 2011." NBER working paper 18733, January.

Bech, M., and R. Garratt. 2017. "Central Bank Cryptocurrencies." *BIS Quarterly Review* (September): 55–70. https://www.bis.org/publ/qtrpdf/r_qt1709f.pdf.

Bernanke, Ben S. 2004. "The Great Moderation." Meetings of the Eastern Economic Association, Washington, D.C., February 20.

Bernanke, B. 2014. "Bernanke Cracks Wise: The Best QE Joke Ever!" CNBC. https://www.cnbc.com/2014/01/16/bernanke-cracks-wise-the-best-qe-joke-ever.html.

Bernanke, Ben S. 2017. "Monetary Policy in a New Era." Brookings Institution working paper, October 2.

Bott, J., and U. Milkau. 2017. "Central Bank Money and Blockchain: A Payments Perspective." *Journal of Payments Strategy and Systems* 11, no. 2: 145–157.

Carlstrom, Charles T., Timothy S. Fuerst, and Matthias Paustian. 2015. "Inflation and Output in New Keynesian Models with a Transient Interest Rate Peg." *Journal of Monetary Economics* 76: 230–243.

Crow, J. 2013. "PracticalExperiences in Reducing Inflation: The Case of Canada." *The Great Inflation: The Rebirth of Modern Central Banking*, edited by M. D. Bordo and A. Orphanides, xx–xx. Chicago: University of Chicago Press, pp. 37–55.

Dincer, N. Nergiz, and Barry Eichengreen. 2008. "Central Bank Transparency: Where, Why and with What Effects?" *Central Banks as Economic Institutions*. Cournot Centre for Economic Studies Series, edited by Jean-Philippe Touffut, 105–141. Cheltenham, UK and Northampton, MA: Elgar.

Dincer, N. Nergiz, and Barry Eichengreen. 2014. "Central Bank Transparency and Independence: Updates and New Measures." *International Journal of Central Banking* 10, no. 1: 189–253.

Economist. 2017. "Bitcoin Divides to Rule." August 5. https://www.economist.com/news/business-and-finance/21725747-crypto-currencys-split-two-versions-may-be-followed-others-bitcoin.

Eijffinger, Sylvester C. W., and Petra M. Geraats. 2006. "How Transparent Are Central Banks?" *European Journal of Political Economy* 22, no. 1: 1–21.

El-Erian, Mohamed. 2016. *The Only Game in Town*. New York: Random House.

Epstein, Larry G. and Stanley E. Zin. 1989. "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework." *Econometrica* 57: 937–969.

Filardo, Andrew, and Phurichai Rungcharoenkitkul. 2016. "A Quantitative Case for Leaning against the Wind." BIS working paper 594, December.

Haldane, Andrew. 2009. "Rethinking the Financial Network." Speech. Financial Student Association, Amsterdam, April 28. http://www.bankofengland.co.uk/archive/Documents/historicpubs/speeches/2009/speech386.pdf.

IMF. 2017. "Fintech and Financial Services: Initial Considerations." IMF Staff Discussion Note SBN/17/05. https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2017/06/16/Fintech-and-Financial-Services-Initial-Considerations-44985.

King, Mervyn. 2000. "Monetary Policy: Theory and Practice." Speech. January 7. http://www.bankofengland.co.uk/archive/Documents/historicpubs/speeches/2000/speech67.pdf.

King, Mervyn. 2016. *The End of Alchemy*. New York: W. W. Norton.

Leinonen, H. 2016. "Virtual Currencies and Distributed Ledger Technology: What Is New under the Sun and What Is Hyped Repackaging?" *Journal of Payments Strategy & Systems* 10, no. 2: 132–152.

Lombardi, Domenico, and Pierre L. Siklos. 2016. "Benchmarking Macroprudential Policies: An Initial Assessment." *Journal of Financial Stability* 27 (December): 35–49.

Maier, Philipp. 2010. "How Central Banks Take Decisions: An Analysis of Monetary Policy Meetings." *Challenges in Central Banking*, edited by P. L. Siklos, M. T. Bohl, and M. E. Wohar, 320–356. Cambridge: Cambridge University Press.

Mainelli, M., and A. Milne. 2016. "The Impact and Potential of Blockchain on Securities Transactions." SWIFT Institute working paper 2015-007, May.

Masciandaro, Donato. 2012. "Back to the Future?" *European Company and Financial Law Review* 9, no. 2: 112–130.

Orphanides, Athanasios. 2013. "Is Monetary Policy Overburdened?" BIS working papers 435, December.

Popper, N. 2015. *Digital Gold*. London: Allen Lane.

Reinhart, C., and K. Rogoff. 2009. *This Time Is Different: Eight Centuries of Financial Folly*. Princeton: Princeton University Press.

Rogoff, K. 2017. *The Curse of Cash*. Princeton: Princeton University Press.

Siklos, Pierre L. 2017. *Central Banks into the Breach: From Triumph to Crisis and the Road Ahead*. Oxford: Oxford University Press.

Siklos, Pierre L., and Matthias Neuenkirch. 2015. "How Canadian Monetary Policy Is Made: Two Canadian Tales." *International Journal of Central Banking* (January): 225–250.

Sims, Christopher. 1980. "Macroeconomics and Reality." *Econometrica* 48 (January): 1–48.

Svensson, Lars E. O. 2016. "Cost-Benefit Analysis of Leaning against the Wind: Are Costs Larger Also with Less Effective Macroprudential Policy?" IMF working paper 16/3, January.

Tucker, Paul. 2016. "The Design and Governance of Financial Stability Regimes." *Essays in International Finance* 3 (September). Waterloo, Ontario: Centre for International Governance Innovation.

PART I

CENTRAL BANK GOVERNANCE AND VARIETIES OF INDEPENDENCE

CHAPTER 2

MONETARY POLICY COMMITTEES AND VOTING BEHAVIOR

SYLVESTER EIJFFINGER, RONALD MAHIEU, AND LOUIS RAES

2.1 Introduction

In many modern economies, the position of a monetary authority bears remarkable similarities to the position of the highest-level court (Goodhart (2002)). For both bodies, there is a commonly held belief that they should be able to operate independently. What this independence exactly entails differs for both types of institutions from one country to another. In the United Kingdom, the highest court is the Appellate Committee of the House of Lords (in short, Law Lords). There is a consensus among legal scholars that the powers of the Law Lords with respect to the legislature are less wide ranging in the United Kingdom than the powers of the Supreme Court in the United States (Goodhart and Meade (2004), p.11). This difference may sound familiar to economists. In economic jargon, one would say that the Supreme Court has goal independence whereas the Law Lords have instrument independence.

If we compare the monetary policy committee (MPC) of the Bank of England (BoE) with the Federal Open Market Committee (FOMC) of the Federal Reserve, we notice a similar pattern. The MPC has, due to a clear inflation target, little goal independence. The FOMC, on the other hand, has multiple objectives providing some discretion to the monetary policy makers.

The similarities extend further. Because independence, however defined, is deemed important for both the monetary authority and judicial courts, governments have applied similar recipes to guarantee independence. In the United States, for example, Supreme Court justices have tenure for life. Similarly, board governors, part of the FOMC, are appointed for fourteen years. These lengthy appointments, for life in the case

of the Supreme Court and fourteen years in the case of the Board of Governors, serve to insulate justices and governors from political pressure.

Various other aspects (decision-making procedures, the role of consensus, the role of the chairman, communications strategy, etc.) also demonstrate remarkable similarities: see Goodhart and Meade (2004) for some examples.

At the same time, different countries tend to fill in the details in different ways, and these details may matter. In the case of monetary authorities, most central banks have put a committee in charge of monetary policy. These committees vary substantially on various dimensions across different countries.[1]

Besides guaranteeing independence, there are two additional concerns underlying the institutional design of a monetary authority or a judicial court. First, there is the need to balance independence with accountability. Delegating important public tasks to individuals who are not elected and may even not be directly under the control of elected public servants requires a system of checks and balances to ensure sufficient accountability. Second, there is the need to have sufficient technical skills because these bodies often deal with complex issues.[2]

Both monetary policy committees and judicial courts have been the topic of research. Given the similarities we described above, there has occasionally been crossover between these literatures. Scholars explaining decision-making in groups and committees often use MPCs or judicial courts as an example. This overlap concerns mainly theoretical work.[3]

Empirical work on MPCs and judicial courts has evolved more separately. One consequence of this is that we see different methodologies being used by scholars studying decision-making at central banks and by those studying deliberations of courts.

In our work, we use methods that are predominantly used in the study of voting in legislative bodies and judicial bodies (e.g., the Supreme Court) to study voting at central banks. We do so because we believe that this methodological crossover may be fertile. We do not claim that one methodology is superior to another; rather, we feel that different approaches can prove to be complementary to each other.

Crossing methodological boundaries between disciplines is not always straightforward. One may lack the expertise to use certain methods or lack colleagues to bounce back ideas. In this chapter, we aim to provide a succinct introduction. We first provide a snapshot of the literature on voting at MPCs. We then discuss the spatial voting model in its simplest form. Next, we illustrate the methods discussed with voting data from the Riksbank. We give a brief overview of results in the literature using spatial voting models. We then point to some possible methodological extensions, some of which are not yet explored to our knowledge.

2.2 Related Literature

In the introduction, we mentioned that the institutional design of central banks differs across countries. These differences often seem minor from a distance but could matter

a great deal in practice. The implication for research on central bank committees is that one should be cautious in generalizing the results of the study of one central bank. Many studies use the voting records of a particular central bank (most often the Federal Reserve or the BoE) to study a particular feature of the institutional design of that particular bank. As an example, consider research studying regional bias at the FOMC.[4] Regional bias refers here to the notion that an FOMC member would systematically favor his or her home region by attaching disproportional weights to regional indicators when contemplating appropriate monetary policy. The study of this topic is motivated by the structure of the FOMC where regional representation is by design an important feature.

Jung and Latsos (2015) report that they find evidence of regional bias, but they judge the impact to be fairly small. This finding is relevant for the design of MPCs, but the question remains to what extent one can generalize this to other central banks. Jung and Latsos (2015) suggest conducting similar research on other central banks where a regional bias may play a role as well and are rightly cautious in generalizing the findings to other central banks. However, if the possibility to generalize is limited, then studies of separate central banks should be treated as case studies.

