Conventional and Unconventional Votes:
A Tale of Three Monetary Policy Committees

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Abstract

Following the 2008 global financial crisis, short-term interest rates in a number of major economies reached the effective zero-lower bound (ZLB), joining Japan, which has experienced prolonged deflation and virtually zero interest-rates since 1998. In such a low policy interest-rate environment, members of monetary policy committees no longer vote solely on the level of the policy-rate, but measures which are commonly described as being 'unconventional'. Focussing on the experience of the United States FOMC, the Bank of Japan's Policy Board, and the Bank of England's MPC, the drivers of dissent voting behavior under conventional and unconventional monetary policy regimes are modeled. Among our findings, we show that relative to conventional policy regimes, committee members voting in unconventional regimes who are (*i*) *directly* appointed by the government, and (*ii*) appointed in periods during which left-wing governments are in power, are more likely to dissent on the side of monetary ease. Put another way, the decision to dissent is partially governed by whether the monetary policy regime is a conventional or an unconventional one.

Key Words: quantitative easing, conventional and unconventional monetary policy regimes, dissent voting, monetary policy committees, panel data, career characteristics.

JEL Classification: O11, O33, O47, L52, C22.

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1 Introduction

Whilst the literature on monetary policy committee decision making is replete with papers that empirically model aspects of voting behavior associated with how the short-term interest rate is set (see for example Chappell, Havrilesky, and McGregor 1993; Besley, Meads, and Surico 2008; Harris, Levine, and Spencer 2011), scant attention has been paid to how individual committee members vote when faced with policy measures *other* than setting the policy rate as the main instrument of monetary policy. This assertion has particular resonance in wake of the 2007-2008 global financial crisis (GFC), where short-term interest rates in a number of major industrialized economies reached the effective nominal zero-lower bound (ZLB), joining Japan, a country that has experienced prolonged deflation and exceptionally low interest rates since 1998.[1] In such a low interest rate environment, and when confronted with an extraordinarily dismal economic outlook, members of monetary policy committees no longer merely vote on and adopt policy proposals appertaining to the appropriate level of the short-term interest rate; rather, *in addition to* voting to keep the short-term interest rate at or close to the ZLB, members vote on policy decisions which are commonly described as being 'unconventional' or 'unorthodox' (see for instance: Fujiki, Okina, and Shiratsuka 2001; Joyce, Tong, and Woods 2011; Shiratsuka 2010; Ito 2009). Such decisions typically involve the central bank conducting large scale asset purchases, and are taken because at the ZLB, further reductions in the short-term interest rate to stimulate the economy are no longer possible.[2]

Using data on individuals' career background and personal characteristics for three monetary policy committees (the United States Federal Open Market Committee (FOMC), the Bank of Japan Policy Board (PB), and the Bank of England Monetary Policy Committee (MPC)), this paper models the determinants of dissent voting behavior. Our analysis exploits information corresponding to both *conventional* votes on monetary policy - that is, votes on the level of the short-term policy rate; and what we label *unconventional votes* - that is, votes on policy proposals to provide monetary stimulus via measures such as

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[1]The GFC refers to a series of events beginning in the United States in latter part of 2007, which culminated in the collapse of Lehman Brothers in September 2008. Due to the global interconnectedness of financial markets and institutions, severe financial distress was experienced in many advanced industrialized countries other than the US, including the UK. The severity of the crisis caused many affected economies to experience significant falls in output, which led to central banks reducing short-term interest rates to near zero levels coupled with the introduction of 'unconventional' monetary policies, such as quantitative easing. For excellent accounts of the GFC, and its causes and consequences, see Mishkin (2011) and Mizen (2008).

[2]Historically, the introduction of 'unconventional' policies in Japan during the mid-1990s and in countries affected by the GFC, heralded the end of an extended period spanning the mid-to-late 20th century, where central banking in advanced industrialized economies had become characterized by a narrow yet well-defined policy range (Ishi, Fujita, and Stone 2011). For instance, prior to the 1950s, the remit of many central banks typically encompassed a variety of quasi-fiscal activities, and it was the difficulties caused by fiscal mission creep and related high inflation which resulted in the policy range diminishing. See Allen (2012) for a discussion of QE type measures used in the context of debt management in Britain since 1919.

quantitative easing (QE). A noteworthy innovation in our paper is to employ an approach to coding members' dissents which extends Xiong (2012), who estimates the determinants of the 'policy stance' of the People's Bank of China (PBC): as no single instrument best captures the PBC's policy standpoint for the sample period under scrutiny, the author creates a *monetary policy stance index* which is exploited to create a discrete trichotomous ordered dependent variable; this variable captures the PCB's decision to adopt a looser, unchanged, or tighter policy stance, respectively. In our model, we construct an ordered dependent variable that captures a member's decision to dissent on the side of monetary ease, assent, or dissent on the side of monetary tightness during monetary policy committee meetings. This innovation permits us to gauge a member's overall policy stance, irrespective of whether he or she is voting on a conventional or an unconventional policy measure.[3] In adopting this approach, we not only contribute to the literature on career characteristics and monetary policy voting (see for instance: Havrilesky 1995; Havrilesky and Gildea 1991b; Havrilesky and Schweitzer 1990; Harris, Levine, and Spencer 2011); we provide a framework within which it is possible to gauge the impact of career and personal characteristics on monetary policy decisions *without* having to break up the sample period due to a change in the main policy instrument. This is especially important given that our sample period straddles the pre- and post-GFC periods, during which the US Federal Reserve (Fed), the Bank of England (BoE), and the Bank of Japan (BoJ) changed their main instrument of monetary policy from a conventional to an unconventional one.

The paper proceeds as follows. First, we discuss the institutional characteristics of the FOMC, MPC and PB, with a view to familiarizing the reader with their similarities and differences. We then discuss why members of a monetary policy committee might be expected to dissent during meetings. This is followed by an overview of our data in which we: (i) elaborate on our aforementioned notions of 'conventional' and 'unconventional' votes; and (ii) construct a measure of members' (dissenting) policy stances à la Xiong (2012). Table 1 provides an overview of the sample periods under consideration. For the FOMC we cover the period August 18th 1987 to January 29th 2014, which spans the entirety of the Greenspan and Bernanke Chairmanships. For the BoE, our sample encompasses the entire period under which Governors George and King successively chaired the MPC, covering its very first meeting held June 6th 1997, up to and including the meeting held on June 6th 2013. With respect to the BoJ, we investigate the period under which the nine-member PB was chaired by BoJ Governors Hayami, Fukui, and Shirakawa, respectively. This period covers the dates April 9th 1998 to March 3rd 2013 inclusive. In all, our analysis exploits information pertaining to 701 policy meetings and 6197 votes.

To preview our results, random effects ordered probit analysis indicates that career

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[3]As is shown later, during periods in which unconventional policies were pursued, monetary policy committee members typically voted for 'two-pronged' policy proposals which simultaneously incorporated an 'unconventional' measure (i.e., a recommendation for a given level of asset purchases) and a 'conventional' one (a policy rate recommendation).

Table 1: Time periods associated with each committee Chairmanship

Committee	Chairman	Dates served✠
FOMC (18/08/1987–29/01/2014)	Alan Greenspan♦	11/08/1987 − 31/01/2006
	Ben Bernanke	01/02/2006 − 31/01/2014
MPC (06/06/1997–06/06/2013)	Eddie George	06/06/1997 − 30/06/2003
	Mervyn King	01/07/2003 − 30/06/2013
PB (09/04/1998–03/03/2013)	Masaru Hayami	20/03/1998 − 19/03/2003
	Toshihiko Fukui	19/03/2003 − 19/03/2008
	Masaaki Shirakawa	09/04/2008 − 19/03/2013

✠ This table focuses on the dates served as *committee* Chairman, and not the complete tenure of the central bank Chair/Governor *per se*. For instance, Eddie George began his Governorship of the Bank of England on 30/06/1993, four years before the creation of the MPC.
* Dates use the format *day/month/year*.
♦ Served as Chairman Pro-Tempore for all FOMC meetings held 03/03/1996 − 20/06/1996.
♣Shirakawa was initially appointed as a Deputy Governor on 20/03/2008 for what was to be a five-year term ending 19/03/2013. He served only 20 days in this role, a role which saw him concurrently serve as acting Governor of the BoJ. Immediately following this, Sharakawa was promoted to the position of Governor for a five-year term commencing 09/04/2008.

backgrounds do not measurably affect an individual's decision to dissent. This finding reinforces the main result of Harris, Levine, and Spencer (2011) who find that career backgrounds exert a negligible impact on dissents cast by MPC members; however, it completely overturns the findings of studies which suggest that career backgrounds are a significant determinant of FOMC dissents (Havrilesky and Schweitzer 1990). Dissents are instead shown to be driven by other factors: amongst other findings we uncover evidence that members appointed by left-wing governments are more likely to dissent on the side of monetary ease, which is consistent with findings in the political economics and public choice literature (Alesina and Roubini 1992; Chappell, Havrilesky, and McGregor 1993). We also uncover evidence that the pattern of dissents differs depending if the main tool of monetary is conventional or unconventional in nature.

2   Committees and Monetary Policy

Common to the Fed, the BoE, and the BoJ is the fact that monetary policy decisions are delegated to a committee. From an historical perspective, the establishment and design of this institutional feature varies depending on the central bank in question. For instance, the United States *Federal Open Market Committee* (FOMC) was created due

to the 1933 Banking Act, and assumed its present day structure as a result of the 1935 Banking Act and its subsequent amendment in 1942.[4] It held its first meeting in 1936, and has twelve voting members, seven of whom are members of the Board of Governors of the Federal Reserve System. These members are appointed by the US President subject to being confirmed by the Senate, and serve fourteen year terms. The five remaining members are Federal Reserve Bank (FRB) presidents. Of this group, only the president of the FRB New York has permanent FOMC voting rights, whereas the remaining four positions are subject to a rotating annual membership shared between the remaining eleven FRB presidents. All FRB presidents are appointed to five-year renewable terms by a FRB's board of directors, albeit final approval for the appointment is also required from the Board of Governors of the Federal Reserve System. All non-voting members also participate in FOMC meetings and discussions, and meetings are typically held eight times a year.

The remaining two committees were established more recently. The present form of the BoJ's *Policy Board* (PB) is attributable to the Bank of Japan Law of 1998, which relative to the Bank of Japan Act of 1942 and its revision in 1949, aimed to bolster the independence of policy making and PB member appointments.[5] It consists of nine members: the Governor and two Deputy Governors of the Bank (which we refer to as the *Troika*), and what we refer to as six '*rank-and-file*' members who are typically chosen from industry, academia and the financial sector. All members have permanent voting rights in PB meetings, and prior to being appointed, all members are nominated by the government and require approval by the Diet. Significantly, the PB was originally established in 1949 as a seven member committee, although neither the minutes of its meetings nor the voting record for the 1949-1997 period have ever been placed in the public domain.[6]

Finally, the BoE's nine member *Monetary Policy Committee* (MPC) was established due to the Bank of England Act of 1998, although it operated on a *de facto* basis from June 1997 until June 1998, when the Act officially came into force. Detailed accounts of the Act and the MPC's institutional environment are given in Rodgers (1997, 1998) and Budd (1998). Prior to its establishment, monetary policy decisions were taken by the

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[4]The 1933 Banking Act originally legislated for the FOMC to be a 12-member body comprised only of representatives from each of the 12 Federal Reserve Banks. This provision was superseded by the 1935 Banking Act, which saw the creation of a Federal Reserve Board-dominated FOMC comprising 19 members, of which only 12 enjoyed voting rights: here, all FRBs were subject to rotation, unlike members of the Board of Governors whose voting rights were permanent. A significant provision of the 1942 act was to change the structure of the rotating groups such that the FRB New York was given a permanent voting right.

[5]The 1949 revision also abolished an article requiring the permission of the government to set or change the official discount rate, although in practice, it is widely accepted that the BoJ is one of the world's most *de jure* dependent central banks (Cargill and O'Driscoll, Jr. 2012).

[6]We also note that two members of the original seven member PB who were appointed prior to the 1998 Bank of Japan law coming into effect (Yasuo Goto and Susumu Taketomi) served out the remainder of their five-year terms on the nine member PB, and hence feature in our analysis.

Chancellor of the Exchequer.[7] MPC policy meetings take place on a monthly basis. The committee comprises five 'internal' members who are appointed from within the ranks of the BoE staff - namely the Governor, two Deputy Governors, and two staff members with executive responsibilities - and four 'external' members, who are appointed directly by the government from outside such ranks. These members are typically chosen from academia and the financial sector.[8] Similar to the PB, MPC members enjoy permanent voting rights; however, unlike both the FOMC and PB, MPC appointments do not require approval from Parliament.

The voting records for all of these committees - which identify how individual members vote at each meeting - are placed in the public domain shortly after a policy decision is taken. In addition to utilizing information on members' career backgrounds, it is this data which forms the basis of our analysis.[9] As a focus of this paper is *dissent* voting behavior, we now discuss its possible determinants.

3   Accounting for dissent

Members of a monetary policy committee cast dissenting votes for numerous reasons. First, differing views on the nature of monetary policy transmission coupled with uncertainty surrounding the impact of policy measures may cause members to adopt different policy stances, irrespective of whether the policy environment is characterized by the use of conventional or unconventional measures. Here, Bernanke and Gertler (1995) and Mishkin (1996) highlight the uncertainties surrounding how conventional policies may impact on the economy; for unconventional measures see Gertler and Karadi (2013), Joyce, McLaren, and Young (2012) and Bowdler and Radia (2012). As is argued by Harris, Levine, and Spencer (2011), different beliefs about the structure of the economy may lead to differences in voting behavior even when the same objective of monetary policy is shared by all individuals.[10]

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[7]i.e., the Finance Minister, who is also an elected politician.

[8]Unlike internal members, who have full-time positions at the Bank, external members typically hold part-time positions. The Government does not appoint all members. With respect to internal members, while statutes prescribe that the Governor and two Deputy Governors (all directly chosen by the government) automatically assume MPC positions, two further members of Bank staff are appointed to the MPC by the Governor following consultation with the Chancellor of the Exchequer. However, in practice, the Chancellor has all but no say in the matter. In contrast, the Chancellor (and by implication the Government) directly appoints all external members. We thank Charles Goodhart for clarifying this matter

[9]As noted in Fry, Julius, Mahadeva, Roger, and Sterne (2000), committees enjoy near-ubiquity as vehicles for setting monetary policy; however, the number of committees that place the voting record in the public domain are in a minority. In addtion to the Fed, the BoE and the BoJ, other institutions which follow this practice include the Swedish Riksbank; the National Bank of Poland (NBP); the Bank of Korea; and the Hungarian central bank (Magyar Nemzeti Bank).

[10]Riboni and Ruge-Murcia (2008) characterize members of a monetary policy committee as having different 'prudence' motives vis-a-vis monetary policy - attributable to its members having different loss functions - which in turn leads to individuals being associated with different (optimal) nominal interest

It is also plausible that the 'type' of monetary policy committee impacts voting behavior. This is recently shown by Gerlach-Kristen (2008), who investigates the premise that the FOMC Chairman exerts greater influence over the voting behavior of its members than the corresponding influence of the MPC Chairman. Her contribution neatly formalizes the insights of Blinder (2007), who classifies monetary policy committees as being *individualistic*, *genuinely collegial* or *autocratically collegial*. According to this taxonomy, the MPC is of the 'individualistic' variety, attributable to the fact that during the course of policy meetings, unanimity is neither expected nor sought; rather, members 'not only express their own opinions verbally, but probably also act on them by voting'.[11] As is shown in Section 6, this characteristic is reflected in the (relatively) high number of dissents cast by its members. In contrast, the FOMC is *autocratically collegial* given the assumed greater power and influence of the Chairman: accordingly, fewer dissents are recorded. In the case of the Japan, Blinder (2004) observes that the PB is "more individualistic than the FOMC, but considerably less individualistic than the British MPC,"[12] suggesting that it is a *genuinely collegial* committee.