Some studies lump central banks together in an effort to gain a cross-country perspective. For example, Adolph (2013) is an impressive effort to study the career concerns of central bankers and monetary policy in a wide range of industrial countries. Such a cross-country study seems more general than the case studies we mentioned before, but this comes at the cost of limited assessment of detail.[5]

For these reasons, we caution the reader to put the research results on MPCs in perspective. While some studies are impressive efforts of data collection and refined statistical analysis, good judgment is required to judge the merits in different contexts.

As mentioned before, research on MPCs has focused historically mostly on the FOMC and the BoE. A first topic studied in the context of the FOMC is the aforementioned regional bias. A second branch of the literature has focused on the chairman. The chairman at the FOMC plays an important role, for different reasons. He heads the FOMC and leads the meetings. The chairman tends to lead the communication by the FOMC and as a consequence receives most media attention. Furthermore, the Humphrey-Hawkins Full Employment Act of 1978 requires the chairman to give an oral testimony to the Committee on Banking, Housing, and Urban Affairs of the Senate and the Committee on Financial Services of the House of Representatives.

The role of the chairman has been much discussed, and many scholars have written on the influence of the chairman in decision-making at the FOMC; see Chappell, McGregor, and Vermilyea (2007), Gerlach-Kristen and Meade (2010), El-Shagi and Jung (2015), Ball (2016).

A third line of research is concerned with political influence. There is the concern that there might be (tacit) political influence on FOMC members. This pressure might come through informal conversations or might arise due to people with a specific partisan background being appointed to the Board of Governors. There is a long tradition in analyzing these matters. Many researchers do believe that there is some steering by means of appointing candidates with a certain ideological profile. The extent to which this really influences decision-making remains debated.[6]

The aforementioned branches of the literature all boil down to uncovering the preferences of FOMC members and analyzing the extent to which these are influenced by certain determinants (see also Havrilesky and Gildea (1991), Chappell, Havrilesky, and McGregor (2000), Thornton, Wheelock, et al. (2014), Eichler and L¨ahner (2014)).

The literature on the MPC of the BoE also has a strong focus on uncovering the determinants of dissent. One important difference between the MPC and the FOMC is that the MPC is considered to be more individualistic in comparison to the FOMC (see Blinder (2009)).[7] A consequence is that dissent is more common at the MPC.

The MPC consists of insiders and outsiders, that is, MPC members appointed from within the bank and MPC members with no connection to the bank. This is one particular feature that has drawn considerable attention in the literature investigating dissents at the BoE; see Besley, Meads, and Surico (2008), Harris and Spencer (2009), Gerlach-Kristen (2009), Bhattacharjee and Holly (2010), Harris, Levine, and Spencer (2011). However, there is some disagreement on how these two types of MPC members differ in their preferences and voting behavior from each other (see Eijffinger, Mahieu, and Raes (2013a)).

Finally, besides the BoE and the Federal Reserve, other central banks have also been studied, albeit to a lesser extent. Examples are Jung and Kiss (2012), Chappell, McGregor, and Vermilyea (2014), Siklos and Neuenkirch (2015), Horvath, Rusnak, Smidkova, and Zapal (2014).

The papers using the type of spatial voting models we advocate follow the line of research we have described in this section. These papers use voting records to estimate the latent preferences of policymakers, which are then studied. Hix, Hoyland, and Vivyan (2010) and Eijffinger, Mahieu, and Raes (2013a) study the MPC of the BoE. Eijffinger, Mahieu, and Raes (2013b) study four smaller central banks, and Eijffinger, Mahieu, and Raes (2015) focus on the FOMC. In the next sections, we shall explain this approach and provide an illustration.

2.3 Spatial Voting

In this section, we discuss the spatial voting model. In political science, spatial voting models belong to the standard toolbox. A key reference is Clinton, Jackman, and Rivers (2004). In economics, this approach is less commonplace which motivates us to elaborate on the methodology. The discussion in this section is largely based on the corresponding sections in Eijffinger, Mahieu, and Raes (2013a).

We start by discussing how the canonical spatial voting model can be motivated from a random utility framework.

Ideal points and a spatial voting model

The data we analyze consist of votes expressed during monetary policy deliberations. The votes were cast by MPC members to whom we refer as voters $n = 1, \ldots, N$. The voters are voting on policy choices $t = 1, \ldots, T$. Each policy choice presents voters with a choice

between two policy rates, where the lower rate is considered a *dovish* position ψ_t and the higher rate is a *hawkish* position ζ_t. The positions ψ_t and ζ_t are locations in a one-dimensional Euclidean policy space $\mathbb{R}$.[8] A voter n choosing the hawkish position ζ_t on policy choice t is denoted as $y_{nt} = 1$. If voter n chooses the dovish position ψ_t, we code this as $y_{nt} = 0$.

The choices ζ_t and ψ_t are functions of a policy rate and possibly other variables capturing the contemporaneous economic conditions prevailing at policy choice t. However, the two choices differ only in the policy rate. We assume that voters have quadratic utility functions over the policy space such that $U_n(\zeta_t) = -\| x_n - \zeta_t \|^2 + \eta_{nt}$ and $U_n(\psi_t) = -\| x_n - \psi_t \|^2 + \nu_{nt}$, where $x_n \in \mathbb{R}$ is the *ideal point* or the underlying monetary policy preference of voter n, and η_{nt}, ν_{nt} are the stochastic elements of utility, and $\| . \|$ denotes the Euclidean norm.

Utility maximization implies that $y_{nt} = 1$ if $U_n(\zeta_t) > U_n(\psi_t)$ and $y_{nt} = 0$ otherwise.

To derive an item response specification, we need to assign a distribution to the errors. Assuming a type 1 extreme value distribution leads to a logit model with unobserved regressors x_n corresponding to the ideal points of the voters:

$$\begin{aligned} P(y_{nt} = 1) &= P(U_n(\zeta_t) > U_n(\psi_t)) \\ &= P(\nu_{nt} - \eta_{nt} < \| x_n - \psi_t \|^2 - \| x_n - \zeta_t \|^2) \\ &= P((\nu_{nt} - \eta_{nt}) < 2(\zeta_t - \psi_t)x_n + (\psi_t^2 - \zeta_t^2)) \\ &= \text{logit}^{-1}(\beta_t x_n - \alpha_t). \end{aligned} \tag{1}$$

The last line follows from substituting $2(\zeta_t - \psi_t)$ with β_t and substituting $(\zeta_t^2 - \psi_t^2)$ with α_t.

Assuming (conditional) independence across voters n and meetings t yields the following likelihood (see Clinton, Jackman, and Rivers (2004)):

$$\mathcal{L}(\beta, \alpha, \boldsymbol{x} \mid \boldsymbol{Y}) = \prod_{n=1}^{N} \prod_{t=1}^{T} (\text{logit}^{-1}(\beta_t x_n - \alpha_t))^{y_{nt}} \times (1 - \text{logit}^{-1}(\beta_t x_n - \alpha_t))^{1 - y_{nt}}, \tag{2}$$

with $\beta = (\beta_1, \ldots, \beta_T)'$, $\alpha = (\alpha_1, \ldots, \alpha_T)'$ vectors of length T, x = $(x_1, \ldots, x_N)'$. a vector of length N and $\boldsymbol{Y}$ the $N \times T$ (observed) vote matrix with entry (n, t) corresponding to y_{nt}.

This derivation should be familiar to most economists as it mimics the discrete choice derivation of a logit model. Model 1 is in this sense just a logit model where the regressor x_n is not observed in the data but is a latent variable. A key difference, in terms of interpretation, is that the object of interest is precisely the latent regressor x_n (the ideal points).

To understand the intuition behind the parameters, start by considering the situation where β_t equals 1. Then the model reduces to:

$$P(y_{nt} = 1) = \text{logit}^{-1}(x_n - \alpha_t). \tag{3}$$

Figure 2.1 provides a visual presentation of this simplified model with two voters and two meetings.[9]

For each meeting t, there is a corresponding vote parameter α_t. This parameter captures the overall inclination to vote dovishly; that is, a higher α_t increases the probability that each voter will vote for the dovish policy choice. This parameter captures the

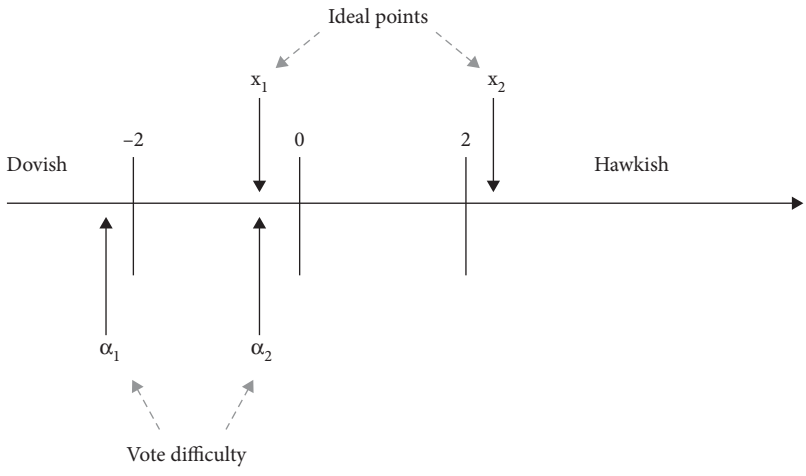

FIGURE 2.1 Ideal Points on a Single Latent Dimension

Notes: This figure illustrates equation (3). On the latent dove-hawk dimension, two ideal points x_1, x_2 (voters) and two vote parameters α_1, α_2 (meetings) are shown. If the ideal point of voter n is larger than the vote parameters α_t, then it is more likely that voter n votes for the hawkish policy choice. In this example, voter 1 is as likely to vote hawkishly as to vote dovishly on the policy choice represented by α_2.

economic environment in which voting takes place. Consider now voter 1. Voter 1 has an ideal point x_1 slightly smaller than zero, whereas voter 2 has an ideal point x_2 larger than 2. The dove-hawk dimension runs from dovish to hawkish, and so x_2 would be a clear hawk here. Both voters have an ideal point larger than the vote parameter α_1 associated with meeting 1. This implies that both voters are more likely to vote for the hawkish policy option in this meeting, since for $n = 1,2$ we have that $\text{logit}^{-1}(x_n - \alpha_1) > 0.5$. However, the ideal point of voter 2 is larger than the ideal point of voter 1, so the predicted probability of voting hawkishly is larger for voter 2. Now consider meeting 2. For this meeting we have $x_1 = \alpha_2$, so the ideal point of voter 1 and the vote parameter of this meeting are equal. We find that $\text{logit}^{-1}(x_1 - \alpha_2) = \text{logit}^{-1}(0) = 0.5$. There is an equal probability that voter 1 chooses the hawkish or the dovish option in this meeting. Once again, voter 2 has an ideal point larger than α_2, and so we give this voter a higher probability of voting for the hawkish policy choice. These examples show that the vote parameter α_t captures meeting characteristics (e.g., state of the economy) and determines how likely it is a priori that voters vote for the dovish or the hawkish policy choice.

Now consider the effect of β_t or the *discrimination parameter*. This parameter captures the extent to which preferences in the dove-hawk dimension determine the choice between two competing policy rate proposals. Say we find that for a certain meeting t, β_t equals zero. Then $\beta_t x_n$ equals zero, and the preferences in the underlying dove-hawk dimension do not have an impact on the choice between competing policy proposals. Analogously, a negative β_t implies that doves (hawks) have a higher probability of choosing the hawkish (dovish) policy choice. A voter n is as likely to make the dovish as the hawkish choice if his ideal point x_n equals α_t / β_t. This ratio is referred to as the cut point, the point in the policy space where voters are indifferent between two policy choices presented in meeting t.

The model we presented in equation 1 is not identified. For example, for a constant C, we have $(\beta_t x_n + C) - (\alpha_t + C) = \beta_t x_n - \alpha_t$. Similarly, we have $C \times \beta_t \frac{x_n}{C} = \beta_t x_n$.

To identify the parameters, we use the common approach of normalizing the ideal points to have mean zero and a standard deviation of 1. The left-right direction is fixed by specifying one ideal point to be negative and one ideal point to be positive. We do this on the basis of the summary statistics (see below).

Voting could depend on a whole range of influences, including personal and group preferences (e.g., through an organizational consensus, varying reputational concerns). Identifying each of these requires considerably more data and/or assumptions. The measures of revealed policy preferences we propose in this chapter, represented by the ideal points, are therefore a mix of these influences on monetary policy voting rather than a literal measure of policy preference.[10] In our opinion, these serve as a useful summary of policy preferences and could aid researchers in analyzing monetary policy votes.

2.4 Data

In this chapter, we use the Riksbank as a running example.[11] Specifically, we use the voting records from January 2000 to October 2009.

The Executive Board, the MPC of the Riksbank, consists of six internal members who are appointed for a period of six years. The Executive Board is considered to be an individualistic committee (Apel, Claussen, and Lennartsdotter (2010)), which means that Executive Board members vote according to their beliefs.[12] In the case of a split vote, the governor's vote is decisive.

An overview of the Executive Board and the terms of office of its members in the period 1999–2009 is presented in figure 2.2.

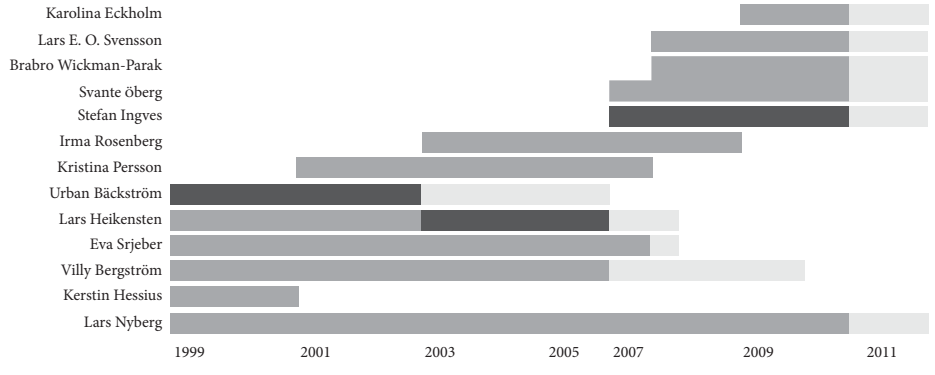

FIGURE 2.2 The Terms of Office of Members of the Executive Board (1999–2009)

Notes: This is a reproduction of figure 1 in Ekici 2009. The blue shading means that the person was a regular member, the red shading indicates the chairman, and the gray shading indicates the remaining term of office.

The econometric framework laid out above requires us to recode the data. Unanimous votes are dropped, as these are uninformative for our purposes. The remaining votes are coded as decisions between two alternatives. The lower interest-rate proposal is coded as a zero, whereas the higher interest-rate proposal is coded as a 1. To make this clear, consider the following fictitious example which is summarized in table 2.1.[13]

We have a meeting with four voters: Alice, Bob, Cameron and David. Alice votes for lowering the policy rate by 0.25 percent, whereas the other three vote for no change in the policy rate. Since the vote by Alice represents the dovish choice, we would code Alice's vote as 0, whereas the other three votes would be coded as 1.

Dropping the unanimous meetings leads to thirty-three meetings and thirteen voters (Executive Board members). A summary can be found in table 2.2. Table 2.2 makes clear that we expect Srjeber to be a hawk, given that she preferred the higher policy choice in twenty-three out of twenty-five votes, whereas we expect Persson to

Table 2.1 How We Coded Voting Records

Name	Vote cast	Coded as
Alice	−0.25	0
Bob	+0	1
Cameron	+0	1
David	+0	1

Table 2.2 Summary of the Data

Name	Total votes	Hawkish votes	Dovish votes	Fraction dovish
Villy Bergström	25	9	16	0.64
Urban Bäckström*	19	6	13	0.68
Karolina Eckholm	3	3	0	0.00
Lars Heikensten*	25	9	16	0.64
Kerstin Hessius	12	6	6	0.50
Stefan Ingves*	7	4	3	0.43
Lars Nyberg	33	13	20	0.61
Barbro Wickman-Parak	6	4	2	0.33
Kristina Persson	14	0	14	1.00
Irma Rosenberg	11	4	7	0.64
Eva Srjeber	25	23	2	0.08
Lars E. O. Svensson	6	2	4	0.67
Svante Öberg	8	8	0	0.00

Note: * Executive Board member who has been governor at some point.

be a dove, as she always preferred the lower policy rate proposal in the fourteen votes in our sample. We therefore specify that the ideal point of Srjeber should be positive and Persson's should be negative. Together with the normalization (see above), this identifies the model.

Figure 2.3 visualizes the same data in two ways. In the top graph, we have plotted the votes across time. The hawkish votes are indicated by a plus sign and the dovish votes by a circle. The time scale looks unwieldy because the frequency of meetings varies over time.

This graph shows periods of persistency in votes as well as switches by some committee members. In the bottom graph, we show the same data after having stripped out the majority votes. This makes the dissenters more salient.

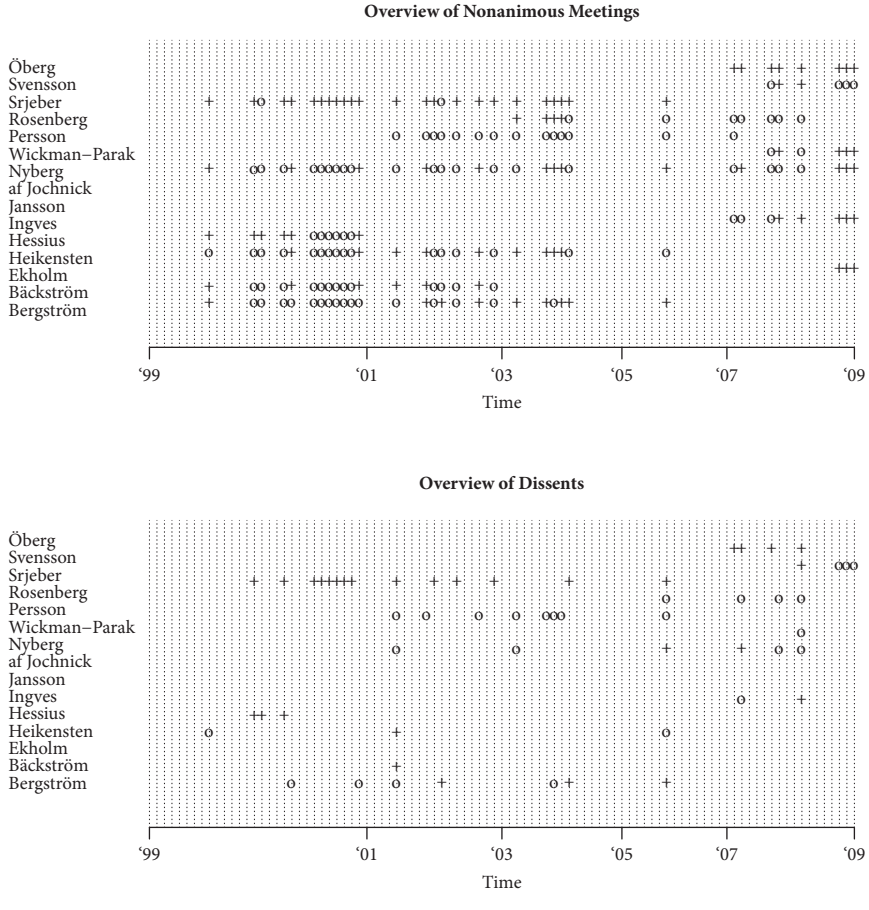

FIGURE 2.3 Visualizations of the Data

Notes: The top graph shows all nonunanimous votes in our data set. Hawkish votes are marked as a plus and dovish votes as a circle. The bottom graph shows the same data after removing the majority votes. In the case of an equal split, all votes are shown.

Earlier, we put forward the assumption of independence across votes and voters. These graphs may provide sufficient reason for some to doubt this assumption. For example, Nyberg and Heikensten have often voted in a similar way in nonunanimous meetings. A solution to violations of the conditional independence assumption is to include the (potentially latent) factors in the specification. The advantage of such an approach is that it allows for a quantification of the presumed effect. However, given the limited amount of data we have, it will be hard to obtain reasonably precise estimates of such effects. In the remainder of this study, we maintain the independence assumption.