A committee member may also perceive himself as losing individual credibility or 'climbing down' on an issue by assenting, especially when he is known to hold view which differs from the majority of members. This may encourage dissent voting behavior, a possibility which is acknowledged in the contribution of Havrilesky and Schweitzer (1990). In contrast, a member may be incentivized to *refrain* from dissenting if going against the will of the majority is perceived to damage his future career prospects, a possibility also recognized by Havrilesky and Schweitzer (1990), as well as Harris and Spencer (2009) and Adolph (2013). Members may also be inclined to 'fall into line' and cast assenting votes if they value consensus and group solidarity, behavior which is consistent with Blinder's definition of a 'genuinely collegial' committee.[13]

Committee members may also dissent to heighten one's media profile, a possibility suggested by Gerlach-Kristen (2003). Whether or not individuals are in practice driven by such an incentive, it is inarguable that while a single isolated dissent by a member

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rates. Such differences manifest themselves in dissenting votes. Their theoretical model is clearly well-developed for the case of conventional monetary policy measures given that the short-term interest rate is used as the policy instrument. However, it is not so applicable to situations that involve committee members voting on unconventional policy measures such as large scale asset purchases. This is not due to a shortcoming specific to their particular contribution, but one that generally applies to *all* theoretical contributions which treat the nominal interest-rate as the of monetary policy instrument (for instance, Svensson (1997)). An exception to this is Ellison and Tischbirek (2014) who introduce an unconventional 'asset purchasing rule' as a supplement to conventional monetary policy (e.g. a Taylor-type rule) in the context of a DSGE framework.

[11] Blinder (2004), p.119.

[12] Blinder (2004), p.56.

[13] The desire to reach a consensus may explain Teizo Taya's decision to vote with the *majority* of PB members for a reduction in the discount rate from 0.5 percent to 0.35 percent at the meeting held February 9th 2001. This is despite Taya stating a clear preference during the meeting for a discount rate of 0.25 percent. Using the transcripts of FOMC meetings, Chappell, McGregor, and Vermilyea (2007b) cite instances of similar behavior by FOMC members.

may draw some attention from the financial and news media, dissenting across a series of back-to-back policy meetings invariably draws even more attention. For instance, PB member Nobuyuki Nakahara cast a considerable number of back-to-back dissents calling for unconventional monetary policy measures prior to their introduction by the BoJ in 2001.[14] The *Japan Times* consequently referred to him as somebody who is 'known for his preference for easing monetary policy'.[15] Likewise, David Blanchflower was a virtual unknown outside of academic economics circles prior to his membership of the MPC between October 2006 - September 2011. During his tenure, which witnessed him cast a considerable number of dissenting votes on the side of monetary ease, he was the subject of a number of newspaper articles, no doubt attributable to his relatively 'dovish' (dissent) voting behavior.[16] Similarly, MPC member Andrew Sentance also found himself under media scrutiny for his numerous dissents on the side of monetary tightness in the aftermath of the GFC.[17]

Members' career backgrounds may have an impact on the decision to dissent, as conjectured in Havrilesky and Schweitzer (1990) and Harris, Levine, and Spencer (2011), who use public choice arguments to link dissent voting behavior to constituency group representation. These contributions are notable for introducing a formal theory of dissent, and explicitly test the hypothesis that committee members whose career characteristics are less proximate to the 'mean' career characteristics for the committee are more likely to dissent. This literature finds that FOMC members with Federal Reserve Bank and private sector experience exhibit more conservative monetary policy preferences, unlike the case for the MPC, where the impact of career backgrounds is at best negligible. The latter result provides tentative support for Romer and Romer (2004), who suggest that it is not "concrete background characteristics" (p.151) which best predict the behavior of the Chairman of the Federal Reserve, but their public statements.[18]

Lastly, with respect to all of the contributions discussed above, it is clearly evident that other than the Bank of Japan PB, the voting behavior of members of the FOMC and MPC

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[14]This arguably makes Nakahara the first proponent of what is referred to in the news and financial media as 'Abenomics'.

[15]See 'BOJ's Sept. 18 vote to ease monetary policy passed 8-1', *Japan Times*, November 2nd 2001.

[16]Following his departure from the MPC, Blanchflower became an economics columnist (in September 2009) for the *New Statesman*, a British magazine with left-of-centre political leanings. He was later appointed as its economics editor, and has also regularly contributed articles to the left-wing *Independent* newspaper. In March 2011, Blanchflower also began working for Bloomberg Television as a contributing editor. These opportunities, we tentatively propose, might not have materialized had Blanchflower (*i*) not been appointed to the MPC and (*ii*) dissented on the side of monetary ease so frequently. In relation to this point, recent work by Adolph (2013) introduces a formal model in which central bankers use monetary policy decisions to signal to future employers that they would be a good hire.

[17]See for instance 'Interest rates: is Mervyn King or Andrew Sentance right?', *The Guardian* (online edition), Thursday 17th February 2011.

[18]Clearly, analogous arguments could be made regarding the determinants of the voting behavior of FOMC members other than the Fed Chair, and further, members of other committees such as the PB and the MPC. However, obtaining members' personal statements and classifying them for such a large cohort would be something of an arduous task, and is not pursued here.

has received considerable attention in the academic literature. We do, however emphasize that for all of the contributions discussed above, the time periods under scrutiny are often confined to the *pre*-GFC era, which pre-dates the introduction of unconventional monetary policy measures. In relation to this point, the observation that Bank of Japan PB votes are rarely modelled or examined in the academic literature is in some respects unsurprising:[19] despite the voting record of the PB being placed in the public domain since 1998, interest rates have been either at, or very close to the ZLB, exhibiting very little variability. This makes estimating members' reaction functions within a Taylor-type rule framework problematic,[20] particularly because PB members were asked to vote on policies corresponding to the use of instruments other than the short-term interest rate as the main policy tool. However, given that the PB voting record is well documented coupled with the significant attention paid to unconventional monetary policy in recent academic literature (for instance, Rogers, Scotti, and Wright 2014; Ellison and Tischbirek 2014), it is clearly worthy of investigation. We now elaborate on the distinction between conventional and unconventional policy votes.

4   'Conventional' and 'unconventional' policy votes

As noted in the introduction, the literature on decision making by monetary policy committees is typically geared towards short-term interest rate setting: scant attention has been paid to how individual committee or board members vote when faced with policy measures *other* than setting the policy rate as the main instrument of monetary policy. In this section, we pin down more precisely our definition of so-called 'conventional' and 'unconventional' policy votes. This serves as a basis for our discussion in Section 6, where we construct a measure of how an individual's dissenting policy stance evolves over time, and which cuts across periods during which the main instrument of monetary policy switches from a conventional to an unconventional one.

Conventional policy votes are defined as those cast on the short-term policy rate: in the case of the FOMC, this corresponds to the *target fed funds rate* (FFR); for the MPC, it corresponds to the 'Bank Rate' or the 'repo-rate' depending on the time period under scrutiny; and for the PB, it refers to the *uncollateralised overnight call rate* (UOCR). In contrast, unconventional policy votes are classed as those cast in relation to QE measures. As an exception to this classification, we also include in this category votes cast by FOMC members in relation to the 'Maturity Extension Programme' (MEP). Under this scheme the Federal Reserve purchased long-term Treasuries funded through the sale of

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[19] A notable exception is Fujiki (2005).

[20] A number of authors have recently tried to model Taylor-rule reaction functions at low interest rates. For instance, Kim and Mizen (2010) estimate a Japanese policy reaction function for the years 1979-2003 using a Tobit model. Martin and Milas (2013) find that the Taylor rule for the UK breaks down after 2007, due to the estimated response to inflation falling markedly and becoming insignificant.

an equivalent amount of short-term Treasury securities from its own balance sheet. Like QE, a key aim of the policy was to provide extra macroeconomic stimulus by lowering long-term interest rates.[21]

In adopting the above criteria for 'unconventional' policy votes, we effectively confine ourselves to votes cast in relation to the large scale purchases of government and commercial bonds from financial institutions that are characterized as having an 'unwind date' albeit at an *unspecified* point in the future. This strategy effectively rules out votes cast in relation to the raft of 'unconventional' short-term liquidity enhancing measures introduced by the Fed, the BoE and the BoJ in the wake of the GFC, such as the Fed's 'Term Auction Facility' (TAF). Two reasons underpin the rationale behind this omission. First, in practice, it is not immediately clear whether dissents cast in relation to the introduction and continuance of temporary liquidity measures represented a relatively easier or a tighter monetary policy stance: such measures are principally aimed at reducing financial distress and market uncertainty. Second, analysis of the MPM indicate that the many of the decisions to introduce such measures were not taken by monetary policy committees themselves. This includes, for instance, the BoE's *Special Lending Scheme*, which was purposely designed to be 'ring-fenced from and independent of the BoE's money market operations', so as to not 'interfere with the Bank's ability to implement monetary policy' (Bank of England 2008). A brief discussion of some of the emergency measures introduced by each central bank is provided in Appendix A.1.

Table 2 presents a breakdown of conventional and unconventional policy measures adopted by the Fed, the BoE and the BoJ across our sample periods, based on their implementation dates. In line with the preceding discussion, policy measures are classified as being one of three distinct variants: 'Conventional', which refers to policy measures to manipulate the short-term interest rate; 'QE', which denotes quantitative easing measures; and MEP which refers to the Fed's *Maturity Extension Program*. The final column of the table outlines the nature and duration of the implemented policies, for which a number of noteworthy observations can be made:

(I) The recent monetary policy experience of the UK and US is markedly different from that of Japan, which is associated with relatively longer durations of zero and near-zero policy rates, and unconventional policy measures. This is attributable to the fact that the (post-1998) macroeconomic environment into which the nine-member PB was born was

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[21]The scheme was initially operational from September 2011 to June 2012, and involved the purchase of $400 billion in long-term Treasuries. Due to the continued poor US economic performance, the scheme was extended to run from July 2012 through December 2012. This second stage witnessed long-term Treasuries purchases worth $267 billion. Unlike QE, the MEP (also referred to as 'Operation Twist' after the 1961 Federal Reserve initiative of the same name) does not involve the creation of new money, and hence does not impact on the size of the Federal Reserve's balance sheet, bank reserves, or the monetary base. A drawback of the policy is that it is restricted in its scope by the amount of short-term securities the Federal Reserve holds, and hence can sell (Labonte 2013).

characterized by deflation, and by international standards, an exceptionally low policy-rate. The PB thus inherited a very different set of economic conditions than for instance, the MPC, which was established at a similar time. A consequence of this circumstance is that the majority of FOMC and MPC votes in our panel were cast during periods when unconventional measures were *not* recommended as the main instrument of monetary policy in the policy proposal; this contrasts with PB members, for whom the majority of policy proposals include recommendations relating to unconventional policy measures. To better appreciate differences in policy rate behavior, we supplement the information contained in Table 2 with Figure 1, which plots policy rate movements from August 1997 - January 2014.[22] The starting date of the sample coincides with the beginning of the Greenspan era at the Fed (and hence our FOMC sample period).[23] Clearly visible is the fact that for *all* of the period during which the nine-member PB has been in existence, even when the UOCR was not actually at the ZLB, it was set at a level very close to it. This feature sharply contrasts with the policy rates set by the MPC and FOMC: for most of the period depicted, these committees were not setting policy in a deflationary environment.

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[22]Before March 1997 the UK official rate was the 'base rate', defined as the yield equivalent to the discount rate on 'band 1' treasury bills (those with 5–37 days remaining maturity). From March 1997 to May 2006, the official rate was changed to the two-week repo rate, after which it was changed again to the Official Bank Rate paid on commercial bank reserves. For the BoJ, prior to September 1998, the key official interest-rate was the 'official discount rate'. After this date, it was changed to the 'uncollateralised overnight call rate' (UOCR) until March 2013. In April 2013 (in the period commencing immediately after our sample period ends), the monetary base became the key operating target of monetary policy, and the policy interest-rate the rate on Bank of Japan funds-supplying operations.

From July 1989 to December 2008, the US official rate was the target for the federal funds rate (FFR). Since this time, the target FFR was expressed as a *range* of values.

[23]It also coincides with the year which according to some economists is associated with the onset of the 'Great Moderation' in the United States (Clarida 2010). By historical standards, the Great Moderation represents an unusually long period characterized by "predictable policy, low inflation, and modest business cycles," ending in 2007 with the onset of the GFC. For the case of the UK, Benati (2008) proposes a 'Great Moderation' period beginning in the final quarter of 1992; based on our own calculations, this was followed by 61 quarters of uninterrupted positive and stable (real) output growth until the second quarter of 2008 - the period immediately prior to the climax of the global financial crisis (GFC).
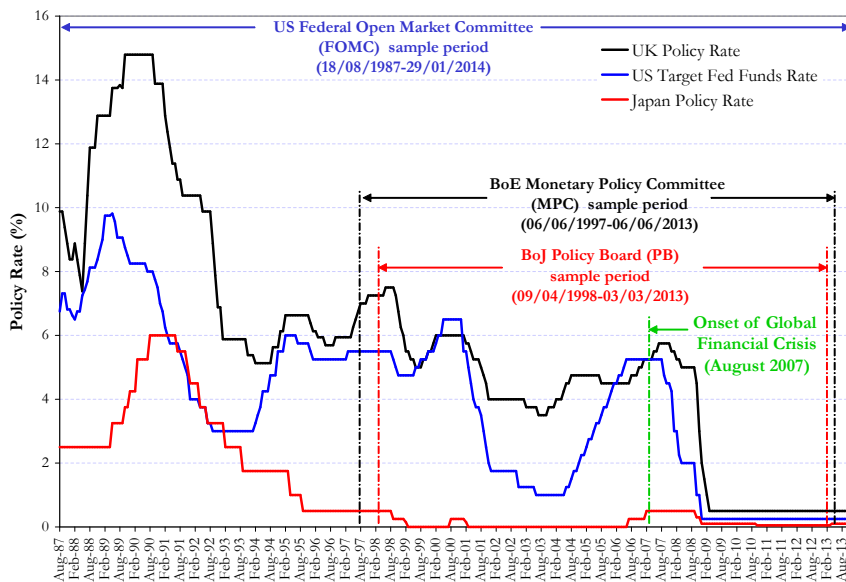
Figure 1: Policy-rate decisions: The Bank of Japan, the Bank of England and the US Federal Reserve, August 1997 - January 2014 (Source: Central bank websites)
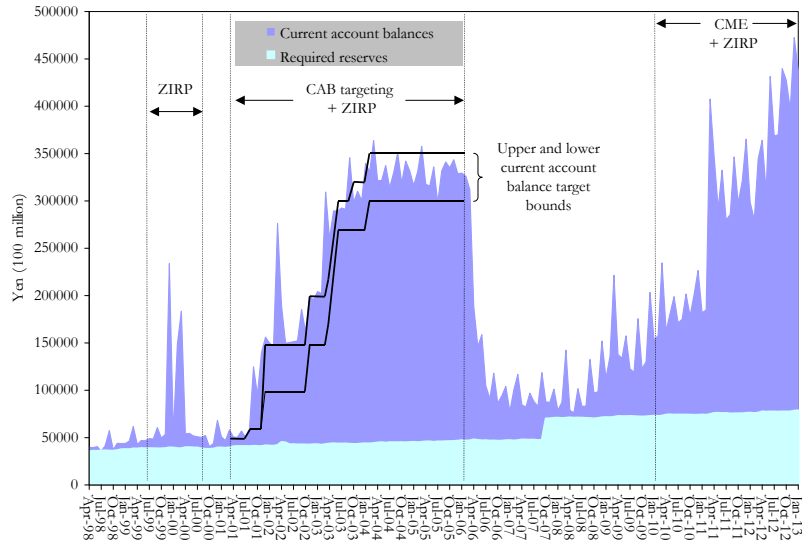
Figure 2: Bank of Japan current account balances (CABs), CAB target bounds, and required reserves, 1998-2013 (Source: Bank of Japan)

(*II*) *The way in which QE is conducted is characterized by significant inter-institutional differences.* As case in point, the Bank of Japan's (BoJ's) unconventional policy measures conducted between March 2001 to March 2006 - termed 'quantitative easing policy' (QEP) - targeted the level of the BoJ's current account balances (CABs) held by commercial banks, thereby focusing on the *liabilities* side of its balance sheet. Accordingly, members of the PB were asked to vote on the desirable target range of CABs at policy meetings during this period. The ranges chosen by the committee are depicted in Figure 2, as is the behavior of excess reserves, which exhibit considerable volatility. In contrast, the Bank of England's (BoE's) unconventional policy measures introduced in June 2009 - also termed QE - focused on the *assets* side of the balance sheet, and were implemented via the establishment of an 'Asset Purchasing Facility' (APF). This saw MPC members casting votes on the appropriate level of asset purchases, and not, for instance, the level of excess reserves. Further, whilst the implementation of these policies by both institutions witnessed the acquisition of a large amount of government and commercial securities by the central bank, the type of the securities purchased and the nature of institutions from which securities were purchased from differed. In a similar vein, whilst the nature of the Federal Reserve's QE policies saw its members voting on the level of (large-scale) asset purchases, the type of the securities purchased and the nature of institutions from which securities were purchased differed from those purchased by the BoJ and the BoE.[24]

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[24]Although not explored (or illustrated) here, excellent accounts of the central bank balance sheet effects of unconventional monetary policies on the institutions covered here are found in Shiratsuka (2010) and Fawley and Neely (2013).