2.5 Ideal Point Analysis

A first summary of the model is given in figure 2.4. This figure provides a historical ranking of Executive Board members on a dove-hawk scale. Because the appointments

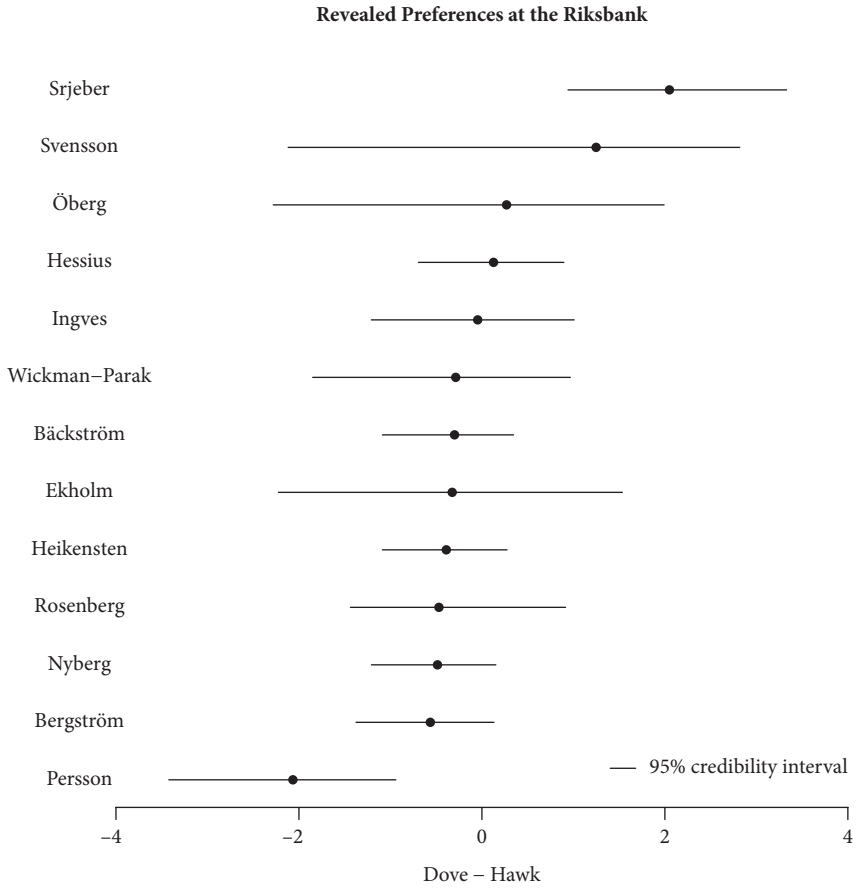

FIGURE 2.4 Overview of All Ideal Points

of Executive Board members are staggered, the ideal point approach allows us to compare Executive Board members who were not appointed at the same time.

The figure shows substantial uncertainty around some of the ideal points. For example, the intervals around Svensson, Öberg, and Ekholm are very wide. This reflects the fact that in our small sample we have only six recorded votes for Svensson, eight for Öberg, and three for Ekholm.

We could also zoom in on the different compositions of the Executive Board over our sample period. In figure 2.5, each row displays another composition of the Executive Board in our sample period. Rather than presenting the ideal points, we show here the probabilities that the respective board members occupy a certain rank, with 1 being the most dovish and 6 being the most hawkish.

Consider, for example, the first row. This concerns the first Executive Board. This board consisted of Bäckström (governor), Heikensten, Srjeber, Bergström, Hessius, and Nyberg.

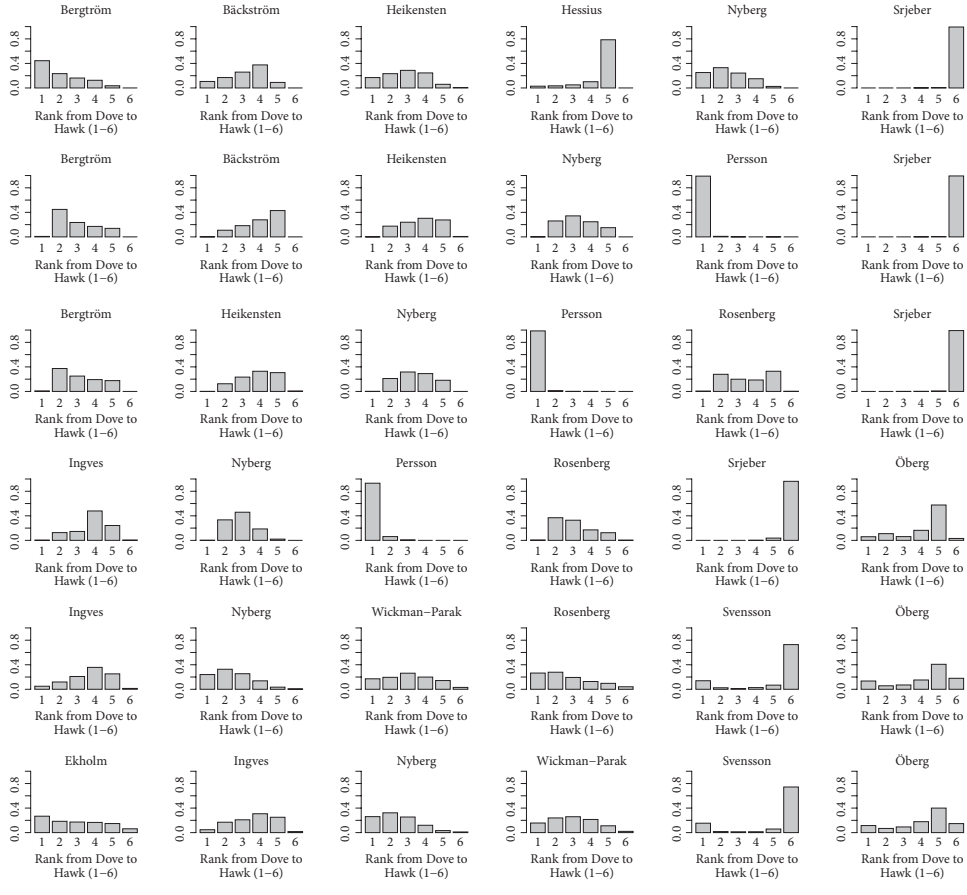

FIGURE 2.5 Rank Probabilities in Different Boards

Notes: This figure shows the rank probabilities of Executive Board members in different compositions of the board. Each row shows another composition.

This board composition remained unchanged from January 1, 1999, until December 31, 2000, when Kerstin Hessius left the Executive Board and was replaced by Kristina Persson. We see that in this first Executive Board, Srjeber clearly is the most hawkish member. Hessius seems also more hawkish than the other board members. The ranks of the other four are less clear, although the governor, Bäckström, seems more likely to be ranked in the middle, spots three and four. When Hessius is replaced by Persson, we notice a shift in the ranks. Persson is clearly the most dovish. Now Bergström, to whom we earlier attached the highest probability of being the most dovish, moves a spot to the middle.

Going from row four to row five, we see that Persson and Srjeber left the Executive Board and were replaced by Svensson and Wickman-Parack. We see that now Svensson is clearly the most hawkish.[14]

Of particular interest in the case of the Riksbank is the position of the governor. Apel, Claussen, and Lennartsdotter (2010) note that at least until 2010, the governor had never been on the losing side in a vote. The Executive Board consists of six members, and in the case of a tie, the governor has the decisive vote. Given that in our sample we only have votes over two interest-rate proposals, this means that a governor would be on the losing side if four (or more) Executive Board members favored another interest rate. Apel, Claussen, and Lennartsdotter report that past Executive Board members feel that the governor at the Riskbank tends to support the majority view rather than trying to steer the majority in his direction. With the ideal point estimates in hand, we can try to quantify theprobability that the governor does occupy the middle ground. In the left panel of figure 2.6, we show for the six different board compositions the probability that the governor occupies the middle ground. We find that the chances fluctuate around 50 percent for the different board compositions. The right panel of figure 2.6 shows the ideal points in the different board compositions. We notice a substantial diversity of opinion during the period when Persson and Srjeber were both on the board.

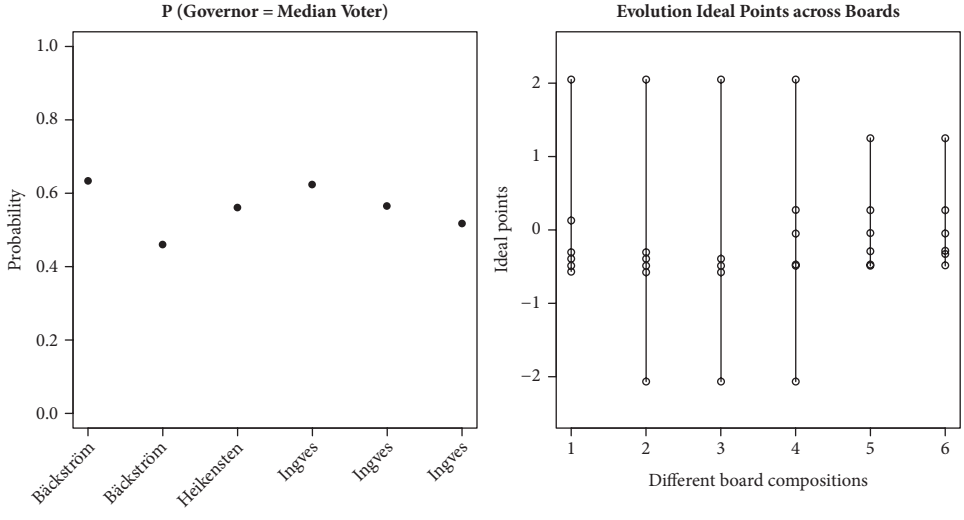

FIGURE 2.6 Other Quantities of Interest

Notes: The left panel of the figure shows the probability that the governor is the median voter (rank 3, 4). The right panel shows the distribution of ideal points in different boards. Only the point estimates of the ideal points are shown.

The point of this simple exercise was to show what ideal point analysis is and what we can do with it. The approach is powerful in the sense that we obtain a joint probability distribution over all latent ideal points. We can easily construct substantial quantities while keeping track of the uncertainty surrounding these quantities. As a final example, say we are interested in knowing whether Bäckström's successor, Heikensten, was more dovish or hawkish. Our model suggests that the probability that Bäckström is more hawkish than Heikensten is about 59 percent. The probability that Heikensten is more dovish than his successor, Ingves, is, on the other hand, about 70 percent.[15]

2.6 More Traditional Approaches

This chapter can be read as a pamphlet promoting the use of ideal point models to complement more traditional approaches such as reaction functions. One key strength of Bayesian ideal point models we emphasize is that we can keep track of uncertainty in the estimates while constructing quantities of interest. Leaving this feature aside, one may ask how estimates of ideal point models compare to traditional estimates.

In the case of the Riksbank, there is recent work on estimating preferences using a reaction function framework. Chappell, McGregor, and Vermilyea (2014) and Chappell and Mc-Gregor (2015) provide analyses of the preferences at the Riksbank. Chappell, McGregor, and Vermilyea (2014) argue that in the case of the Riksbank, the chairman is highly influential. This stands in contrast to Blinder (2004) and our assumption regarding voting at the Riksbank.

However, Chappell and McGregor (2015) follow through on Chappell, McGregor, and Vermilyea (2014) and provide an interesting Monte Carlo study suggesting that we should be careful with the trust we place in preference estimates in a traditional reaction function framework. They provide evidence of substantial bias in the estimates and relate this to the incidental parameters problem. At first sight, the incidental parameters problem should not be of any concern in studies like these, given the nature of the panel data used. For example, in their study, Chappell and McGregor (2015) use 101 meetings and seventeen individuals.

This problem seems to arise, however, because of various complications. The data are highly unbalanced, with more than 65 percent of the observations missing. For some voters, we have only few observations, and on top of that we have a discrete dependent variable. The authors speculate that the large biases they find in the preference estimates could well be present in other studies of MPC behavior.[16]

However, Chappell and McGregor (2015) do seem confident that at least the ranking of members' preferences is robust.

To see how the ideal point estimates and reaction function estimates compare, we can look at the different graphs provided in figure 2.7. In these graphs we compare our estimates with estimates provided by Chappell and McGregor (2015) (top left graph) and Chappell, McGregor, and Vermilyea (2014) (top right graph). We can see that we have a similar order to that of as Chappell, McGregor, and Vermilyea (2014). The differences with Chappell and McGregor (2015) are larger. For example, we have Persson as the most dovish member in our sample, whereas Chappell and McGregor (2015) put her in the middle.[17]

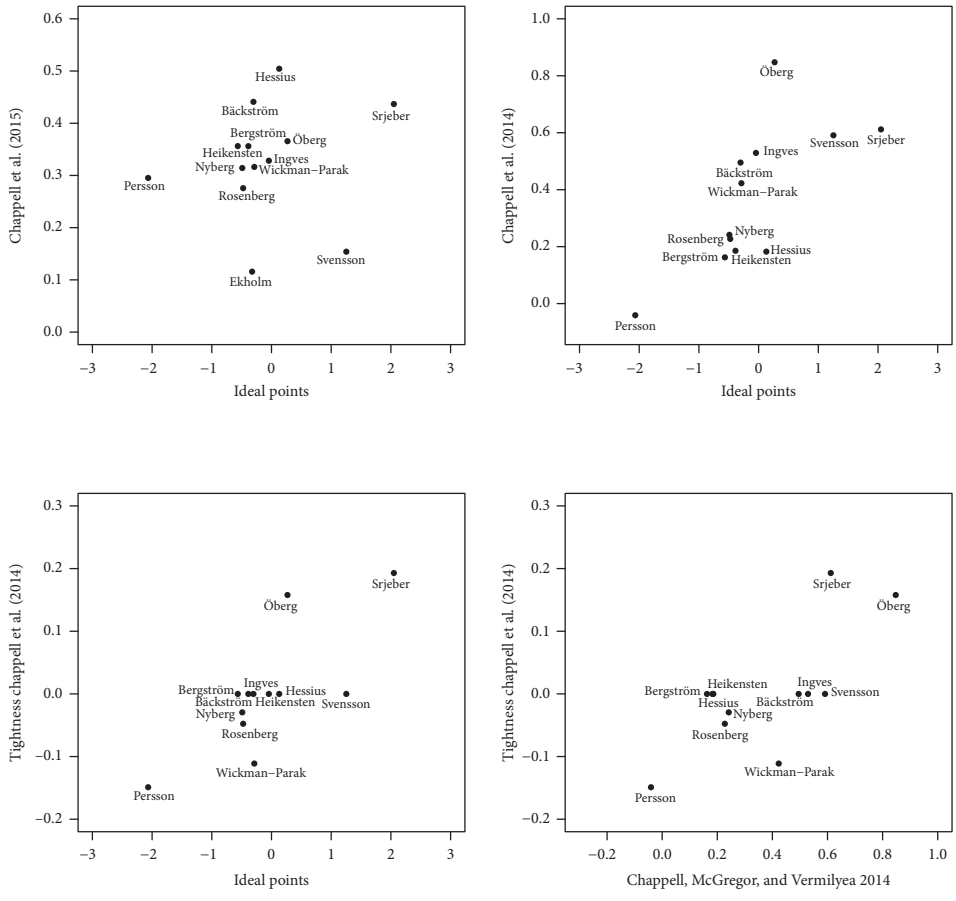

FIGURE 2.7 Comparing Estimates

Notes: The top left graph plots our ideal point estimates against estimates of preferences reported in Chappell and McGregor 2015, table 1, column 1. The top right graph reports our ideal point estimates against estimates of preferences reported in Chappell, McGregor, and Vermilyea 2014, table 7. The bottom left graph reports ideal point estimates against net tightness frequencies as provided by Chappell, McGregor, and Vermilyea 2014, table 7. The bottom right graph reports estimates of preferences reported in Chappell, McGregor, and Vermilyea 2014 versus net tightness frequencies from the same article, table 7.

The bottom row shows graphs where our estimates and the estimates reported in Chappell, McGregor, and Vermilyea (2014) are compared with *net tightness frequencies*, also taken from Chappell, McGregor, and Vermilyea (2014). This is defined as the number of times a member prefers a rate higher than the committee choice less the number of times a member prefers a lower rate, with the difference expressed as a fraction of total votes. The authors consider this a good validation check. Visual inspection suggests that our estimates seem to do well by this measure.

Furthermore, we note that we put Öberg and Srjeber in a different order from Chappell, McGregor, and Vermilyea (2014). Is Srjeber *significantly more likely to be hawkish*? Our approach allows for a fast calculation of this question. We find a nearly 97 percent chance of Srjeber being more hawkish than Öberg.

Our analysis here was mainly illustrative. A further analysis of the Riksbank can be found in Eijffinger, Mahieu, and Raes (2013b). We are aware of four papers applying this

approach to voting records of central banks: Hix, Hoyland, and Vivyan (2010), Eijffinger, Mahieu, and Raes (2013a), Eijffinger, Mahieu, and Raes (2013b) and Eijffinger, Mahieu, and Raes (2015). Hix, Hoyland, and Vivyan (2010) show that the British government has been able to move the position of the median voter in the MPC over time. Eijffinger, Mahieu, and Raes (2013a) use a similar approach to that of Hix, Hoyland, and Vivyan (2010) over a longer sample period. Their main finding is that external members tend to hold more diverse policy preferences than internal members. Furthermore, MPC members with industrial experience tend to be more hawkish. Eijffinger, Mahieu, and Raes (2013b) present a range of case studies on different central banks. Eijffinger, Mahieu, and Raes (2015) do not use voting records but use opinions expressed in FOMC meetings to create hypothetical votes which are subsequently analyzed with a hierarchical spatial voting model. Theyfind little evidence of presidential influence through appointments but do report that historically, board governors tend to hold more dovish preferences than bank presidents.

2.7 Extensions

The basic model we outlined above can be extended in various ways. There have been various extensions proposed in the literature investigating voting behavior in political bodies or judicial courts. Furthermore, one could in principle also look into the vast literature on item response theory (IRT) for interesting extensions or just propose one's own extension. We discuss here a few examples to give an idea of what is possible.

First, one could think of alternative link functions. The spatial voting model given by equation 1 can be thought of as belonging to a class of models:

$$P(y_{nt} = 1) = F(\beta_t x_n - \alpha_t), \tag{4}$$

where F is a cumulative distribution function. Instead of opting for a logistic distribution, we could also specify F to be the cumulative distribution function (cdf) of the standard normal distribution, which would lead to a probit model.

Other choices of link functions might have desirable properties. For example, Liu (2004) proposed using the cdf of t-distribution with five to eight degrees of freedom. This approximates the logistic link but has heavier tails, which makes it more robust, hence the name *robit*.

Another avenue for further research might be asymmetric link functions. This has been explored in the context of IRT models. Bazán, Branco, and Bolfarine (2006) find that a skew-probit model is more appropriate for modeling mathematical test results of pupils. We are not aware of any explorations of this in the context of votes (neither in political science nor in economics).

Eijffinger, Mahieu, and Raes (2013a) work with a modification proposed by Bafumi, Gel-man, Park, and Kaplan (2005), who propose adding a level of error ϵ_0 and ϵ_1 as follows:

$$P(y_{nt} = 1) = \epsilon_0 + (1 - \epsilon_0 - \epsilon_1)\text{logit}^{-1}(\beta_t x_n - \alpha_t). \tag{5}$$

The parameters ϵ_0 and ϵ_1 are introduced to make the model more robust to outliers.

Throughout this chapter, we focus on models that are estimated in a Bayesiann manner. This implies that another straightforward extension is to include hierarchical predictors. For example, Eijffinger, Mahieu, and Raes (2015) estimate ideal points of FOMC members using the following hierarchical setup:

$$
\begin{aligned}
P(y_{nt} = 1) &= \text{logit}^{-1}(\beta_t x_n - \alpha_t) \\
x_n &\sim N(\mu_x, \sigma_x^2) \\
\mu_x &= \gamma v_n \\
\sigma_x &\sim \text{Unif}(0,1) \\
\gamma &\sim N(0,2) \\
\beta_t &\sim N(1,4) \quad \text{truncated at 0} \\
\alpha_t &\sim N(0,4).
\end{aligned}
$$

Here the ideal points x_n are modeled as depending on predictors v_n. In their application, these predictors include whether or not the FOMC member is a board governor, a dummy variable for the appointing president, and career experiences before joining the FOMC.