(*III*) *In addition to inter-institutional differences the way in which QE is conducted is also characterized by what we term intra-institutional differences: that is, for a given central bank, QE policies implemented during different periods may have different characteristics with respect to the composition of asset purchases and the specified policy target.* For instance, in the case of Japan, the PB implemented its QEP from March 2001 through March 2006. This was achieved by changing the main operating target of monetary policy from the UOCR to the level of outstanding CABs held by financial institutions at the BoJ. To achieve these targets the BoJ used purchases of Japanese Government Bonds (JGBs) as the main instrument of monetary policy (Berkmen 2012). For its 'comprehensive monetary easing' (CME) policy conducted May 2010 to April 2013, the basic elements were no different to the QEP: excess reserves were created, as was a commitment to the duration of the policy (Takahashi 2013). Figure 2 depicts how the principal effect of the QEP and CME was to increase CABs significantly beyond required reserves. Significantly, the level of outstanding CABs was no longer identified as the main target of monetary policy under CME: rather, the target was the UOCR, with emphasis given to purchasing a sufficient volume of JGBs to maintain near-zero interest rates. These facets are reflected in the minutes of the PB's monetary policy meetings: under the QEP, the Chairman's policy proposal was typically framed in terms of an outstanding CAB target-range recommendation; for the CME period, the policy proposal is framed in terms of a recommended range for the UOCR. These differences are explicitly highlighted in Table 3, which reproduces examples of the Chairman's policy proposal under the different policy regimes identified in Table 2. Comparable examples are also provided for the MPC and the FOMC. In the case of the FOMC, an example of the Chairman's 'domestic policy directive' corresponding to the first bout of quantitative easing - popularly referred to as 'QE1' - is presented. As subsequent bouts of QE differed with respect to the *type* of securities that were purchased by the Federal Reserve, these policies earned the respective labels 'QE2', 'QE3' and 'QE4'. Given space constraints, details of how these policies differed are provided in Appendix A.2.

(*IV*) *Whilst QE (and MEP) policies were always adopted when the policy rate was at the ZLB, what constitutes the ZLB itself differs across institutions.* Table 2 shows that for the FOMC, the ZLB period is characterized by the FFR being set as a *range* of values between 0-0.25 percent, from December 2008 to January 2014 inclusive. Figure 1 depicts the upper-bound of this range. For the BoJ four distinct periods during which the ZLB was adopted are identified.[25] As Table 2 shows, the ZLB was reached - and hence a ZIRP was adopted - for two (prolonged) periods during which QE measures were *not* employed

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[25]This classification follows the insights of Ito (2009):

by the PB. This feature makes the PB unique in our sample. Two further salient points can be made regarding the PB's adoption of the ZIRP. First, the decision to maintain CABs above required reserves during the QEP period automatically caused the UOCR to automatically fall to zero (Ito 2009). On this interpretation, voting to support a CAB level above required reserves amounts to implicitly supporting a zero interest rate policy.[26] Second, the target UOCR during the ZIRP was often defined as a range of possible values (with a zero percent UOCR constituting the lower bound). In the case of the BoE, a Bank Rate of 0.5 percent was judged by the MPC as constituting the effective ZLB; and, unlike the FOMC and the PB, monetary policy at the ZLB is *always* specified by the MPC as comprising a single value for the policy rate, and not a *range* of values.[27]

To conclude, the analysis developed in this section has provided a coherent platform to develop a measure of an individual's overall monetary policy stance: based on our discussion, it is evident that QE as practised by the central banks analyzed here is not based on a Procrustean standard: unconventional policies are instead geared towards the institutional nuances and financial infa-structure associated with each central bank. This is reflected in the type of policy proposals which committee members are asked to vote on, which typically constitutes more than setting a policy interest rate. To motivate our empirical model of dissent voting, we now introduce a model of dissent which links committee members' career backgrounds and experiences to their propensity to cast dissenting votes. Our model forms the basis of our choice of covariates and the estimation strategy developed in Section 6.

"In 2008, the Bank of Japan has lowered the policy rate to 0.1%, and excess reserves are subject to a remunerated deposit rate at the Bank of Japan. This is effectively ZIRP. The FRB lowered the policy rate to the range 0.00-0.25% with the remunerated deposit rate at 0.1%. This is another case of ZIRP. Some may argue that the ZIRP had not been adopted firmly until April 1999. But for simplicity, I date the Japanese first ZIRP started in February 1999." (Ito 2009)

[26] Significantly Ito (2009) argues that the QE policy of the BoJ between 2001-2006 should be viewed as the *combination* of a ZIRP and QE, noting in a further contribution that under CAB targeting, "...liquidity to the market is provided to the system, so that the banks would place excess funds in the Bank of Japan account that bears zero interest. By implication, the zero interest rate would result. The change of instrument was a radical move towards quantitative easing" (Ito 2006). For this reason he suggests that it would be more apposite to call the 2001-2006 period "Quantitative easing (QE) - excess reserve targeting" (Ito 2009).

[27] As noted previously, for operational and technical reasons it is sometimes considered infeasible for central banks to reduce the policy interest rate below a certain level. In the case of the Bank of England, in setting a rate of 0.5 percent, the MPC "judged that Bank Rate could not practically be reduced below that level" (see http://www.bankofengland.co.uk/monetarypolicy/pages/qe/default.aspx). However, it is also noted in the March 2009 meeting's *Minutes*, that when coupled with the decision to reduce the Bank's *Operational Standing Deposit Facility* from 0.75 percent to 0 percent, overnight market interest rates would likely trade in the range between zero and 0.5 percent.

5   A Model of Dissent Voting

In setting out a formal model of dissent, we closely follow Havrilesky and Schweitzer (1990) and Harris, Levine, and Spencer (2011) by envisaging committee comprising g members, each of whom may have amassed career experiences, for different durations, in j different fields. In keeping with this literature, we refer to these as a member's *career characteristics*. As is argued in Section 6.4, the practical analogue of these j characteristics is experience in different sectors or areas of the economy, such as private industry and finance. As in Havrilesky and Schweitzer (1990), a directly testable (and explicit) assumption of this theoretical framework is that MPC members' career backgrounds can - and do - impact on the decision to dissent on the side of monetary tightness or ease.

For member g, denote her j^{th} career characteristic as X_{gj}, such that $\overline{X}_j$ represents the MPC's mean for that characteristic. So-called 'career proximity' to central government is increasing in $X_{gj} - \overline{X}_j$ such that $X_{gj} - \overline{X}_j > 0 \ (< 0)$ promotes dissents on the side of monetary ease (tightness). As $X_{gj} - \overline{X}_j > 0 \ (< 0)$ becomes larger (smaller), so too does the propensity to dissent on the side of ease (tightness). However, given there are j characteristics, the extent to which a given MPC member dissents is ultimately a function of how each characteristic is weighted. We are now in a position to write an expression for member g's *utility*, namely

$$U_g(D_g) = U(D_g \mid X_{gj} - \overline{X}_j, j = 1, 2, ..., N) \tag{1}$$

It is further assumed that expression (1) is characterized by a unique global maximum that defines the optimal number of dissenting votes, $\overline{D}_g$, such that

$$\frac{\partial U}{\partial (D_g - \overline{D}_g)} \ < \ 0 \tag{2}$$

$$\frac{\partial^2 U}{\partial (D_g - \overline{D}_g)^2} \ < \ 0. \tag{3}$$

In (1), the utility achieved by member g is a function of the number of dissenting votes cast, the direction and number of which is conditioned by career proximity parameters, $X_{gj} - \overline{X}_j, j = 1, 2, ..., N$. It turns out that the actual number of dissents cast by member g, D_g, will not necessarily equal the number of dissents which maximize utility. This is because members also experience *disutility*, an expression for which is given by

$$V_g(D_g) = V(D_g \mid X_{gj} - \overline{X}_j, j = 1, 2, ..., N) \tag{4}$$

which has a unique global minimum at $D_g = 0$. Here, the assumed properties of $V_g(D_g)$

$$\frac{\partial V}{\partial D_g} > 0 \tag{5}$$

$$\frac{\partial^2 V}{\partial D_g^2} > 0 \tag{6}$$

imply that as the number of dissents moves further away from zero, the disutility felt by member g increases at an increasing rate.

It is easily shown that when the marginal utility of increasing dissent equals the marginal disutility of increasing dissent, member g's net utility will satisfy an unconstrained maximum where:

$$\frac{\partial U}{\partial D_g} = \frac{\partial V}{\partial D_g}. \tag{7}$$

Put another way, marginal net utility must be zero. To glean the normative implications of the model, H-S consider the conditions required to ensure a monotonic transformation from the weighted career characteristic differences, $X_{gj} - \overline{X}_j$, to the actual number of dissents, D_g. Due to the nature of the first order conditions for *utility* and *disutility* in (1) and (4), the actual number of dissents is not guaranteed to map monotonically onto career characteristic differences. Ensuring such a transformation requires the restriction that the marginal net utility of the jth member increasing dissent towards her global optimum is strictly less than that pertaining to the $(j + k^{th})$ member: as Havrilesky and Schweitzer state, this holds the implication that "a member with marginally stronger moral convictions in favor of dissenting cannot be marginally more easily cowed by group...disapproval".

This can be formally proved as follows. In order to partially differentiate, express the net welfare of member g as $W_g = U_g - V_g = W_i(D_g, X_{gj} - \overline{X}_j, j = 1, 2, ..., N)$. The first order condition for a maximum is then

$$\frac{\partial W_g}{\partial D_g}(D_g, X_{gj} - \overline{X}_j, j = 1, 2, ..., N) = 0 \tag{8}$$

which results in an optimal choice $D_i = D_i^*(X_{gj} - \overline{X}_j, j = 1, 2, ..., N)$. From (2) and (5)

$$\frac{\partial^2 W_g}{\partial D_g^2} < 0 \tag{9}$$

and the second-order condition for an optimum is satisfied.

Partially differentiating again with respect to the deviation of characteristic j denoted by $\hat{X}_{gj} \equiv X_{gj} - \overline{X}_j$ yields

$$\frac{\partial^2 W_g}{\partial D_g^2}\frac{\partial D_g^*}{\partial \hat{X}_{gj}} + \frac{\partial^2 W_g}{\partial \hat{X}_{gj}\partial D_g} = 0 \tag{10}$$

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Hence we have

$$\frac{\partial D_g^*}{\partial \hat{X}_{gj}} = -\frac{\frac{\partial^2 W_g}{\partial \hat{X}_{gj} \partial D_g}}{\frac{\partial^2 W_g}{\partial D_g^2}} \tag{11}$$

From (11) and (9) we therefore have that $\frac{\partial D_g^*}{\partial \hat{X}_{gj}} > 0$ and there is a monotonic transformation from the each of the career characteristic differences, $X_{gj} - \overline{X}_j$, to the actual number of dissents D_g, iff $\frac{\partial^2 W_g}{\partial \hat{X}_{gj} \partial D_g} = \frac{\partial}{\partial \hat{X}_{gj}}\left(\frac{\partial W_g}{\partial D_g}\right) > 0$. That is, the marginal net utility of the jth member increasing dissent towards her global optimum is strictly less than that pertaining to the $(j + k^{th})$ member. This proves the result. We now examine our data, after which our econometric modelling strategy is introduced.

6 Data

6.1 Defining Dissent

Dissent voting data for each monetary policy committee is obtained from its respective voting record, and (i) identifies who the dissenting voters are at each meeting, and (ii) whether they dissented on the side of ease or tightness. However, unlike previous studies of voting behavior, where the focus is restricted to dissenting with respect to the level of the short-term interest rate (see for instance, Harris, Levine, and Spencer 2011), we use the monetary policy minutes ('MPM') to identify *six* types of dissenting vote, each which falls into one of three categories: *conventional dissents*; *unconventional dissents*; and *broad dissents*. There are important caveats to these classifications, which are expounded as follows:

1. *Conventional dissents*:

   (a) **Conventional dissent for tighter policy**: Defined as where a member votes for a higher short-term interest-rate than that chosen by the winning majority of committee members. *A member may vote for no change or a decrease in the interest-rate but still be classed as dissenting for tighter policy if the rate chosen by the committee is lower than their chosen rate.*

   (b) **Conventional dissent for looser policy**: Defined as where a member votes for a lower short-term interest-rate than that chosen by the winning majority of committee members. *A member may vote for no change or an increase in the interest-rate but still be classed as dissenting for looser policy if the rate chosen by the committee is higher than their chosen rate.*

2. *Unconventional dissents*:

   (a) **Unconventional dissent for tighter policy**: Defined as where a member votes for a lower level of monetary easing than that chosen by the winning majority of committee members. *A member may vote for no change or an increase in the level of monetary easing, but is still be classed as dissenting for tighter policy if the level of monetary easing chosen by the committee is greater than their chosen level.*

   (b) **Unconventional dissent for looser policy**: Defined as where a member votes for a higher level of monetary easing than that chosen by the winning majority of committee members. *A member may vote for no change or a decrease in the level of monetary easing, but is still be classed as dissenting for easier policy if the level of monetary easing chosen by the committee is lower than their chosen level.*

3. *Broad Dissents*:

   (a) **Hawkish dissent**: Defined as where a member's vote, relative to the winning majority of committee members, reflects a tighter *overall* monetary policy stance. *When voting on the policy proposal, a member may support a policy rate identical to that supported by the winning majority of committee members, but still be classed as casting a hawkish dissent if his vote reveals a preference for a lower level of monetary easing than that chosen by the winning majority of committee members. Likewise, a member may vote for exactly the same level of monetary easing as the wining majority of committee members, but still be classed as casting a hawkish dissent if he votes for a higher short-term interest-rate than that chosen by the winning majority of committee members.*

   (b) **Dovish dissent**: Defined as where a member's vote, relative to the winning majority of committee members, reflects a looser *overall* monetary policy stance. *When voting on the policy proposal, a member may support a policy rate identical to that supported by the winning majority of committee members, but still be classed as casting a dovish dissent if his vote reveals a preference for a higher level of monetary easing than that chosen by the winning majority of committee members. Likewise, a member may vote for exactly the same level of monetary easing as the wining majority of committee members, but still be classed as casting a dovish dissent if he votes for a lower short-term interest-rate than that chosen by the winning majority of committee members.*

Here, *broad dissents* can be viewed as being a combination of conventional and unconventional dissents, and extending the general idea in Xiong (2012), captures a member's overall monetary stance, *irrespective* of the type of policy instrument used by the central bank. The measure is also advantageous given that during periods in which unconventional measures were pursued, committee members were asked to vote on two issues: the level of the policy rate *and* the appropriate level of monetary easing (see Tables 2 and 3).[28] However, as is observed in Table 3, both issues are typically encompassed by a single policy proposal. From a practical perspective, one can envisage a scenario where some members of a committee might, *relative to other members*, prefer a less accommodative monetary policy stance, which could be implemented through increasing the short-term interest rate (conventional policy) and/or by opting for a lower level of large scale asset purchases (unconventional policy). For example, in June 2010 BoE MPC members were invited by Governor King to vote on the 'joint' policy proposal that (*i*) Bank Rate should be maintained at 0.5%; *and* (*ii*) that the Bank of England should maintain the stock of asset purchases financed by the issuance of central bank reserves at £200 billion. All MPC members voted in agreement with this proposal other than Andrew Sentance, who preferred to increase the Bank Rate from 0.5 to 0.75 percent.[29] However, in casting a dissenting vote, Sentance did not object to the maintenance of the stock of asset purchases. Under our broad dissent measure, Sentance is therefore recorded as casting a 'hawkish' dissent.[30]

Lastly, where difficulties were encountered in interpreting some members' dissents (for instance, where it was not immediately clear if the dissent was in favor of ease or tightness) the vote was omitted from the estimation sample. For emergency or unscheduled committee meetings where formal policy votes were taken, such information was included in our sample; moreover, in cases where *no* formal vote was taken, but for which it was possible to classify members' votes using the MPM or the meeting transcripts, such votes were also included in our sample.[31] A more complete discussion of meetings where interpreting dissents was not straightforward is provided in Appendix A.5.

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[28]In the case of the PB, Nobiyuki Nakahara actively called for QE measures *outside* of periods during which unconventional policies were being used by the BoJ. In doing so, this make him unique in our entire sample. For a discussion of the relationship between Nakahara and calls for QE, the reader is referred to Appendix A.4.

[29]The June 2010 minutes also report the view of an unidentified MPC member for whom "it was appropriate to begin to withdraw gradually some of the exceptional monetary stimulus provided by the easing in policy in late 2008 and 2009." We tentatively suggest that this member is also Andrew Sentance.

[30]By (logical) implication, an *assenting* vote is defined as one cast in agreement with the winning majority of committee members at each meeting. In the special case of *broad dissents*, an assenting vote is characterized by a member agreeing with the majority of members with respect to all clauses in the policy proposal (i.e., during QE regimes, this corresponds to both the level of the short term interest rate *and* the nature of the proposed unconventional policy measure).

[31]Only FOMC votes fall into this latter category.

6.2 Summary statistics

Tables 4 - 6 document the dissent voting behavior of FOMC, MPC and PB members, respectively.[32] In each table, the column heading entitled 'Meetings', provides information on (*i*) the total number of meetings attended (and therefore voted in) by each member; (*ii*) the number of votes cast in non-QE regimes; and (*iii*) total votes cast in QE regimes, where by construction, the sum of votes cast under non-QE and QE regimes equals the total number of votes cast in the sample. The remaining columns record the number of tightness and ease dissents cast by each member, based on our classifications of *conventional, unconventional* and *broad* dissents, respectively.

Taking each committee in turn, Table 4 classifies FOMC members according to whether they are members of the Board of Governors of the Federal Reserve System, or Federal Reserve Bank (FRB) Presidents. As noted earlier, studies of this institutional distinction are common in the FOMC voting literature (Chappell, Havrilesky, and McGregor 1993);[33] we emphasize here that a significant difference between these two sets of cohorts is that unlike members of the Board of Governors, FRB Presidents are not what we term *political appointments* (i.e., directly chosen by the government). Indeed, employing the distinction introduced in Harris, Levine, and Spencer (2011), *political appointments are characterized as being directly chosen by the government, whereas for non-political appointments, the government plays no direct role.*

Table 5 identifies Bank of England MPC members according to their internal-external status, and highlights whether members are appointed by political or non-political means. This yields three groups: (*i*) politically appointed internals; (*ii*) non-politically appointed internals; and (*iii*) politically appointed externals. In the context of the MPC, all external members, plus the Bank's Governor and two Deputy Governors are *classed as being political appointments*, whereas the remaining two internal appointments are non-political, and are chosen by the Bank's Governor (both of these individuals enjoy executive responsibilities at the Bank of England, one of whom is the Bank's Chief Economist). Lastly, Table 6 classifies PB members as falling into one of two groups: first, the '*troika*', which includes the Bank of Japan's Governor and the two Deputy Governors;[34] and second, the *rank-and-file* members, none of whom have any executive responsibilities at the BoJ. *All* PB members are political appointments, and are selected in a way which is comparable

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[32] In practice, because there are sometimes absences and vacancies, the number of members voting each period varies across time. This is observed for the three committees under scrutiny in this paper. For instance, excluding vacancies, for the PB, only five members missed meetings between April 1998 and March 2013. These are: Fukuma on 8th-9th March 2006; Nishimura on 18th September 2008; Noda on 1st December 2009; Shirakawa on 10th May 2010; Miyao on 30th November 2011. The figures in our tables and statistical analysis explicitly take this phenomenon into account.

[33] As is the 'internal-external' distinction in studies of MPC voting behavior (see for example, Besley, Meads, and Surico 2008).

[34] In the Russian language, a *troika* is simply defined as a group comprising three members, although it is also used in political discourse.

to members of the Board of Governors of the Federal Reserve System.

Table 7 aggregates the voting data in Tables 4 - 6, *irrespective of the monetary policy regime*, and allows for inter-committee comparisons of dissent voting behavior based on our "broad dissent" measure: columns *a.* and *c.* and show the number of dissenting votes cast on the side of ease and tightness, respectively; column *b.* shows the total number of assents; and column *d.* shows the total number of dissenting votes cast, irrespective of direction (i.e., ease plus tightness dissents). Figures in parentheses (·) express the number of dissenting votes cast as a percentage of all votes cast by a given cohort. Of note is the observation that over the MPC's entire sample period, almost fifteen per cent of votes cast by its members were dissents. This contrasts with the FOMC and PB, for which the figure is considerably lower.[35] Of note is the observation that members of the PB's *troika* only recorded a single dissent over a fifteen year period, a period corresponding to 240 meetings. Even when compared to the FOMC's Board of Governors - where levels of dissent are regarded as being low - this figure is remarkably small.[36] It is also notable that PB dissents appear to be driven by two members: Nobuyuki Nakahara and Eiko Shinotsuka. Together, these members account for over half of all PB dissents. This in unlike the FOMC and MPC, where dissenting votes are distributed more evenly across members.

To motivate our statistical analysis, we begin by investigating whether members of different committees exhibit significantly different voting patterns. This is achieved using χ^2 tests of association on the data presented in Table 7, results for which are given in Table 8. When judged at five percent levels, the votes cast for monetary ease, assent and tightness are, with a few exceptions, significantly different between committees. As an example, the test of the null hypothesis denoted H_0 : FOMC=MPC=PB tests whether all three committees are identical with respect to their tendency to cast dissenting votes, for a variety of different criteria. The testing of this hypothesis with respect to "Assent *vs.* ease *vs.* tighten" under "All regimes" simply tests if the pattern of dissenting votes cast on the side of ease, assents, and dissents cast on the side of monetary tightness, is identical across committees, irrespective of whether the policy regime is a conventional or an unconventional one.[37] The "*Yes*" in the corresponding box indicates that this highly restrictive (null) hypothesis is rejected. Table 8 also contains the results of 'regime-specific' tests (i.e., using only observations from a conventional ('non-QE') or unconventional ('QE') policy regimes). So, for instance, excluding assenting votes, the pattern of dissenting votes cast on the side of monetary ease versus tightness ('Ease *vs.* tighten') under an unconventional policy regime ('QE') is significantly different for the FOMC when compared

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[35] Figures in parentheses (·) express the number of dissenting votes cast as a percentage of all votes cast within each group.

[36] As noted in Table 6, Deputy Governor Kazumasa Iwata is the only *troika* member to have dissented during the entire sample period. He cast a single dissenting vote.

[37] In other words, the full samples (i.e., all observations) are used for each committee.

to the MPC (i.e., we reject H_0 : FOMC=MPC for this specific testing criteria).

Significantly, we emphasize that in Table 8, no attempt is made to test for differences between different types of member *within* each committee (i.e., for instance, '*Internals* vs. *Externals*' or '*BoGs* vs. *FRB Presidents*'). Moreover, no attempt is made to test for differences in voting behavior *across* different policy regimes: that is, whether the pattern of dissent changes when one is in a conventional regime, as compared to an unconventional one. This latter question is directly addressed in Section 6.3, whereas the results of χ^2 tests of association corresponding to differences between different member types *within* each committee are documented. Here, Table 9 provides robust evidence that such institutional distinctions are associated with different voting patterns. As a case in point, the null hypothesis FOMC$_{BOG}$ =FOMC$_{FRBs}$ tests for differences in the pattern of dissent voting behavior between members of the FOMC's Board of Governors and FRB Presidents, using the same criteria as in Table 8. We find that with the exception of *internal* versus *external* MPC members, whose pattern of dissents for monetary ease and tightness (Ease *vs.* tighten) appear to be no different under an unconventional policy regime ('QE'), committee members differ significantly in their voting behavior. We now turn to the impact of policy regime shifts on voting behavior.

6.3 Does the propensity to dissent change during regime shifts?

To capture the effect of voting behavior under different monetary policy regimes, we examine the extent to which the incidence and type of dissenting votes cast can be construed as being 'regime-specific'. Results of this exercise are provided in Table 10, which disaggregates the information contained in Table 7 into *broad dissents* cast under: (i) QE regimes (top half); and (ii) non-QE regimes' (bottom half). Turning to the raw data first, Table 10 shows that in the case of the FOMC and MPC, votes cast during QE regimes are noticeably lower than for non-QE regimes. This is attributable to the fact that for these committees, QE-type policies were only pursued post-2008 (e.g. in the wake of the GFC). In contrast, the PB implemented QE policies for substantial time periods both prior to *and* after the GFC. It is also observed that under QE regimes, both the PB's *troika* and the FOMC's Board of Governors registered *no* dissents.

Table 11 documents the results of χ^2 tests of association, where our specific interest here is the null hypothesis that the pattern of broad dissents associated with *the same type of member* remains unchanged following a policy-regime shift. As a case in point, the test of the null hypothesis denoted H_0 : FOMC$_{QE}$=FOMC$_{non-QE}$ tests whether the dissent voting behavior of FOMC members remains unchanged under a QE regime - as compared to a non-QE regime - for a variety of different criteria. The testing of this hypothesis with respect to "Ease *vs.* tighten" under "FRBs" simply tests if the pattern

of dissenting votes cast on the side of ease and tightness, is statistically no different for Federal Bank Presidents in QE and non-QE regimes. The "**No**" in the corresponding cell indicates that this hypothesis is *not* rejected. Put another way, for this set of criteria, voting behavior is unaffected. More generally, for Table 11, we can observe that MPC members seem to be "least affected" by a shift in regime: there is no significant change in the behavior of external members or 'all members' (i.e., internals and externals considered together) in such circumstances. Different committees are evidently more susceptible to policy regime change than others. Moreover, what this basic analysis has shown is that differences exist between different types of members *within* committees as well as *across* committees: voting behavior is characterized by considerable heterogeneity. As a prelude to the econometrics model and estimation, we now turn to examining committee members' career backgrounds, which in the context of the theoretical model introduced in Section 5, can be viewed as potential determinants of dissent voting behavior.

6.4 Career backgrounds

To capture career background effects, a series of covariates proxying members' career characteristics are constructed à la Havrilesky and Schweitzer (1990). Career backgrounds are categorized according to years spent working in six broadly defined categories:

(*i*) Academia - refers to years working at a university in an academic capacity.

(*ii*) Bank- denotes the number of years employed at the central bank. *In the case of the FOMC, we are able to make a further distinction between years working for a Federal Reserve Bank, and years working for the Board of Governors of the Federal Reserve System, as in* Havrilesky and Schweitzer (1990). *However, for estimation purposes, years spent in both of these categories are combined.*

(*iii*) Finance - refers to positions held in banking and finance.

(*iv*) Government - denotes years spent working as a public servant.

(*v*) Industry - refers to years spent an economist in industry.

(*vi*) Law - refers to years spent working in law.

(*vii*) NGO - refers to non-governmental organizations. This covers both national and international independent research organizations such the Organization for Economic Cooperation and Development (OECD), and trans-national institutions such as the International Monetary Fund (IMF), World Trade Organization (WTO) and Bank for International Settlements (BIS).

Following Harris, Levine, and Spencer (2011), our classification system covers only full-time positions and secondments held by committee members up to *but not including* time working on a each committee; excluded from the criteria are all part-time positions,

special advisory roles and academic consulting. While the effects of career backgrounds have required making some judgement calls, voting behavior is anticipated to be influenced in the follow ways. Past studies have assumed that backgrounds in academia, finance, at the central bank and NGOs promote tightness dissents: in the case of academia, this reflects the considerable impact of the literature on time-consistent monetary policy, and a view that experience in academia promotes independent thinking hence lowering members' susceptibility to yield to short-run political pressures; the inclusion of prior NGO experience reflects a view that such careers are removed from governmental power and influence.

We propose that the impact of finance and central banking experience is harder to call: whilst in conventional policy regimes, experience in finance may lead to a propensity to cast tightness dissents (e.g., banks and financial institutions arguably have more to lose from inflation than from unemployment, as it diminishes the future value of the money that their debtors will repay them), during unconventional policy regimes, such members' constituents in the finance industries may significantly *benefit* from the raft of (unconventional) policy measures implemented by central banks, through, for instance, improved balance sheets. Similarly, central bank experience has typically been assumed to engender an acute awareness of the inflationary consequences of activist monetary policy, thus promoting tightness dissents, such that for 'career' central bankers, dissenting on the side of monetary tightness may also be used to signal their credentials as being 'conservative' or 'inflation-averse'. However, quantitative easing measures are typically implemented when the prospect of falling prices - or *deflation* - is a threat. Under such circumstances, when the threat of deflation 'outweighs' the threat of inflation, central bankers may exhibit a greater tendency to dissent on the side of ease: this signals a determination to *inflate* the economy. In this sense, a given career background may exert a different influence on dissent voting, depending on the type of monetary policy (e.g., conventional or unconventional) being implemented. Indeed, following the GFC, many central banks have emphasized a commitment to provide sufficient monetary stimulus via unconventional measures until their economies recover (Dale 2013).

We also conjecture that time spent in industry and government will promote ease dissents. In the case of industry, whilst rising prices may imply higher wage claims and thus rising costs for the firm (prompting calls for the monetary authorities to bring inflation under control through tightening interest rates), ease dissents are more likely to be promoted: this is because higher interest rates affect the ability of firms to (*i*) invest and borrow, (*ii*) reduce consumer expenditure, and (*iii*) reduce the international competitiveness of products for export through exchange rate effects. In the specific case of QE, lower long-term interest-rates reduce the cost of government borrowing, which we suggest may increase the propensity of a member with experience in government to dissent on the size of ease. A related argument can be made for experience in industry:

purchases of long-term government bonds[38] drive down long-term interest-rates, leading to a portfolio balance effect; in turn, this incentivizes investors to channel funds into corporate bonds, making borrowing less expensive for corporations.

To visualize how career experience has changed over time for each committee, Figures 3 - 5 depict how the career background of the 'average' or 'representative' committee member has evolved over our respective sample periods. In each figure, the vertical axis measures the percentage of overall time spent in a given career category *prior* to the average member becoming a committee member. Using the same notation as in section 5, for a given mean career characteristic $\overline{X}_j$, $j = 1, 2, \ldots N$, this percentage is calculated as

$$100 \times \frac{\overline{X}_{jt}}{\sum_{j=1}^{N} \overline{X}_{jt}} \tag{12}$$

where the time subscript t corresponds to the period in which the policy meeting was held. For the case of the FOMC,[39] no single career background clearly dominates any other, although we do note that experience in industry falls dramatically towards the final third of our sample window. However, FRB experience, along with time spent in academia and the financial sector remain constant and modestly sized throughout. We note here that Figure 3 reflects the fact that four voting seats are subject to an annual rotating membership; when taking into account the observed staff turnover from the Board of Governors too, we should therefore expect *at least* four different voting members to participate in FOMC decisions each year. This may account for the relative 'volatility' of the average FOMC member's composition over time, as compared to the MPC and the PB.

Turning to Figure 4, the average level of academic experience enjoyed by MPC members at successive MPC meetings has generally remained high and constant, although it does not completely dominate other career characteristics. Experience in industry contributes to average member experience only modestly, whereas the proportion of time spent at the Bank of England, in government, and in the financial sector changes significantly mid-sample. Prima face, it appears that some of the observed increase in government and especially financial experience mid-sample comes at the expense of experience at the Bank.

Lastly, the average PB member, in contrast to the FOMC and MPC, is characterized by a significant amount of experience in industry relative to other career classifications. Figure 5 shows that throughout the sample period, experience in academia and at the BoJ remains modest but at relatively constant levels. However, experience in government

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[38] We also include mortgage backed securities (MBS) in the case of the United States.

[39] We only include members who cast a vote at each meeting in our sample. All other FOMC members are excluded. Due to the non-monthly nature of the meeting schedule, coupled with member absenteeism and the use of alternate voters for (absent) FRB Presidents, each data-point on the horizontal axis corresponds to a meeting, and not an equally sized (e.g. monthly) time period.

and the financial sector is subject to more volatility.[40] Having considered differences in committee composition we now turn to econometric estimation, with a view to gauging the extent to which the career characteristics described above account for dissenting votes. This is achieved in the context of a *random effects ordered probit model* (Greene and Hensher 2010).