Besides the extensions we discuss here, various others are possible. The IRT literature is very rich, and exploring that literature might prove to be insightful when thinking about modeling votes in committees.

2.8 Conclusion

There is a substantial literature using voting records of MPCs to learn about decision-making at central banks. This literature is motivated by the fact that central banks ought to make decisions independently, need to be held accountable for their decision-making and ideally leverage the pooling of opinions.

MPCs come, however, in a wide variety of forms often reflecting their historical development. However, even if one could redesign a central bank from scratch, it is not entirely obvious what an optimal design should look like (Reis (2013)).

The literature has studied various aspects of committees around the world. These aspects include appointment systems, career concerns, the inclusion of outsiders, size, and so on. Some aspects are relatively well understood by now, but generalizing conclusions requires carefulness because most of these studies are in essence case studies.

One way forward is the study of a more diverse set of central banks. However, to date, a number of central banks are fairly reluctant to share transcripts and voting records, despite pleas for more transparency (Eijffinger (2015)).

In this chapter, we have discussed an approach to studying voting records (and by extension transcripts). The methods we put forward are commonplace in the analysis of legislative bodies or judicial courts but are as yet underutilized in economics.

While we see substantial advantages to this approach, such as the flexibility to create quantities of interest and the careful incorporation of uncertainty, there are certainly drawbacks.

One objection to the approach outlined in this chapter is that it is too simplistic. We have heard on more than one occasion that a complex decision-making process cannot and should not be reduced to mapping policymakers on one simple dimension. This objection is similar to objections made in the context of political science (see Lauderdale and Clark (2014)). However, as demonstrated in Eijffinger, Mahieu, and Raes (2013a), even a single latent dimension generates a low prediction error and hence leaves little room for statistical improvement.

Furthermore, in the stylized spatial voting model we described here, we neglected to incorporate macroeconomic information which is often deemed to be crucial in monetary policymaking (economic growth, inflation, etc.). All this information was captured by the meeting-specific parameters α_t. In principle, one can try to model the parameters α hierarchically, as in the extension we outlined for the ideal points in the previous section. The extent to which this works remains to be explored.

It should be clear that we do not argue that spatial voting is superior to approaches commonly used in the study of MPCs (e.g., estimating reaction functions). However, we find spatial voting models a neat addition to the toolkit of scholars investigatingcommittees.

We have also touched upon some possible extensions of the spatial voting framework for researchers. Furthermore, not only voting records can be used as data but also transcripts. Eijffinger, Mahieu, and Raes (2015) use transcripts to create artificial voting records. Another approach could be to use text analysis (see Baerg and Lowe (2016)) in addition to spatial voting models.

Notes

1. See, for example, the survey by Lybek and Morris (2004). The book by Siklos, Bohl, and Wohar (2010) shows the diversity in institutional framework among central banks.
2. On top of purely technical skills, there may be a need for some political skills as well; see Goodhart and Meade (2004), 14–16.
3. See Gerling, Grüner, Kiel, and Schulte (2005) for a survey.
4. Papers studying this topic include Meade and Sheets (2005), Chappell, McGregor, and Vermilyea (2008), Hayo and Neuenkirch (2013), Bennani, Farvaque, and Stanek (2015) and Jung and Latsos (2015).
5. Other cross-country studies are Vaubel (1997), Göhlmann and Vaubel (2007), Belke and Potrafke (2012).
6. See, for example, Chappell, Havrilesky, and McGregor (1993), Tootell (1996), Chappell, Havrilesky, and McGregor (1995), Havrilesky and Gildea (1995), Chang (2001), Falaschetti (2002), Adolph (2013).
7. It should be added that the degree of individualism at the FOMC has evolved over time. Many researchers attribute a lower degree of individualism to the influence of the governor; see Blinder (2009).
8. Extending the model to higher dimensions is possible, although identification (see below) becomes more complicated. We limit ourselves here to one-dimensional models as it facilitates the discussion. We return to the issue of one latent dimension later on.

9. This discussion and example are taken from Eijffinger, Mahieu, and Raes (2013a).
10. See also the discussion in Jackman (2009) 458–459.
11. A more detailed analysis of ideal points in the Executive Board of the Riksbank can be found in Eijffinger, Mahieu, and Raes (2013b). An insightful discussion on the history and workings of the Executive Board of the Riksbank is Apel, Claussen, and Lennartsdotter (2010).
12. Apel, Claussen, and Lennartsdotter (2010) provide some survey evidence from Executive Board members indicating that there is some *bargaining region* in repo decisions. When the majority vote is reasonably close to their own assessment, some executive members occasionally refrain from entering reservations.
13. In our sample period, we have no meetings where more than two policy alternatives were mentioned in the voting record.
14. Two remarks are in order regarding this result. First, this result comes from the restricted sample we use. Second, these ranks are *relative* statements.
15. It should be understood that a statement like this is conditional on the model being *true*. This is clearly never the case, so this statement holds strictly speaking only in the model world. See McElreath (2016) for an insightful discussion.
16. To be clear, Bayesian inference is not necessarily immune to this problem, but in some cases we may have good hope that Bayesian approaches have superior large sample properties; see Jackman (2009), 437. In the case of ideal point models, we are not aware of research looking at bias and confidence interval coverage for data of the size we often deal with in the context of MPCs.
17. We should point out these are not the preferred estimates by Chappell and McGregor (2015). We pick these estimates to illustrate how different preferences estimates can be.

References

Adolph, C. 2013. *Bankers, Bureaucrats, and Central Bank Politics: The Myth of Neutrality*. New York: Cambridge University Press.

Apel, M., C. Claussen, and P. Lennartsdotter. 2010. "The Executive Board of the Riksbank and Its Work on Monetary Policy—Experiences from the First Ten Years." *Economic Review, Riksbank*.

Baerg, N. R., and W. Lowe. 2016. "A Textual Taylor Rule: Estimating Central Bank Preferences Combining Topic and Scaling Methods." Mimeo.

Bafumi, J., A. Gelman, D. K. Park, and N. Kaplan. 2005. "Practical Issues in Implementing and Understanding Bayesian Ideal Point Estimation." *Political Analysis* 13: 171–187.

Ball, L. 2016. "Ben Bernanke and the Zero Bound." *Contemporary Economic Policy* 34, no. 1: 7–20.

Bazán, J. L., M. D. Branco, and H. Bolfarine. 2006. "A Skew Item Response Model." *Bayesian Analysis* 1, no. 4: 861–892.

Belke, A., and N. Potrafke. 2012. "Does Government Ideology Matter in Monetary Policy? A Panel Data Analysis for OECD Countries." *Journal of International Money and Finance* 31, no. 5: 1126–1139.

Bennani, H., E. Farvaque, and P. Stanek. 2015. "FOMC Members' Incentives to Disagree: Regional Motives and Background Influences." NBP working paper 221, Warsaw.

Besley, T., N. Meads, and P. Surico. 2008. "Insiders versus Outsiders in Monetary Policymaking." *American Economic Review* 98, no. 2: 218–23.

Bhattacharjee, A., and S. Holly . 2010. "Rational Partisan Theory, Uncertainty, and Spatial Voting: Evidence for the Bank of England's MPC." *Economics and Politics* 22, no. 2: 151–179.

Blinder, A. 2004. *The Quiet Revolution: Central Banking Goes Modern*. New Haven: Yale University Press.

Blinder, A. S. 2009. "Making Monetary Policy by Committee." *International Finance* 12, no. 2: 171–194.

Chang, K. 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* 17, no. 2: 319–355.

Chappell, H. W., T. M. Havrilesky, and R. R. McGregor. 1995. "Policymakers, institutions, and Central Bank Decisions," *Journal of Economics and Business* 47, no. 2: 113–136.

Chappell, H. W., T. M. Havrilesky, and R. R. McGregor. 2000. "Monetary Policy Preferences of Individual FOMC Members: A Content Analysis of the Memoranda of Discussion." *Review of Economics and Statistics* 79, no. 3: 454–460.

Chappell, H. W. J., and R. R. McGregor. 2015. "Central Bank Voting and the Incidental Parameters Problem." Working paper.

Chappell, H. W., R. R. McGregor, and T. A. Vermilyea. 2007. "The Role of the Bias in Crafting Consensus: FOMC Decision Making in the Greenspan Era." *International Journal of Central Banking* 3, no. 2: 39–60.

Chappell, H. W., R. R. McGregor, and T. A. Vermilyea. 2008. "Regional Economic Conditions and Monetary Policy." *European Journal of Political Economy* 24, no. 2: 283–293.

Chappell, H. W., R. R. McGregor, and T. A. Vermilyea. 2014. "Power-Sharing in Monetary Policy Committees: Evidence from the United Kingdom and Sweden." *Journal of Money, Credit and Banking* 46. no. 4: 665–692.

Chappell, Henry W. J., T. M. Havrilesky, and R. R. McGregor. 1993. "Partisan Monetary Policies: Presidential Influence through the Power of Appointment." *Quarterly Journal of Economics* 108, no. 1: 185–218.

Clinton, J., S. Jackman, and D. Rivers. 2004. "The Statistical Analysis of Roll Call Data." *American Political Science Review* 98, no. 2: 355–370.

Eichler, S., and T. Lähner. 2014. "Forecast Dispersion, Dissenting Votes, and Monetary Policy Preferences of FOMC Members: The Role of Individual Career Characteristics and Political Aspects." *Public Choice* 160, no. 3–4: 429–453.

Eijffinger, S. 2015. "Monetary Dialogue 2009–2014: Looking Backward, Looking Forward." *Kredit und Kapital* 48, no. 1: 1–10.

Eijffinger, S., R. Mahieu, and L. Raes. (2018) "Inferring Hawks and Doves from Voting Records." *European Journal of Political Economy* 51:107–120.

Eijffinger, S. C., R. J. Mahieu, and L. Raes. 2013a. "Estimating the Preferences of Central Bankers: An Analysis of Four Voting Records." CEPR discussion paper DP9602.

Eijffinger, S. C., R. Mahieu, and L. Raes. 2015. "Hawks and Doves at the FOMC." CEPR discussion paper DP10442.

El-Shagi, M., and A. Jung. 2015. "Does the Greenspan Era Provide Evidence on Leadership in the FOMC?" *Journal of Macroeconomics* 43: 173–190.