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[40] As NGO experience was negligible, it was omitted from the Figure; this is also the case for the FOMC.

Table 2: Conventional and unconventional policy measures adopted by the Federal Reserve, the Bank of England, and the Bank of Japan

Fed	
Policy Regime	Specific Policy Measures (18/08/1987–29/01/2014)
Conventional	Targeting the effective Fed Funds Rate (FFR). Achieved primarily through using OMOs to steer the FFR. Level of FFR voted on in *all* meetings held between 18/08/1987–29/01/2014, including those associated with QE and MEP regimes (see below).
QE + ZIRP	Large scale asset purchases (LSAPs) from financial institutions using electronically created money. All purchases made on the secondary market. Level of LSAPs voted on in selected meetings between 25/11/2008–18/12/2013, during which the FFR was also held at the ZLB. Specific dates are: 'QE1' (25/11/2008–31/03/2010); 'QE2' (03/11/2010–30/06/2011); 'QE3' (13/09/2012–18/12/2013). FFR target range of 0-0.25% adopted during QE1, QE2 and QE3 periods.
MEP + ZIRP	Sale of short-term (<3 year) securities on Fed's balance sheet to purchase longer term securities (6 to 30 year maturities). Policy conducted between 21/09/2011–31/12/2012. No new money creation involved. FFR target range of 0-0.25% adopted during MEP period.
BoE	
Policy Regime	Specific Policy Measures (06/06/1997–06/06/2013)
Conventional	'Bank Rate' and 'repo-rate' targeting primarily through using OMOs from 06/06/1997–06/06/2013. Policy-rate proposition included in all policy proposals. ZIRP adopted from 05/03/2009–06/06/2013, but implemented *simultaneously* with QE (see below).
QE + ZIRP	Asset Purchase Facility (APF) to buy high-quality assets financed by the electronic creation of central bank reserves. All purchases made on the secondary market. ZLB (Bank Rate = 0.5%) adopted during QE period.
BoJ	
Policy Regime	Specific Policy Measures (09/04/1998–03/03/2013)
Conventional	Influence UOCR through OMOs and CAB targeting.
ZIRP only	ZIRP effectively adopted *in the absence of* QE measures between: 12/02/1999–11/08/2000 (0–0.15%); 19/12/2008–04/10/2010 (0.1%).
QE + ZIRP	QEP characterized by CAB targeting via the outright purchase of JGBs coupled with a UOCR of 0% (19/03/2001–09/03/2006); CME♦ implemented via the outright purchase of JGBs and a UOCR target range of 0–0.1% (05/10/2010–03/04/2013).

♦ CME was superseded by the open-ended 'Quantitative and Qualitative Easing' (QQE) policy announced 4th April 2013. This policy change coincided with the appointment of new BoJ Governor Haruhiko Kuroda on 20th March 2013.

Table 3: Examples of the Chairman's policy proposals under different monetary policy regimes: the FOMC, the MPC and the PB

FOMC	
Policy Regime	Typical Policy Proposal ('Domestic Policy Directive')
FFR	"The Federal Open Market Committee seeks monetary and financial conditions that will foster price stability and promote sustainable growth in output. To further its long-run objectives, the Committee in the immediate future seeks conditions in reserve markets consistent with maintaining the federal funds rate at an average of around $5\frac{1}{4}$ percent." (Source: Minutes of the Federal Open Market Committee meeting held December 12, 2006)
QE + ZIRP	"The Federal Open Market Committee seeks monetary and financial conditions that will foster price stability and promote sustainable growth in output. To further its long-run objectives, the Committee seeks conditions in reserve markets consistent with federal funds trading in a range of 0 to $\frac{1}{4}$ percent. The Committee directs the Desk to purchase GSE debt and agency-guaranteed MBS during the intermeeting period with the aim of providing support to the mortgage and housing markets. The timing and pace of these purchases should depend on conditions in the markets for such securities and on a broader assessment of conditions in primary mortgage markets and the housing sector. By the end of the second quarter of next year, the Desk is expected to purchase up to $100 billion in housing-related GSE debt and up to $500 billion in agency-guaranteed MBS. The System Open Market Account Manager and the Secretary will keep the Committee informed of ongoing developments regarding the System's balance sheet that could affect the attainment over time of the Committee's objectives of maximum employment and price stability." (Source: Minutes of the Federal Open Market Committee meeting held December 15-16, 2008)
MEP + ZIRP	"The Federal Open Market Committee seeks monetary and financial conditions that will foster price stability and promote sustainable growth in output. To further its long-run objectives, the Committee seeks conditions in reserve markets consistent with federal funds trading in a range from 0 to $\frac{1}{4}$ percent. The Committee directs the Desk to purchase, by the end of June 2012, Treasury securities with remaining maturities of approximately 6 years to 30 years with a total face value of $400 billion, and to sell Treasury securities with remaining maturities of 3 years or less with a total face value of $400 billion. The Committee also directs the Desk to maintain its existing policy of rolling over maturing Treasury securities into new issues and to reinvest principal payments on all agency debt and agency mortgage-backed securities in the System Open Market Account in agency mortgage-backed securities in order to maintain the total face value of domestic securities at approximately $2.6 trillion. The Committee directs the Desk to engage in dollar roll transactions as necessary to facilitate settlement of the Federal Reserve's agency MBS transactions. The System Open Market Account Manager and the Secretary will keep the Committee informed of ongoing developments regarding the System's balance sheet that could affect the attainment over time of the Committee's objectives of maximum employment and price stability." (Source: Minutes of the Federal Open Market Committee meeting held September 20-21, 2011)
MPC	
Policy Regime	Typical Policy Proposal
Policy Rate	"The Governor invited members of the Committee to vote on the proposition that the repo rate should be maintained at 3.75%" (Source: Minutes of the Monetary Policy Committee meeting held on 3 and 4 December 2003)
QE + ZIRP	"The Governor invited the Committee to vote on the proposition that: Bank Rate should be maintained at 0.5%; The Bank of England should maintain the stock of asset purchases financed by the issuance of central bank reserves at £200 billion." (Source: Minutes of the Monetary Policy Committee meeting held on 8 and 9 December 2010)
PB	
Policy Regime	Typical Policy Proposal ('The Chairman's Policy Proposal')
UOCR	"The Bank of Japan will encourage the uncollateralized overnight call rate to move on average around 0.25 percent." (Source: Minutes of the Monetary Policy Meeting on October 30, 2000)
ZIRP	"The Bank of Japan will provide more ample funds and encourage the uncollateralized overnight call rate to move as low as possible. To avoid excessive volatility in the short-term financial markets, the Bank of Japan will, by paying due consideration to maintaining market function, initially aim to guide the above call rate to move around 0.15%, and subsequently induce further decline in view of the market developments." (Source: Minutes of the Monetary Policy Meeting on September 21, 1999)
QEP + ZIRP	"The Bank of Japan will conduct money market operations, aiming at the outstanding balance of current accounts held at the Bank at around 27 to 30 trillion yen. Should there be a risk of financial market instability, such as a surge in liquidity demand, the Bank will provide more liquidity irrespective of the above target." (Source: Minutes of the Monetary Policy Meeting on June 25, 2003)
CME + ZIRP	"The Bank of Japan will encourage the uncollateralized overnight call rate to remain at around 0 to 0.1 percent." "Members approved the staff proposal regarding the Establishment of "Principal Terms and Conditions for the Asset Purchase Program" by a majority vote and agreed that it should be made public." (Source: Minutes of the Monetary Policy Meeting on October 28, 2010)

Table 4: FOMC Dissents - All members, August 1987- January 2014

| | | Meetings | | | Dissent by type | | | | | |
| | | | | | Conventional | | QE | | Broad | |
Governors[P]		All	Non-QE	QE	Tighten	Ease	Tighten	Ease	Hawk	Dove
Governor	Angell	52	52	0	7	1	0	0	7	1
	Bernanke	89	46	43	0	0	0	0	0	0
	Bies	42	42	0	0	0	0	0	0	0
	Blinder	13	13	0	0	0	0	0	0	0
	Duke	43	4	39	0	0	0	0	0	0
	Ferguson	71	71	0	0	0	0	0	0	0
	Gramlich	66	66	0	0	1	0	0	0	1
	Greenspan	153	153	0	0	0	0	0	0	0
	Heller	14	14	0	0	0	0	0	0	0
	Johnson	23	23	0	0	1	0	0	0	1
	Kelly	118	118	0	1	1	0	0	1	1
	Kohn	67	53	14	0	0	0	0	0	0
	Kroszner	25	24	1	0	0	0	0	0	0
	LaWare	53	53	0	6	0	0	0	6	0
	Lindsey	41	41	0	2	2	0	0	2	2
	Meyer	49	49	0	0	0	0	0	0	0
	Mishkin	16	16	0	0	0	0	0	0	0
	Mullins	29	29	0	0	0	0	0	0	0
	Olson	36	36	0	0	1	0	0	0	1
	Phillips	52	52	0	0	0	0	0	0	0
	Powell	14	0	14	0	0	0	0	0	0
	Raskin	24	0	24	0	0	0	0	0	0
	Rivlin	25	25	0	0	0	0	0	0	0
	Seger	29	29	0	0	11	0	0	0	11
	Stein	14	0	14	0	0	0	0	0	0
	Tarullo	40	0	40	0	0	0	0	0	0
	Warsh	42	24	18	0	0	0	0	0	0
	Yellen[▽]	46	20	26	0	0	0	0	0	0
Presidents[NP]										
Atlanta	Forrestal	24	24	0	0	0	0	0	0	0
	Guynn	32	32	0	0	0	0	0	0	0
	Lockhart	16	0	16	0	0	0	0	0	0
Boston	Syron	15	15	0	0	0	0	0	0	0
	Minehan	40	40	0	0	0	0	0	0	0
	Rosengren	21	5	16	0	1	0	0	0	1
Chicago	Keehn	28	28	0	0	0	0	0	0	0
	Moskow	57	57	0	0	0	0	0	0	0
	Evans	28	4	24	0	0	0	2	0	2
Cleveland	Hendricks	1	1	0	0	0	0	0	0	0
	Hoskins	16	16	0	0	7	0	0	0	7
	Jordan	47	47	0	6	2	0	0	6	2
	Pianalto	42	24	18	0	0	0	0	0	0
Dallas	Boykin	13	13	0	3	0	0	0	3	0
	McTeer	30	30	0	0	3	0	0	0	3
	Fisher	24	14	10	5	0	2	0	7	0
Kansas	Guffey	7	7	0	2	0	0	0	0	0
	Hoenig	61	53	8	4	0	8	0	12	0
	George	8	0	8	0	0	0	0	0	0
Minneapolis	Stern	62	61	1	3	0	0	0	3	0
	Kocherlakota	9	0	9	0	0	2	0	2	0
New York	Corrigan	47	47	0	0	0	0	0	0	0
	McDonough	83	83	0	0	0	0	0	0	0
	Geithner	42	42	0	0	0	0	0	0	0
	Dudley	41	0	41	0	0	0	0	0	0
	Oltman[▲]	1	1	0	0	0	0	0	0	0
	Stewart[▲]	4	4	0	0	0	0	0	0	0
	Cumming[▲]	1	0	1	0	0	0	0	0	0
Philadelphia	Boehne	37	37	0	0	1	0	0	0	1
	Santomero	16	16	0	0	0	0	0	0	0
	Plosser	18	8	10	2	0	2	0	4	0
Richmond	Black	16	16	0	0	0	0	0	0	0
	Broaddus	32	32	0	6	0	0	0	6	0
	Lacker	24	8	16	4	0	8	0	12	0
San Francisco	Parry	48	48	0	2	1	0	0	0	0
	Yellen[▽]	16	8	8	0	0	0	0	0	0
	Williams	8	0	8	0	0	0	0	0	0
St. Louis	Melzer	23	23	0	5	1	0	0	5	1
	Poole	38	38	0	3	0	0	0	3	0
	Bullard	16	0	16	0	0	0	0	0	0
Totals										
Governors		1283	1053	230	16	18	0	0	16	18
Presidents		1095	885	210	53	9	17	3	81	12
All members		2378	1938	440	69	27	17	3	97	30

[▲] Otman and Cumming voted as alternate FOMC members; Stewart voted as acting President of FRB NY.
[▽] Yellen also served as a member of the Board of Governors. Her votes corresponding to this position are given above. [P]Political appointment. [NP]Non-political appointment.

Table 5: Dissents - All Bank of England MPC Members: June 1997 - June 2014

| | Meetings | | | Dissent by type | | | | | |
| | | | | Conventional | | Unconventional | | Broad | |
Internals[P]	All[*]	Non-QE	QE	Tightness	Ease	Tightness	Ease	Hawk	Dove
King[◇,†]	194	142	52	14	0	0	3	14	3
George[◇]	74	74	0	0	0	0	0	0	0
Davies[◇]	2	2	0	0	0	0	0	0	0
Clementi[◇]	61	61	0	3	1	0	0	3	1
Large[◇]	40	40	0	9	0	0	0	9	0
Lomax[◇]	60	60	0	2	3	0	0	2	3
Gieve[◇]	37	37	0	1	2	0	0	1	2
Tucker[◇]	133	81	52	6	1	0	0	6	1
Bean[◇,†]	154	102	52	0	5	0	0	0	5
Internals[NP]									
Plenderleith[◇]	61	61	0	3	2	0	0	3	2
Vickers[◇]	28	28	0	5	0	0	0	5	0
Dale[◇]	60	8	52	6	0	2	0	8	0
Fisher[◇]	52	0	52	0	0	0	3	0	3
Externals[P]									
Buiter[◇◇]	36	36	0	9	8	0	0	9	8
Goodhart[◇◇]	36	36	0	3	0	0	0	3	0
Julius[◇◇,†]	45	45	0	0	14	0	0	0	14
Budd[◇◇]	18	18	0	4	0	0	0	4	0
Wadhwani[◇◇]	37	37	0	0	13	0	0	0	13
Nickell[◇◇,†]	73	73	0	4	13	0	0	4	13
Allsopp[◇◇]	37	37	0	0	11	0	0	0	11
Barker[◇◇,†]	109	109	0	1	4	0	0	1	4
Bell[◇◇]	36	36	0	0	5	0	0	0	5
Lambert[◇◇]	34	34	0	0	0	0	0	0	0
Walton[◇◇,**]	12	12	0	2	1	0	0	2	1
Blanchflower[◇◇]	36	33	3	0	18	0	0	0	18
Besley[◇◇]	36	30	6	7	0	0	1	7	1
Sentance[◇◇]	56	29	27	5	0	12	0	17	0
Miles[◇◇]	49	0	49	0	0	0	12	0	12
Posen[◇◇]	36	0	36	0	0	0	14	0	14
Weale[◇◇]	35	0	35	7	0	0	0	7	0
Broadbent[◇◇]	25	0	25	0	0	1	0	1	0
McCafferty[◇◇]	10	0	10	0	0	0	0	0	0
Totals									
All Internals	956	696	260	49	14	2	12	51	26
Internals[P]	755	599	156	35	12	0	6	35	18
Internals[NP]	201	97	104	8	2	2	6	16	8
Externals[P]	755	550	205	54	87	1	30	55	117
All members	1712	1246	466	103	101	3	42	106	143

◇/◇◇Denotes internal/external member. *Continued to serve on the MPC after March 2013.
†Reappointed. [P]Political appointment. [NP]Non-political appointment.
⋆ Denotes total number of votes cast by each member.

Table 6: Dissents - Bank of Japan Policy Board members, April 1998 - March 2013

| | | | | Dissent by type | | | | | |
| | Meetings | | | Conventional | | Unconventional | | Broad | |
Troika	All	Non-QE	QE	Tighten	Ease	Tighten	Ease	Hawk	Dove
Hayami[G]	88	55	33	0	0	0	0	0	0
Fujiwara[DG]	88	55	33	0	0	0	0	0	0
Yamaguchi[DG]	88	55	33	0	0	0	0	0	0
Fukui[G]	75	29	46	0	0	0	0	0	0
Muto[DG]	75	29	46	0	0	0	0	0	0
Iwata[DG,◊]	75	29	46	0	1	0	0	0	1
Shirakawa[G,♣]	77	41	36	0	0	0	0	0	0
Nishimura[DG,▲]	119■ (42,77)	70■ (41,29)	49■ (36,13)	0	0	0	0	0	0
Yamaguchi[DG]	67	31	36	0	0	0	0	0	0
Rank-and-File									
Goto	29	29	0	0	0	0	0	0	0
Taketomi	65	55	5	0	0	0	0	0	0
Miki	73	55	18	0	0	0	1*	0	1
N.Nakahara	73	55	18	0	9	0	51	0	58
Shinotsuka	56	55	1	38	0	0	0	38	0
Ueda	121	55	66	0	1	1	0	1	1
Taya[Ψ]	83	22	61	0	1	3	0	3	1
Suda	156	71	85	1	1	3	0	4	1
S.Nakahara	79	5	74	0	0	0	0	0	0
Fukuma	75	14	61	0	0	14	2	14	2
Haru	76	15	61	0	0	0	0	0	0
Mizuno	76	58	18	8	0	13	0	21	0
Noda	76	65	11	2	0	0	0	2	0
Kamezaki	78	56	22	0	1	0	0	0	1
Nakamura	78	56	22	0	1	0	0	0	1
Miyao	44	9	35	0	0	0	0	0	0
Morimoto	40	4	36	0	0	0	0	0	0
Shirai	29	0	29	0	0	0	0	0	0
Ishida	25	0	25	0	0	0	0	0	0
Sato	9	0	9	0	0	0	0	0	0
Kiuchi	9	0	9	0	0	0	0	0	0
Totals									
Troika	710	365	345	0	1	0	0	0	1
Rank-and-File	1387	708	679	49	14	34	54	83	66
All members	2097	1073	1024	49	15	34	54	83	67

* In addition to low interest rates, Miki wished to implement additional measures - specifically, a reduction in reserve ratio requirements - to reinforce the easy money policy associated with a near-zero UOCR. We class this as an unconventional dissent on the side of monetary ease.

[G/DG] denotes *Governor/Deputy Governor*.

◊ Iwata is the only Governor or Deputy Governor to have dissented during the entire sample period. His only dissent was cast on the meeting of 20-21 Feb 2007.

♣ Shirakawa was initially appointed as a Deputy Governor on 20/03/2008 for what was to be a five-year term ending 19/03/2013. He served only 20 days in this role, which saw him concurrently serve as acting Governor of the Bank. Immediately following this, Sharakawa was promoted to the position of Governor for a five-year term commencing 09/04/2008.

▲ Nishimura was appointed to the Policy Board on 08/04/2005 as a *Rank-and-File* member before being promoted to Deputy Governor on 20/03/2008, serving until his term expired on 19/03/2013.

■ For Nishimura, we show the total votes cast for each category irrespective of his status on the PB (upper figure), and using parentheses below each figure decompose these totals according to the scheme (*Troika, Rank-and-File*).

Table 7: Number of broad dissents and assents cast by MPC, FOMC and PB members: All regimes

Committee[†]		Broad Dissents under all regimes			
		a. Ease Dissents	*b.* Assents	*c.* Tightness Dissents	*d.* All Dissents
FOMC	*All Members*	30(1.3)	2251(94.7)	97(4.1)	127(5.3)
	Board of Governors	18(1.4)	1249(97.3)	16(1.2)	34(2.7)
	FRB Presidents	12(1.1)	1002(91.5)	81(7.4)	93(8.5)
MPC	*All Members*	143(8.4)[‡]	1463(85.5)	106(6.2)	249(14.5)
	Internal Members	26(2.7)	879(91.9)	51(5.3)	77(8.1)
	External Members	117(15.5)	584(77.2)	55(7.3)	172(22.8)
PB	*All Members*	67(3.2)	1947(92.8)	83(4.0)	150(7.2)
	Troika	1(0.1)	709(99.9)	0(0.0)	1(0.1)
	Rank-and-File	66(4.8)	1238(89.3)	83(6.0)	149(10.7)
Total (all committees)		240(3.9)	5607(91.4)	286(4.7)	526(8.6)

[†] Results based on data from 194 meetings (MPC), 219 meetings (FOMC), and 240 meetings (PB).

[‡] For each voting figure, numbers in round brackets (·) express number of dissenting votes cast as a percentage of all votes cast by a given cohort.

Table 8: Tests of differences between committees

H_0 : FOMC=MPC=PB

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	*Yes*
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*

H_0 : FOMC=MPC

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	*Yes*
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*

H_0 : FOMC=PB

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	**No**
Assent *vs.* dissent	*Yes*	*Yes*	**No**

H_0 : MPC=PB

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	**No**	*Yes*
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*

Table 9: <u>Tests of differences between committees: intra-committee differences</u>

$H_0 : \text{FOMC}_{BOG} = \text{FOMC}_{FRBs}$

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	*Yes*
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*

$H_0 : \text{MPC}_{Internals} = \text{MPC}_{Externals}$

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	**No**
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*

$H_0 : \text{PB}_{Troika} = \text{PB}_{Rank-and-File}$

	Reject H_0?		
	All regimes	non-QE	QE
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	*Yes*
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*
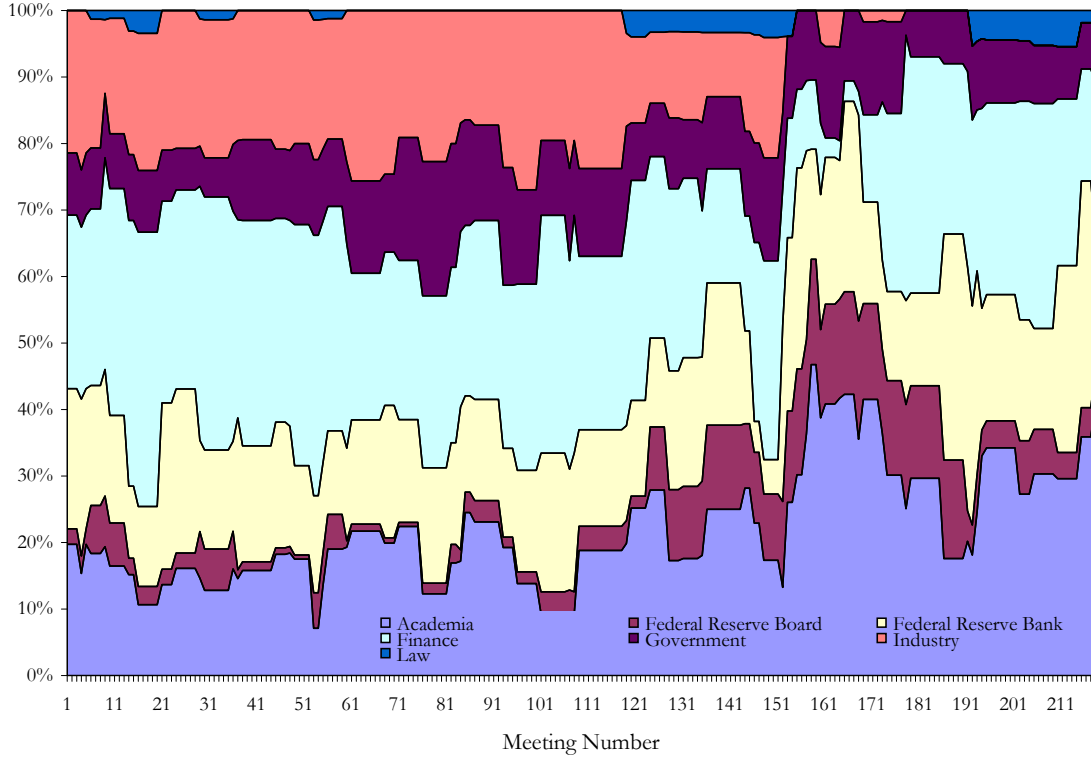
Figure 3: The changing career composition of the FOMC by meeting, August 1987-January 2014

Table 10: Number of broad dissents and assents cast by FOMC, MPC, and PB members: QE versus non-QE regimes

		a. Ease Dissents	b. Assents	c. Tightness Dissents	d. All Dissents
Broad Dissents under QE regimes[†]					
FOMC	*All Members*	3(0.7)	409(93.0)	28(6.4)	31(7)
	Board of Governors	0(0.0)	230(100.0)	0(0.0)	0(0.0)
	FRB Presidents	3(1.4)	179(85.2)	28(13.3)	31(14.8)
MPC	*All Members*	42(9.0)[‡]	396(85.0)	28(6.0)	70(15.0)
	Internal Members	12(4.6)	240(92.3)	8(3.1)	20(7.7)
	External Members	30(14.6)	156(75.7)	20(9.7)	50(24.3)
PB	*All Members*	13(1.3)	977(95.4)	34(3.3)	47(4.6)
	Troika	0(0.0)	345(100.0)	0(0.0)	0(0.0)
	Rank-and-File	13(1.9)	632(93.1)	34(5.0)	47(6.9)
Total (all committees)		58(3.0)	1782(92.3)	90(4.7)	148(7.7)
Broad Dissents under non-QE regimes[††]					
FOMC	*All Members*	27(1.4)	1842(95.0)	69(3.6)	96(5.0)
	Board of Governors	18(1.7)	1019(96.8)	16(1.5)	34(3.0)
	FRB Presidents	9(1.0)	823(93.0)	53(6)	62(7.0)
MPC	*All Members*	101(8.1)[‡]	1067(85.6)	78(6.3)	179(14.4)
	Internal Members	14(2.0)	639(91.8)	43(6.2)	57(8.2)
	External Members	87(15.8)	428(77.8)	35(6.4)	122(22.2)
PB	*All Members*	54(5.0)	970(90.4)	49(4.6)	103(9.6)
	Troika	1(0.3)	364(99.7)	0(0.0)	1(0.3)
	Rank-and-File	53(7.5)	606(85.6)	49(6.9)	102(14.4)
Total (all committees)		182(4.3)	3879(91.1)	196(4.6)	378(8.9)

[†] Results based on data from 42 meetings (FOMC), 52 meetings (MPC), and 115 meetings (PB).

[††] Results based on data from 177 meetings (FOMC), 142 meetings (MPC), and 125 meetings (PB).

[‡]For each voting figure, numbers in round brackets ($\cdot$) express number of dissenting votes cast as a percentage of all votes cast by a given cohort.

Table 11: Does the same type of member vote differently across different policy regimes?
QE versus non-QE regimes

$H_0 : \text{FOMC}_{QE}=\text{FOMC}_{non-QE}$			
	Reject H_0?		
	All members	BoGs	FRBs
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	**No**
Assent *vs.* dissent	**No**	*Yes*	*Yes*

$H_0 : \text{MPC}_{QE}=\text{MPC}_{non-QE}$			
	Reject H_0?		
	All members	Internals	Externals
Assent *vs.* ease *vs.* tighten	**No**	*Yes*	**No**
Ease *vs* .tighten	**No**	*Yes*	**No**
Assent *vs.* dissent	**No**	**No**	**No**

$H_0 : \text{PB}_{QE}=\text{PB}_{non-QE}$			
	Reject H_0?		
	All members	Troika	Rank-and-file
Assent *vs.* ease *vs.* tighten	*Yes*	*Yes*	*Yes*
Ease *vs* .tighten	*Yes*	*Yes*	*Yes*
Assent *vs.* dissent	*Yes*	*Yes*	*Yes*

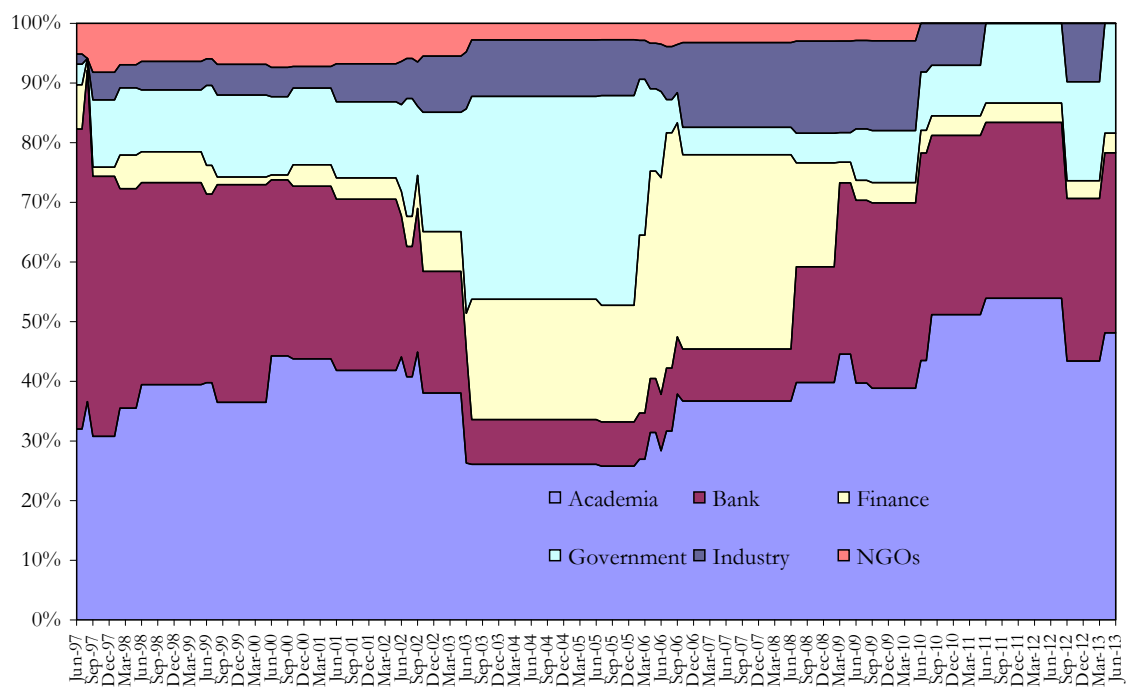| $H_0 : (\text{FOMC}+\text{MPC}+\text{PB})_{QE}=(\text{FOMC}+\text{MPC}+\text{PB})_{non-QE}$			
	Reject H_0?		
	All members	—	—
Assent *vs.* ease *vs.* tighten	**No**	—	—
Ease *vs* .tighten	**No**	—	—
Assent *vs.* dissent	**No**	—	—

Figure 4: The changing career composition of the Bank of England MPC, June 1997-June 2013
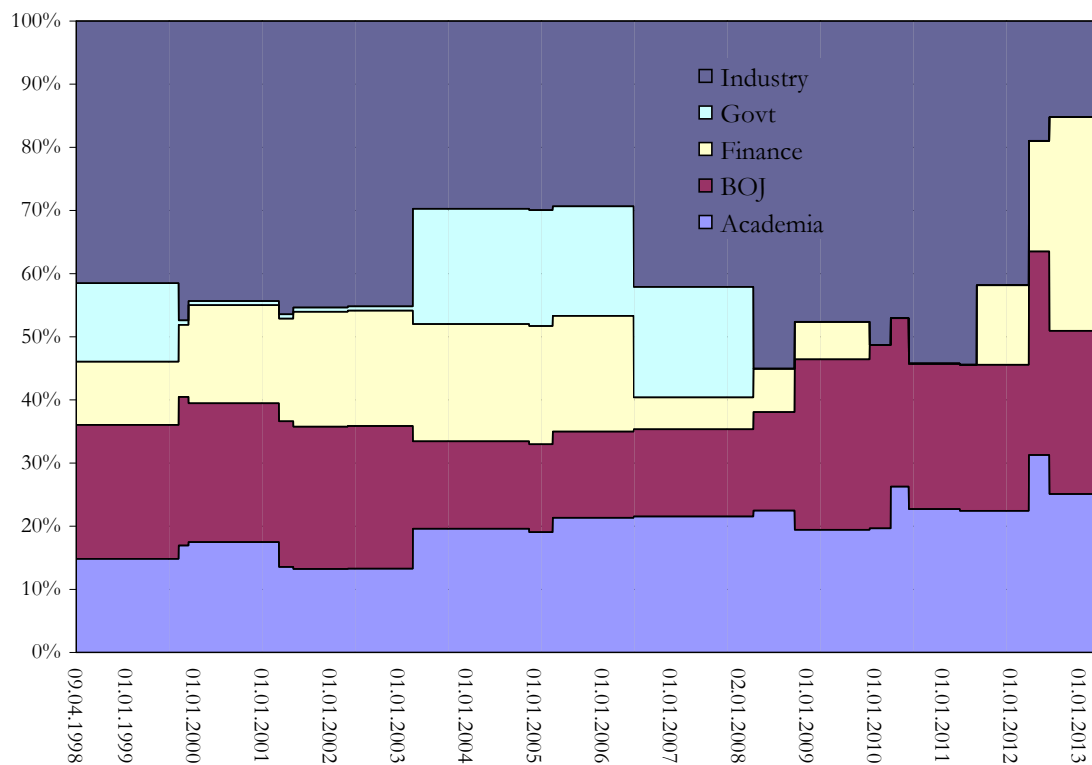
Figure 5: The changing career composition of the Bank of Japan Policy Board, April 1998
- March 2013