Falaschetti, D. 2002. "Does Partisan Heritage Matter? The Case of the Federal Reserve." *Journal of Law, Economics, and Organization* 18, no. 2: 488–510.

Gerlach-Kristen, P. 2009. "Outsiders at the Bank of England's MPC." *Journal of Money, Credit and Banking* 41, no. 6: 1099–1115.

Gerlach-Kristen, P., and E. Meade. 2010. "Is There a Limit on FOMC Dissents? Evidence from the Greenspan Era." Mimeo.

Gerling, K., H. P. Grüner, A. Kiel, and E. Schulte. 2005. "Information Acquisition and Decision Making in Committees: A Survey." *European Journal of Political Economy* 21, no. 3: 563–597.

Göhlmann, S., and R. Vaubel. 2007. "The Educational and Occupational Background of Central Bankers and Its Effect on Inflation: An Empirical Analysis." *European Economic Review* 51, no. 4: 925–941.

Goodhart, C., and E. Meade. 2004. "Central Banks and Supreme Courts." *Moneda y Credito* 218: 11–42.

Goodhart, C. A. 2002. "The Constitutional Position of an Independent Central Bank." *Government and Opposition* 37, no. 2: 190–210.

Harris, M., P. Levine, and C. Spencer. 2011. "A Decade of Dissent: Explaining the Dissent Voting Behavior of Bank of England MPC Members." *Public Choice* 146, no. 3: 413–442.

Harris, M. N., and C. Spencer. 2009. "The Policy Choices and Reaction Functions of Bank of England MPC Members." *Southern Economic Journal* 76, no. 2: 482–499.

Havrilesky, T., and J. Gildea. 1991. "Screening FOMC Members for Their Biases and Dependability." *Economics & Politics* 3, no. 2: 139–149.

Havrilesky, T., and J. Gildea. 1995. "The Biases of Federal Reserve Bank Presidents." *Economic Inquiry* 33, no. 2: 274.

Hayo, B., and M. Neuenkirch. 2013. "Do Federal Reserve Presidents Communicate with a Regional Bias?" *Journal of Macroeconomics* 35: 62–72.

Hix, S., B. Hoyland, and N. 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* 49, no. 6: 731–758.

Horvath, R., M. Rusnak, K. Smidkova, and J. Zapal. 2014. "The Dissent Voting Behaviour of Central Bankers: What Do We Really Know?" *Applied Economics* 46, no. 4: 450–461.

Jackman, S. 2009. *Bayesian Analysis for the Social Sciences*. Chichester: John Wiley.

Jung, A., and G. Kiss. 2012. "Preference Heterogeneity in the CEE Inflation-Targeting Countries." *European Journal of Political Economy* 28, no. 4: 445–460.

Jung, A., and S. Latsos. 2015. "Do Federal Reserve Bank Presidents Have a Regional Bias?" *European Journal of Political Economy* 40: 173–183.

Lauderdale, B. E., and T. S. Clark. 2014. "Scaling Politically Meaningful Dimensions Using Texts and Votes." *American Journal of Political Science* 58, no. 3: 754–771.

Liu, C. 2004. "Robit Regression: A Simple Robust Alternative to Logistic and Probit Regression." In *Applied Bayesian Modeling and Causal Inference from an Incomplete-Data Perspective*, edited by A. Gelman and X. L. Meng, 227–238. Chichester: John Wiley.

Lybek, T., and J. Morris. 2004. "Central Bank Governance: A Survey of Boards and Management."

McElreath, R. 2016. *Statistical Rethinking: A Bayesian Course with Examples in R and Stan,* Boca Raton: CRC Press.

Meade, E. E., and D. N. Sheets. 2005. "Regional Influences on FOMC Voting Patterns." *Journal of Money, Credit and Banking* 37, no. 4: 661–77.

Reis, R. 2013. "Central Bank Design." *The Journal of Economic Perspectives* 27, no. 4: 17–43.

Siklos, P. L., M. T. Bohl, and M. E. Wohar. 2010. *Challenges in Central Banking: The Current Institutional Environment and Forces Affecting Monetary Policy*. Cambridge: Cambridge University Press.

Siklos, P. L., and M. Neuenkirch. 2015. "How Monetary Policy is Made: Two Canadian Tales." *International Journal of Central Banking* 11, no. 1: 225–250.

Thornton, D. L., D. C. Wheelock. 2014. "Making Sense of Dissents: A History of FOMC Dissents." *Federal Reserve Bank of St. Louis Review* 96, no. 3: 213–227.

Tootell, G. M. 1996. "Appointment Procedures and FOMC Voting Behavior." *Southern Economic Journal* 63, no. 1: 191–204.

Vaubel, R. 1997. "The Bureaucratic and Partisan Behavior of Independent Central Banks: German and International Evidence." *European Journal of Political Economy* 13, no. 2: 201–224.

CHAPTER 3

PEAKS AND TROUGHS

Economics and Political Economy of Central Bank Independence Cycles

DONATO MASCIANDARO AND DAVIDE ROMELLI

3.1 Introduction

In 1824, David Ricardo wrote:

> It is said that Government could not be safely entrusted with the power of issuing paper money; that it would most certainly abuse it. . . . There would, I confess, be great danger of this if Government—that is to say, the Ministers—were themselves to be entrusted with the power of issuing paper money.

Ricardo's ideas, nowadays, are a closer representation of the functioning of monetary policy institutions than ever before in history. Central bankers can implement their policies with a degree of autonomy that their predecessors would have only dreamed of. Yet the history of central banks is rich in modifications to their role and functions (Goodhart 1988; Lastra 1996; Goodhart 2011). In particular, over the past four decades, central banks around the world have seen their mandates progressively narrowed and zoomed in on the goal of price stability. At the same time, this narrowing mandate has been accompanied by changes in their governance arrangements, the main focus of which became an increasing degree of independence of monetary policy authorities from the executive power.

This evolution, prompted by Kydland and Prescott's (1977) well-known time inconsistency problem, has attracted a significant interest from the economic profession starting in the 1990s, when the first indices of central bank independence (CBI) were developed. Figure 3.1 displays this growing interest in CBI by showing the number of academic papers and research studies published with a title containing these keywords

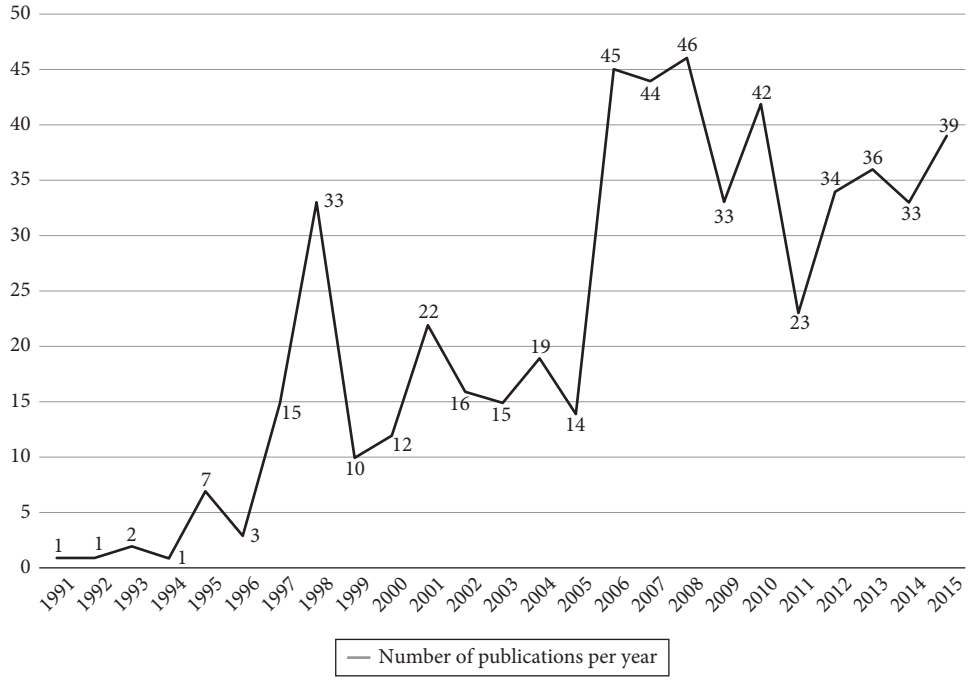

FIGURE 3.1 Research and Policy Articles with a "Central Bank Independence" title (1991–2015)

Note: Data obtained from SSRN and JSTOR.

between 1991 and 2015.[1] During the period 1991–1998, sixty-four research and policy articles were published, peaking in 1998 with thirty-three publications. The 2000s saw a new wave of research in the field (253 published articles), with a new peak of forty-six published articles in 2008. Recent years have seen a renewed interest in studying CBI, with an increasing trend in the number of publications on the topic.

This evolution of research on CBI has followed closely the pace of reforms in central bank institutional design. For example, throughout the 1990s, a large wave of reforms that increased the degree of independence of monetary policy institutions was observed in both developed and developing countries. Similarly, the increased interest in recent years was brought about by the debate on the optimal design of central banks which sparked after the 2008 global financial crisis (GFC).

The GFC has posed new challenges to modern central banking models, in which monetary policy is conducted by an independent central bank that follows an interest-rate rule-based approach to stabilize inflation and output gaps (Goodhart, Osorio, and Tsomocos 2009; Alesina and Stella 2010; Aydin and Volkan 2011; Curdia and Woodford 2011; Giavazzi and Giovannini 2011; Gertler and Karadi 2011; Issing 2012; Woodford 2012; Cohen-Cole and Morse 2013; Cukierman 2013). In the aftermath of the crisis, there has been a large number of important reforms to central bank governance, in particular regarding the involvement of central banks in banking and financial supervision

(Masciandaro and Romelli 2018). For example, the Dodd-Frank Act of 2010 increased the responsibilities of the Fed as prudential supervisor (Komai and Richardson 2011; Gorton and Metrick 2013).[2] In Europe, the European Systemic Risk Board (ESRB), established in 2010, provides macroprudential supervision of the European Union's financial system under the guidance of the European Central Bank (ECB), while the European Single Supervisory Mechanism (SSM), which started operating in November 2014, assigns banking-sector supervision responsibilities to the ECB together with national supervisory authorities. These reforms indicate a reversal in central bank governance, since granting more supervisory power to the central bank is generally associated with a lower degree of CBI (Masciandaro and Quintyn 2009; Orphanides 2011; Eichengreen and Dincer 2011; Masciandaro 2012a and 2012b; Masciandaro and Quintyn 2015).[3]

In this chapter, we provide an overview of this evolution in CBI over the past four decades. We investigate the endogenous determination of central bank institutional design from both a theoretical and an empirical perspective. Theoretically, we build a small, stylized political economy model in which citizens delegate to policymakers the optimal design of central bank governance. This toy model is used to highlight some key determinants that can explain the evolution of CBI as a function of macroeconomic shocks and political economy characteristics of countries. We then employ recently developed dynamic indices of CBI to highlight the peaks and troughs of CBI over the period 1972–2014. Using the recomputed Grilli, Masciandaro, and Tabellini (1991) index in Arnone and Romelli (2013) and Romelli (2018), we highlight several interesting trends in central bank design. For a sample of sixty-five countries, we show that the increasing trend in CBI over the period 1972–2007, was reversing after the GFC, mainly due to the significant changes to the roles of central banks in banking supervision.