7   The Random Effects Ordered Probit Model

Consider a situation where we have *repeated* observations on individuals who vote at monetary policy committee meetings. Each individual i has an underlying, unobserved, propensity to assent or dissent on the side of monetary ease or tightness in meeting t, denoted y_{it}^*. This will be driven by a set of career proximity measures prevailing at time t to the member, x_{it} with unknown weights β; political, institutional and economic factors captured by a set of indicator variables with unknown weights $\boldsymbol{\alpha}$; and a random disturbance term ε_{it} such that

$$y_{it}^* = \mathbf{x}_{it}'\boldsymbol{\beta} + \mathbf{D}_i'\boldsymbol{\alpha} + \varepsilon_{it}. \tag{13}$$

This unobserved index y_{it}^* will translate into a dissent on the side of monetary ease $(y = 0)$, assent $(y = 1)$ and dissent on the side of monetary tightness $(y = 2)$ according to the relationship between y^* and boundary parameters, $\boldsymbol{\mu}$,

$$y = \begin{cases} 0 & if & y^* < \mu_0 \\ 1 & if & \mu_0 \le y^* < \mu_1 \\ 2 & if & y^* \ge \mu_1 \end{cases} \tag{14}$$

where, for identification, μ_0 is normalized to 0 (or equivalently, there is no constant in x). Under the usual assumption of normality, this results in probabilities of each observed state of

$$\Pr\left(y_{it}\right) = \begin{cases} 0 & = & \Phi\left(-x_{it}'\beta\right) \\ 1 & = & \Phi\left(\mu_1 - x_{it}'\beta\right) - \Phi\left(x_{it}'\beta\right) \\ 2 & = & 1 - \Phi\left(\mu_1 - x_{it}'\beta\right) \end{cases} \tag{15}$$

for example to additionally in equation (13).[41]

Assuming the modeler has a set of well-defined variables for this equation, it is also possible to specify *random* unobserved effects (e_i) in the y^* equation of (13) such that

$$y_{it}^* = \mathbf{z}_{it}'\boldsymbol{\gamma} + e_i + \varepsilon_{it}. \tag{16}$$

where $Var\left(\varepsilon_{it}\right) = 1$ and $Var\left(\varepsilon_{it}\right) = 1 + \sigma_e^2$. Note that the correlation of the composite error term $v_{it} = e_i + \varepsilon_{it}$, $corr\left(v_{it}, v_{is} | \mathbf{z}, \mathbf{x}\right)$, $t \ne s$, is given by $\rho_{panel} = \frac{\sigma_e^2}{(\sigma_e^2 + \sigma_\varepsilon^2)} = \frac{\sigma_e^2}{(\sigma_e^2 + 1)}$, or $\sigma_e^2 = \frac{\rho_{panel}}{1 - \rho_{panel}}$, which also gives the relative importance of the individual effects to the overall (composite) variance.

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[41] Using a linear *random parameters* model, Besley, Meads, and Surico (2008) demonstrate that although MPC decisions are characterized by voter heterogeneity, the differences in reactions to the inflation forecast and output gap based on a member's type and career backgrounds are insignificant. This is in contrast to Harris and Spencer (2009) who find that internal and external members react very differently to forecasts of inflation and output.

Conditional on the individual effects, the ε_{it} are independent such that the likelihood for individual i can be written as

$$l_i(\boldsymbol{\theta}) = \int_{-\infty}^{\infty} \prod_{t=1}^{T_i} \sum_{j=0}^{J-1=2} d_{ijt} \left[\Pr(y_{it} = j \,|\, \mathbf{x}_{it}, \mathbf{z}_{it}, e_i) \right] f(e_i) \, \partial e_i \qquad (17)$$

which, under the assumption that $f(e_i)$ is $e_i \sim N(0, \sigma_e^2)$, can be evaluated using simulation methods (Greene 2008); or, more commonly, by Hermite integration quadrature methods (Butler and Moffitt 1982) by using $\tilde{e}_i = e_i / \sqrt{2}$ and replacing e_i in equation (16) with $\theta \tilde{e}_i$, where $\theta = \left[\frac{2\rho_{panel}}{1 - \rho_{panel}} \right]^{1/2}$. The individual log-likelihood is simply $\ln(l_i(\boldsymbol{\theta}))$ and the full log-likelihood, this summed over i.

Model estimates are reported for a variety of specifications. Following Harris, Levine, and Spencer (2011) and Havrilesky and Schweitzer (1990), career characteristics data is manipulated in a way which directly facilitates testing of the theoretical model introduced in Section 5: for each committee member, experience within each career category is expressed as the difference between the number of years spent working in that category, and the committee mean for that category. These variables are denoted Academia$_D$, Bank$_D$, Finance$_D$, Government$_D$, and Industry$_D$, where the D subscript denotes 'deviation from the committee mean'. Given the paucity of observations for NGO experience and Law, these variables are omitted from the empirical model.[42] As stressed in Harris, Levine, and Spencer (2011), career characteristics should not be interpreted as career 'fixed' effects as a committee member's career experience for a given characteristic is *not* detrended by its mean. As the committee mean for a given characteristic changes (i.e., with the turnover of new members with different career backgrounds) so too does a member's given career characteristic. More formally, $(x_{gt} - \overline{x}_g)$ is usual, but in our case we have $(x_{gt} - \overline{x}_t)$, where x represents a given career characteristic, x_t its mean value in period t, x_g is the mean of that characteristic for member g, and x_{gt} is the period t value of that characteristic for member g.

In addition to using variables constructed from the career characteristics data in Section 6.4, a number of additional variables are utilized, which control for the impact of various political and institutional factors, as well as the monetary policy regime.[43] To capture the impact of *political partisanship*, we include a dummy variable ('Left') capturing the political ideology of the political party in power when the member was appointed (1 if left-wing, 0 if right-wing). We predict that members appointed during a left-wing incumbency are more likely to dissent on the side of ease, whereas those appointed during a right-wing incumbency are more prone to cast tightness dissents. In doing so, we

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[42]We note here that their inclusion turns out to be inconsequential for our results.

[43]This approach is exemplified by the contributions of Havrilesky and Gildea (1991a), Havrilesky and Schweitzer (1990) and Chappell, McGregor, and Vermilyea (2007a).

classify the following political parties are right-wing: the United States *Republican Party*, the British *Conservative Party*, and the Japanese *Liberal Democratic Party* (LDP). In contrast, the following political parties are treated as being left-wing in their ideological orientation: the United States *Democratic Party*, the British *Labour Party* and the *Democratic Party of Japan* (DPJ).

A dummy variable ('Political') is also used to control for whether members are *directly* appointed by the government, or selected using a more independent process (1 if directly appointed, 0 if not). Here, we conjecture that members *directly* appointed by the government will have a greater propensity to vote on the side of monetary ease: such members are treated as being more susceptible to opportunistic pressure by the political incumbency to adopt a looser monetary stance prior to an election. This variable may be of particular relevance for the FOMC and the MPC, where some members are appointed in a more politically independent manner than others.[44] We also introduce a dummy variable, denoted 'Type', which captures the institutional distinction between what we term the 'hub' members and the 'spokes' members of a given committee (1 if a 'hub' member, 0 if 'spokes'). Members of the 'Hub' are characterized as a specific grouping within a committee which occupy as having a position of greater seniority *at the central bank* than the remaining 'spokes' members. We class 'hub' members as being: members of the FOMC's *Board of Governors*; *internal* MPC members; and the PB's *Troika*. All other groupings (*FRB Presidents*, *external* MPC members, *rank-and-file*) are the 'spokes'. To provide an example of the type of seniority enjoyed by 'hub' members, in the case of the FOMC, the budgets of individual Federal Reserve Banks in the United States are subject to approval by members of the Fed's Board of Governors. This is just one of an array of executive budgetary, operational, and regulatory responsibilities held by members of the Board of Governors; similar executive responsibilities also extend to internal MPC members at the Bank of England and members of the PB's *troika*.[45]

Whether the policy regime is characterized by the implementation of unconventional policy measures is captured by a dummy variable denoted QE (1 if under a quantitative easing regime, 0 if not). We note that for the case of Japan, it is still possible to observe the economy at the effective ZLB *without* unconventional policies being used. Lastly, as dissent voting may be affected by the distinct institutional features and the monetary policy framework associated with a given central bank, individual committee dummies are included.

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[44]There is a rich literature which examines the impact of politics on central bank appointments, particularly with respect to the impact on FOMC policy decisions. In the case of the US Federal Reserve, Hetzel (1985) notes how monetary policy is influenced by constituent groups through the conduit of Congress, on whom the Fed's autonomy largely depends. To this end, Wooley (1984) notes that threats to curtail the Fed's autonomy ensures a degree of compliance, or rather, sensitivity to the desires of US Congress. In relation to this point, Grier (1991) notes that Congressional influence on monetary policy is significant.

[45]See https://www.boj.or.jp/en/about/organization/tanto.htm/.

Prior to turning to our estimation results, *we stress that in the context of our trichotomous ordered probit model, each dummy variable is interpretable in terms of the extent to which it impacts on members' propensities to dissent on the side of monetary tightness relative to ease.* Accordingly, subject to there being statistically significant marginal effects, a positive and statistically significant dummy coefficient is interpreted as leading to tightness dissents, whereas a negatively valued and statistically significant dummy promotes ease dissents.

7.1 Estimation results

Our estimation strategy pools members' votes together from each committee, yielding a three-committee panel data set. Estimation results are displayed in Tables 12 and 13. In Table 12, four models are presented, of which we initially confine our attention to the first three (Models I, II, and III). Standard errors are shown in parentheses (.), where ***,**,* denote 1, 5 and 10 percent levels statistical significance, respectively. AIC and BIC denote the Akaike and Bayesian information criteria, where a smaller value signals a more desirable specification. Model I represents a 'baseline' specification, insofar as only career background effects are included as covariates. In addition to career background effects, Model II controls for the impact of *political partisanship* ('Left'), political appointment effects ('Political'), 'hub' or 'spokes' members ('Type') and whether the policy regime is characterized by conventional or unconventional policy measures ('QE'). Model III extends the Model II by augmenting the specification with committee membership dummies (denoted 'MPC' and 'PB'), where to prevent the dummy variable trap, the FOMC membership dummy is omitted.

Whilst the career background parameters are highly robust to specification change, their impact on dissent voting behavior is at best negligible ($\mathsf{Finance}_D$,$\mathsf{Industry}_D$) and at worst completely insignificant (Bank_D, $\mathsf{Government}_D$): even where a career background parameter is highly statistically significant, in every instance, its absolute size implies that[46] the deviation in years of a member's career from the committee mean, $\overline{X}_{jt}$, needs to be *exceptionally* (and arguably, unrealistically) large to meaningfully impact on voting behavior.[47] Nevertheless, for the first three models we consider, we were able to reject the hypothesis of career backgrounds being jointly insignificant at conventional levels. Due to this finding, it makes sense to focus attention on Models II and III, which are more desirable than Model I on AIC and BIC grounds, and for which we observe non-career background variables exerting a statistically significant and non-negligible impact on the decision to dissent. For both of these models, parameter estimates indicate that members appointed during a left-wing incumbency are more likely to dissent on the side of monetary

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[46] This assertion is based on marginal effects (not reported here).

[47] E.g., surpassing the total time one would expect to work in a lifetime.

ease, as are individuals who are politically appointed - *this is in keeping with our priors*; further, when controlling for these factors, we additionally find that 'hub' members are more likely to dissent on the side of tightness.[48] Interestingly, both committee dummies (MPC, PB) turn out to be statistically insignificant in Model III: once when members' personal and backgrounds are controlled for, the specific committee a member belongs to is immaterial. This may be due to the fact that by using variables such as political, type and left, we are already controlling for the main determinants of voting behavior, behavior which is attributable to factors that cut across national committee distinctions.

While Models II and III are unanimously better specified than Model I according to AIC and BIC, these metrics are not unanimous in determining whether Model II has a more desirable specification than Model III. According to the BIC, Model II performs best, whereas AIC selects Model III. In some respects, this result is unsurprising: due to its asymptotic consistency and its heavy penalty on complexity, BIC typically selects more parsimonious specifications. Conversely, AIC often chooses less parsimonious specifications as complexity is not so heavily penalized, especially for small or moderate sample sizes. Given that the inclusion of the (jointly insignificant) committee dummies marks the only difference between these two models, Model II is selected for re-estimation using random effects, thus exploiting the panel nature of our data. This new specification appears as Model II$_{RE}$ in Table 12, where we note that based on *both* the AIC and BIC, it significantly outperforms all models in Table 12. Further, the random effects are highly statistically significant, indicating the presence of (substantial) unobserved heterogeneity. Lastly, relative to being in a conventional policy regime, being in a non-conventional one promotes tightness dissents (note the positive coefficient on the QE variable). This may be due to the fact that when the interest rate is at the nominal ZLB, committee members only have one channel through which to cast an ease dissent (through calling for more QE relative to the winning majority of MPC members); however, for tightness dissents, there exists two channels - voting for a smaller QE stimulus relative to the winning majority *or/and* voting to raise the policy rate.

Table 13 provides estimation results after having split the total number of votes into two samples, based on whether they were cast under (*i*) an unconventional or (*ii*) a conventional policy regime. Identical models are estimated across both regimes, although we note that for each of the two specifications estimated under each policy regime, one is specified with the inclusion of random effects (denoted using the subscript '*RE*'), and the other without. Significantly, we emphasize here that as with the models in Table 12, career background effects turn out to be uninformative in explaining voting behavior. Other covariates, however, appear to be significant drivers of dissent voting. Further, the specifications with random effects unanimously outperform those without such innovations (based on AIC and BIC values). Especially noteworthy is the finding that when 'like-for-

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[48]This result holds only for Model III, when specific committee dummies are included.

like' specifications are compared across regimes (e.g. those *with* random effects only, and those *without* random effects only), members appointed during a left-wing incumbency are more prone to dissenting on the side of monetary ease during QE regimes. This also holds true for individuals who are politically appointed. A plausible interpretation of this latter finding is that in the face of exceptionally severe or bad economic conditions, committee members are more susceptible to government pressure to provide monetary stimulus.

8   Conclusion

Scant attention has been paid to how members of monetary policy committees vote when faced with unconventional monetary policy choices. This paper directly addresses this issue by constructing a 'broad' dissenting policy stance index à la Xiong (2012), which permits investigation of the determinants of dissent across sample periods which include major policy regime shifts.

Our findings are manifold. Pooled and panel data estimates provide robust evidence that career backgrounds are not significant determinants of dissent voting behavior. Whilst on the one hand this finding is consistent with previous work on the MPC (Harris, Levine, and Spencer 2011), it contradicts the findings of Havrilesky and Schweitzer (1990) who find evidence in favour of such influence for the FOMC. Our results hence lend empirical support to the conjecture that members' "concrete background characteristics" (Romer and Romer 2004, p.151) are not the best predictors of voting behavior.

A second finding is that appointment channel effects, the ideological leanings of the government when a member was appointed (e.g. left- versus right-wing), and a member's 'type' turn out to be significant determinants of the decision to dissent. These findings in many respects reinforce those reported in the political economics and public choice literature (Alesina and Roubini 1992; Chappell, Havrilesky, and McGregor 1993), where, for instance, political appointees are more likely to dissent on the side of monetary ease. Third, and perhaps most significantly, the decision to dissent is affected by the monetary policy regime itself: individuals appointed during a left-wing incumbency have a greater propensity to dissent on the side of monetary ease during periods of unconventional policy than in conventional periods. This finding also holds true for individuals who are politically appointed. These findings are new to the literature. Finally, our results are strengthened by, and robust to, the inclusion of random effects, which provide strong evidence of (unobserved) member heterogeneity.