We then provide a systematic investigation of the political economy and macroeconomic characteristics that are associated with CBI over time. Employing a dynamic index of CBI, we analyze the evolution of CBI across a large sample of countries and over time and highlight some new interesting determinants of the endogenous evolution of central bank design. We find that legacy matters, that is, that past levels of CBI are highly correlated to future ones. We also show that past episodes of high inflation are positively correlated with high levels of CBI in the following periods. This corroborates the findings in Crowe and Meade (2008) and suggests that high inflation aversion does, indeed, constrain governments to assign higher degrees of independence to their central banks. However, taking stock of our richer panel data, we show that the effect of inflation aversion vanishes in recent years (2000–2014), when the degree of CBI tends to be more closely related to other types of macroeconomic shocks such as fiscal and exchange-rate shocks.

Section 3.2 of this chapter provides a systematic overview of the literature in CBI over the past decades. Section 3.3 presents a stylized model that can explain the drivers of the optimal level of CBI. Section 3.4 discusses the data employed and some descriptive statistics, while section 3.5 presents the empirical strategy and results, and section 3.6 concludes.

3.2 The Design of CBI: The State of the Art

Starting with the new classical revolution, a large literature has been concerned with the optimal institutional design of monetary policy authorities and how this impacts macroeconomic outcomes. The main theoretical argument is that policymakers tend to use monetary tools with a short-sighted perspective, by using an inflation tax to smooth different kinds of macroeconomic shocks, in an attempt to exploit the short-term trade-off between real economic gains and nominal (inflationary) costs.[4] Moreover, the more efficient markets are, the greater the risk that the short-sighted monetary policies just produce inflationary distortions, as rational agents will anticipate the political incentives of using an inflation tax and will fully adjust their expectations. In this framework, the Friedman-Lucas proposition on monetary policy neutrality holds (Friedman 1968; Lucas 1973). Furthermore, this political inflation bias can generate even greater negative externalities, such as a moral hazard among politicians (if the inflation tax is used for public finance accommodation) or bankers (if the monetary laxity is motivated by bank bailout needs) (Nolivos and Vuletin 2014).

As a result, in the late 1970s and early 1980s, the idea of banning the use of monetary policy for inflation tax purposes received a broad consensus among policymakers and the academic community. Consequently, as soon as this institutional setting gained momentum, the relationship (governance) between the policymakers (responsible for the design of policies) and the central bank (in charge of monetary policy) became crucial in avoiding the inflation bias. In this context, Rogoff (1985) argues that only an independent central bank is able to implement credible monetary policies that will favor lower inflation rates and thus eliminate the time inconsistency problem of government policies (Kydland and Prescott 1977).[5] Walsh (1995a) proposes an alternative way to model CBI using a principal-agent framework that underlines the importance of assigning stronger incentives to central bankers in order to reach the socially optimal policy. For example, the Reserve Bank of New Zealand Act of 1989 establishes a contract between the central bank and the government that is close in spirit to Walsh's optimal central bank contract (Walsh 1995b).

The optimal design of central bank governance is essentially a two-sided medal. On one side, the central banker has to be independent, that is, implement its policies without any external (political) short-sighted interference. Therefore, the central banker becomes a veto player against inflationary monetary policies. On the other side, the central banker has to be conservative, where being conservative refers to the importance that he or she assigns to medium-term price stability in its relation to other macroeconomic objectives. Thus, being conservative is a necessary condition to avoid the central banker himself or herself becoming a source of inflation bias, and independence is often considered as the premise for conservative monetary policies. Moreover, independent

and conservative central banks are credible if and only if the institutional setting in which they operate guarantees the accountability and transparency of their policies.

Given these key characteristics of monetary policy settings, a large literature has developed a set of indices that attempt to capture the institutional features of central banks and gauge their degree of independence, conservatism, and transparency. Seminal works include Bade and Parkin (1982), Grilli, Masciandaro, and Tabellini (1991), Cukierman (1992), and Masciandaro and Spinelli (1994).[6] Most of these indices develop de jure indices of independence based on central bank charters. One exception is Cukierman (1992), who first distinguishes between legal and de facto indicators of independence. These classical indices of independence have been updated by, among others, Cukierman, Miller, and Neyapti (2002) and Jácome and Vazquez (2008) for the Cukierman index and Arnone et al. (2009) and Arnone and Romelli (2013) for the Grilli, Masciandaro, and Tabellini index. Moreover, several recent works extend previous measures of CBI by looking at other central bank characteristics. For example, Crowe and Meade (2008) and Dincer and Eichengreen (2014) develop measures of CBI and transparency. Vuletin and Zhu (2011) propose a new de facto index of independence, identifying two different mechanisms embedded in the measure of the turnover rate of central bank governors (see also Dreher, Sturm, and de Haan 2008 and 2010)

Together with the construction of these indices of central independence, a large literature has attempted to determine whether the degree of independence is associated with important macroeconomic indicators such as inflation rates, public debt, and interest rates, as well as income and growth. The assumption was to verify if the existence of a monetary veto player reduces the intended and unintended effects of the misuse of the inflation tax and produces positive spillovers on other macroeconomic variables. By and large, this literature has produced mixed results (de Haan and Sturm 1992; Alesina and Summers 1993; Alesina and Gatti 1995; Posen 1995; Forder 1996; Campillo and Miron 1997; Sturm and de Haan 2001; Gutierrez 2003; Jácome and Vázquez 2008; Siklos 2008; Ftiti, Aguir, and Smida 2017). For example, Klomp and de Haan (2010b) perform a meta regression analysis of fifty-nine studies, examining the relationship between inflation and CBI, and confirm the existence of a negative and significant relation between inflation and CBI in Organization for Economic Cooperation and Development (OECD) countries, although the results are sensitive to the indicator used and the estimation period chosen. More recent studies nonetheless confirm the importance of the legal CBI in explaining inflation rates (Cukierman 2008; de Haan, Masciandaro, and Quintyn 2008; Carlstrom and Fuerst 2009; Down 2009; Alpanda and Honig 2009; Alesina and Stella 2010; Klomp and de Haan 2010a; Maslowska 2011; Arnone and Romelli 2013), government deficits (Bodea 2013), and financial stability (Cihak 2007; Klomp and de Haan 2009; Ueda and Valencia 2014).[7]

Despite this growing consensus, the GFC has once again brought central banks to the core of policy and academic debate by highlighting the need to reconsider, among others, their role in banking supervision (Masciandaro 2012b) and financial stability. Central banks around the world are now perceived as policy institutions with the goal of promoting monetary *and* financial stability, a double mandate that might bring a

new form of time inconsistency problem (Nier 2009; Ingves 2011; Ueda and Valencia 2014). Yet empirical investigations on the interplay between CBI and financial stability have led to confounding results. For instance, Cihak (2007) and Klomp and de Haan (2009) find that CBI fosters financial stability, while Berger and Kißmer's (2013) analysis suggests that more independent central banks are less willing to prevent financial crises. Finally, it is also important to notice how, starting from 2008, central banks such as the Federal Reserve and the Bank of England, have implemented large-scale quantitative easing (QE) policies. Despite the little evidence of significant side effects of these policies, the potential losses that could result from these nonconventional operations might threaten CBI in the future (Goodfriend 2011; Ball et al., 2016).[8]

The large majority of these empirical studies essentially consider CBI as an exogenous (independent) variable that can be useful to explain macroeconomic trends. Yet successive research has argued that political institutions such as central banks evolve endogenously as a response to a set of macroeconomic factors (Farvaque 2002; Aghion, Alesina, and Trebbi 2004; Polillo and Guillén 2005; Brumm 2006 and 2011; Bodea and Hicks 2015; Romelli 2018). The step forward in this line of research is then to consider the degree of CBI as an endogenous (dependent) variable that has to be explained.[9] Which are the drivers that can motivate the decision of a country to adopt a certain degree of independence of the central bank? Why and how are policymakers forced to implement reforms that reduce their powers in using the inflation tax, increasing the degree of independence of the central bank? Various hypotheses have been advanced to explain the genesis of the political process that leads a monetary policy regime to assume a given set of characteristics. Developments in endogenizing CBI have been the subject of analysis in both economics and political science. One argument relates to the possibility that the degree of CBI depends on the presence of constituencies that are strongly averse to the use of the inflation tax, which drives policymakers to bolster the status of the central bank (the constituency view).[10] Other views argue that the aversion to the use of the inflation tax is structurally written in the features of the overall legislative and/or political system, which influence policymakers' decision on whether to have a more or less independent central bank (the institutional view).[11] Yet another view stresses the role of culture and traditions of monetary stability in a country in influencing policymakers' choices (the culture view).[12]

These three views share the role of the preferences of citizens in determining the degree of CBI (Masciandaro and Romelli 2015). In the constituency view, the present preferences against the use of the inflation tax are relevant; in the institutional and culture views, the past anti-inflationary preferences influence the present policymakers' decisions. It is also evident that these preferences might change following periods of economic turmoil, prompting a wave of reforms in the design of the central bank governance.

Overall, whatever the adopted view in explaining the evolution of CBI, our attention should focus on two crucial elements: social preferences and the incentives and constraints that shape the behavior of the agent responsible for the monetary setting