Table 12: Estimation Results: Pooled votes, Models I-III

Variables	Model I	Model II	Model III	Model II$_{RE}$
Academia$_D$	0.005 (0.003)	0.013** (0.006)	0.006 (0.005)	0.004 (0.003)
Bank$_D$	0.003 (0.003)	−0.0007 (0.007)	−0.0008 (0.007)	−0.006 (0.010)
Finance$_D$	0.004* (0.002)	0.008*** (0.003)	0.009*** (0.003)	0.003 (0.009)
Government$_D$	−0.003 (0.005)	−0.006 (0.004)	−0.006 (0.004)	−0.010 (0.010)
Industry$_D$	−0.006** (0.003)	−0.007** (0.003)	−0.007** (0.003)	0.013** (0.005)
Left-Wing	−	−0.219*** (0.054)	−0.392*** (0.0450)	−0.411*** (0.066)
Political	−	−0.396*** (0.086)	−0.293*** (0.0768)	−0.603*** (0.147)
Type	−	0.118 (0.175)	0.167 *** (0.0693)	0.165* (0.099)
QE	−	0.136 *** (0.0352)	0.137 *** (0.0412)	0.270 *** (0.0503)
MPC	−	−	0.108 (0.111)	−
PB	−	−	0.023 (0.0510)	−
μ_1	−1.623*** (0.056)	−1.992*** (0.0463)	−2.324*** (0.0883)	−2.220*** (0.245)
μ_2	1.791*** (0.032)	1.512 *** (0.0557)	1.416*** (0.032)	1.802*** (0.206)
Random effects				
σ_e	−	−	−	0.471*** (0.022)
Summary statistics				
AIC	4435.83	4098.33	4099.13	3172.12
BIC	4569.32	4160.30	4177.02	3195.38
LogL	−2132.64	−2108.24	−2031.89	−1545.42
Obs.	6187	6187	6187	6187

[a]Standard errors in parentheses.

***/**/*Denotes two-tailed significance at one / five / ten percent levels.

Table 13: Estimation Results: Pooled votes, Models IV-V - non-ZLB vs. ZLB

Variables	non-QE regimes only		QE regimes only	
	Model IV	Model IV$_{RE}$	Model V	Model V$_{RE}$
Academia$_D$	0.005 (0.003)	0.004 (0.006)	0.010* (0.006)	−0.014 (0.010)
Bank$_D$	0.005 (0.004)	−0.008 (0.009)	−0.003 (0.008)	−0.020 (0.025)
Finance$_D$	0.016*** (0.002)	0.010 (0.018)	−0.010 (0.009)	0.016 (0.014)
Government$_D$	−0.001 (0.003)	−0.011** (0.005)	−0.016*** (0.002)	−0.065*** (0.018)
Industry$_D$	−0.005 (0.004)	−0.010* (0.006)	−0.010*** (0.004)	−0.071*** (0.008)
Left-Wing	−0.200*** (0.032)	−0.091 (0.088)	−0.382*** (0.082)	−0.810*** (0.043)
Political	−0.403*** (0.100)	−0.744*** (0.231)	−0.692*** (0.161)	−1.203*** (0.341)
Type	0.245*** (0.078)	0.501*** (0.124)	−0.085 (0.080)	0.226 (0.438)
μ_1	−2.001*** (0.075)	−2.88*** (0.091)	−2.693*** (0.192)	−5.06*** (0.156)
μ_2	1.569*** (0.103)	1.82*** (0.099)	1.022*** (0.093)	1.451*** (0.392)
Random effects				
σ_e	–	0.544*** (0.078)	–	0.682*** (0.019)
Summary statistics				
AIC	2551.84	2272.41	1498.80	817.48
BIC	2614.09	2203.93	1556.36	880.79
LogL	−1265.92	−1090.97	−739.40	−397.74
Obs.	4257	4257	1930	1930

[a]Standard errors in parentheses.

***/**/*Denotes two-tailed significance at one / five / ten percent levels.

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A Appendix

A.1 Short-term and emergency liquidity measures taken by the Fed, BoE and BoJ

In addition to pursuing unconventional policy measures aimed at stimulating the economy when 'conventional' policy measures became ineffective, the Fed, BoE, and BoJ also, when deemed necessary, established short-term and emergency *liquidity* facilities aimed at ensuring financial stability and the smooth running of the financial system. For the Fed and the BoE, such measures were primarily introduced both during and in the wake of the GFC; in contrast, the BoJ introduced liquidity enhancing measures even *prior* to the establishment of its nine-member PB in 1998 (and by implication the 2008 GFC).

Many of the Fed's liquidity measures were not subject to approval as part of the so-called 'domestic policy directive' at regular FOMC meetings, but voted on separately, in some cases during conference calls. Such an example is the creation of the *term auction facility,* or, simply 'TAF' (see Taylor and Williams (2009) and Thornton (2011) for analysis is its effectiveness as an emergency liquidity tool): whilst the prospect of its establishment was subject of discussion in an unscheduled FOMC conference call held December 6th 2007, its approval was granted on December 10th 2007 using 'notation voting'. Under this method, material is circulated among the members of the Board of Governors for written vote and comment. This effectively means that the BoG, and *not* the full FOMC formally approved the policy, even if FRB presidents may have indicated their full support for it during the conference call.

In the case of the UK, comparable short-term measures encompass innovations such as the 'Special Liquidity Scheme' (SLS) introduced in April 2008, which was created to improve the liquidity position of the banking system and increase confidence in financial markets (John, Roberts, and Weeken 2012). However, in practice MPC members are not recorded in the MPM as having cast votes on the introduction to this scheme, which was devised by the Bank in conjunction with HM Treasury and the UK Debt Management Office (DMO). Significantly, the SLS was reportedly totally 'ring-fenced from, and independent of, the BoE's money market operations', so as to not 'interfere with the Bank's ability to implement monetary policy' (Bank of England 2008).

As indicated above, many of the BoJ's liquidity measures were introduced *prior* to the GFC. Such measures include those intermittently pursued by the BoJ since 1995, which have involved the purchases of commercial paper (CP) repurchase agreements to 'circumvent the traditional bank-lending channels' and 'spur lending'(Johnson, Small, and Tryon 1999). This assertion is reinforced by Ueda (2009) who states:

"During the years 1998-2006 liquidity and risk premiums rose in many parts of the financial system from time to time. The rise in premiums led to a sharp contraction in

Table 14: Short-term and Emergency Liquidity measures adopted by the Federal Reserve, Bank of England, and Bank of Japan

Central Bank	Specific Policy Measures✠
Fed	short-term liquidity measures such as: Term Auction Facility (TAF) $(12/12/2007 - 08/03/2010)$; Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility $(19/09/2008 - 01/02/2010)$; Term Securities Lending Facility (TSLF) and the TSFL options program (TOP) $(11/03/2008 - 01/02/2010)$; Commercial Paper Funding Facility $(07/10/2008 - 01/02/2010)$.
BoE	Creation of the Special Liquidity Scheme (SLS) between $21/04/2008 - 30/01/2012.^\diamond$
BoJ	The use of commercial paper (CP) and Asset Backed Securities (ABSs) repos to circumvent the orthodox bank-lending channels and provide new funds to the commercial paper market. Outright purchases of ABSs and asset-backed CPs to promote smooth corporate financing by reducing credit risk.

✠Dates in round brackets provide the following information:
(initial announcement date, programme closure date).
$^\diamond$Although the drawdown period for the SLS closed on 30th January 2009, the scheme remained in place for three further years until 30th January 2012.

economic activity in late 1998. Similar stresses were felt in 2001 and 2002. As a result, many of the BoJ's operations attempted to target "soft spots" in the channels of financial intermediation *in order to contain the stresses or the rise in risk premiums.*" (emphasis added).

Examples of the types of liquidity enhancing measures taken by the central banks named above are shown in Table 2. We stress that the table does not provide an exhaustive list of the policy emergency liquidity measures taken: comprehensive details of all the measures taken can be found on each central bank's respective website.

A.2   Quantitative Easing Measures by the US Federal Reserve: A Brief Chronology

Prior to the 2008 GFC, the FOMC considered it highly unlikely that the target fed funds rate would reach zero or near-zero levels, and so the need to conduct unconventional monetary policies of the type used in Japan from 2001-2006 seemed a remote prospect. Nevertheless, the FOMC was not completely dismissive of a Japanese-style liquidity trap arising, as documented in the minutes of the FOMC meeting of January 29-30, 2002. During this meeting, FOMC members agreed that "the potential for such an economic and policy scenario seemed highly remote, but...could not be dismissed altogether."[49] Crucially, the minutes add that "If in the future such circumstances appeared to be in the process of materializing, a case could be made at that point for taking preemptive easing actions to help guard against the potential development of economic weakness and price

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[49]http://www.federalreserve.gov/fomc/minutes/20020130.htm

declines that could be associated with the so-called "zero bound" policy constraint."

In practice, when the need to reduce the TFFR to the effective nominal ZLB arose (defined as a range of effective FFR values between 0-0.25 percent), the FOMC augmented this policy with unconventional policy in the form of *large scale asset purchases* (LSAP), initially funded by the creation of electronic money. However, it can be clearly observed that type of assets purchased, and the way in which unconventional policy was conducted changed over time. For this reason, the period of unconventional US monetary policy associated with our sample can be usefully divided into *five* distinct phases (also see Gertler and Karadi (2013) who adopt similar terminology): 'Quantitative Easing 1' (or QE1), which ran from November 2008 to March 2010; 'QE2', running from November 2010 to June 2011; the Maturity Extension Programme (MEP), running from September 2011 - December 2012; QE3, running September 2012 - November 2012; and QE4, from December 2012 - January 2014.

The general public and financial market participants were first informed of the Federal Reserve's intention to pursue the unconventional monetary policies associated with QE1 on November 25, 2008, via the following announcement:

> "The Federal Reserve announced on Tuesday that it will initiate a program to purchase the direct obligations of housing-related government-sponsored enterprises (GSEs)–Fannie Mae, Freddie Mac, and the Federal Home Loan Banks–and mortgage-backed securities (MBS) backed by Fannie Mae, Freddie Mac, and Ginnie Mae. Spreads of rates on GSE debt and on GSE-guaranteed mortgages have widened appreciably of late. This action is being taken to reduce the cost and increase the availability of credit for the purchase of houses, which in turn should support housing markets and foster improved conditions in financial markets more generally.

> Purchases of up to $100 billion in GSE direct obligations under the program will be conducted with the Federal Reserve's primary dealers through a series of competitive auctions and will begin next week. Purchases of up to $500 billion in MBS will be conducted by asset managers selected via a competitive process with a goal of beginning these purchases before year-end. Purchases of both direct obligations and MBS are expected to take place over several quarters. Further information regarding the operational details of this program will be provided after consultation with market participants."[50]

Following this announcement, the *domestic policy directive* in the FOMC meeting of 16th December 2008, was amended to include monetary easing measures, and not just the

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[50]http://www.federalreserve.gov/newsevents/press/monetary/20081125b.htm

FFR as the main instrument of monetary policy.[51] From a decision making perspective, this meant that FOMC members voted on policy relating to a broader range of policy instruments, and *not* only the target FFR. In the FOMC of meeting of March 18th 2009, its members voted to expand the QE1 programme by a further $750 billion in purchases of agency mortgage backed securities and agency debt, and $300 billion in purchases of Treasury securities. The FOMC voted for further expansions to the programme on September 23, 2009 and November 4, 2009, respectively, before the end of QE1 was announced on March 16, 2010:

> "...To provide support to mortgage lending and housing markets and to improve overall conditions in private credit markets, the Federal Reserve has been purchasing $1.25 trillion of agency mortgage-backed securities and about $175 billion of agency debt; those purchases are nearing completion, and the remaining transactions will be executed by the end of this month."[52]

QE1 was superseded by what is often referred to as QE2, which was announced immediately following the FOMC meeting of November 3, 2010:[53]

> ".....To promote a stronger pace of economic recovery and to help ensure that inflation, over time, is at levels consistent with its mandate, the Committee decided today to expand its holdings of securities. The Committee will maintain its existing policy of reinvesting principal payments from its securities holdings. In addition, the Committee intends to purchase a further $600 billion of longer-term Treasury securities by the end of the second quarter of 2011, a pace of about $75 billion per month."

The period of quantitative easing associated with QE2 ended in June 2011,[54] and was followed by the Maturity Extension Programme (MEP), commencing September 21, 2011:

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[51]The domestic policy directive was amended to read:

"In light of the use of additional tools for implementing monetary policy, the Committee revised the form of the directive to the Open Market Desk of the Federal Reserve Bank of New York. In addition to specifying that it now seeks conditions in reserve markets consistent with federal funds trading in a range of 0 to 1/4 percent, the Committee instructed the Desk to purchase up to $100 billion in housing-related GSE debt and up to $500 billion in agency-guaranteed MBS by the end of the second quarter of 2009. Members agreed that they should not specify the precise timing of these purchases, but that they should leave discretion to the Desk to intervene depending on market and broader economic conditions."

[52]http://www.federalreserve.gov/newsevents/press/monetary/20100316a.htm

[53]In the period between the ending of QE1 and the commencement of QE2, the FOMC instructed the FRB New York's trading desk (the 'Desk') to roll over the Federal Reserve's holdings of Treasury securities as they mature, although maturing agency debt and all prepayments of agency MBS were redeemed without replacement. This latter policy was later extended on August 10, 2010 when the Desk was instructed by the FOMC to to maintain the total face value of domestic securities held in the System Open Market Account at approximately $2 trillion by reinvesting principal payments from agency debt and agency mortgage-backed securities in longer-term Treasury securities.

[54]http://www.federalreserve.gov/newsevents/press/monetary/20101103a.htm

"To support a stronger economic recovery and to help ensure that inflation, over time, is at levels consistent with the dual mandate, the Committee decided today to extend the average maturity of its holdings of securities. The Committee intends to purchase, by the end of June 2012, $400 billion of Treasury securities with remaining maturities of 6 years to 30 years and to sell an equal amount of Treasury securities with remaining maturities of 3 years or less. This program should put downward pressure on longer-term interest rates and help make broader financial conditions more accommodative."[55] (emphasis added)

The MEP has been referred to in the financial and news media as 'Operation Twist' (after the policy measure of the same name and type originally implemented in 1961). Clearly, what distinguishes the MEP from quantitative easing is the *method* used to purchase securities: under QE, purchases of securities are made possible through the creation of electronic money by the central bank. However, under the MEP, long-term US government bonds were purchased using funds from the sale of short-term government bonds from the Fed's balance sheet. This measure had the impact of changing the composition - *but not the size* - of the Federal Reserve's portfolio of assets. The MEP thus represents a policy innovation which like QE, attempts to reduce long-term interest rates, but unlike QE neither creates electronic money (thereby ameliorating possible inflationary concerns) nor increases the size of the Federal Reserve's balance sheet. The FOMC extended the programme on June 20, 2012, with a view to continuing it to the end of the year:

"The Committee...decided to continue through the end of the year its program to extend the average maturity of its holdings of securities. Specifically, the Committee intends to purchase Treasury securities with remaining maturities of 6 years to 30 years at the current pace and to sell or redeem an equal amount of Treasury securities with remaining maturities of approximately 3 years or less. This continuation of the maturity extension program should put downward pressure on longer-term interest rates and help to make broader financial conditions more accommodative. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities."[56]

The tail period of the extended MEP program coincided with the introduction of a third wave of quantitative easing, typically referred to as QE3. Announced immediately following the FOMC meeting of September 13, 2012, it provided for an *open-ended* commitment to purchase agency mortgage-backed securities every month until an improvement in the US labour marker was witnessed:

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[55]http://www.federalreserve.gov/newsevents/press/monetary/20110921a.htm
[56]http://www.federalreserve.gov/newsevents/press/monetary/20120620a.htm

"To support a stronger economic recovery and to help ensure that inflation, over time, is at the rate most consistent with its dual mandate, the Committee agreed today to increase policy accommodation by purchasing additional agency mortgage-backed securities at a pace of $40 billion per month. The Committee also will continue through the end of the year its program to extend the average maturity of its holdings of securities as announced in June, and it is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities. These actions, which together will increase the Committee's holdings of longer-term securities by about $85 billion each month through the end of the year, should put downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative."[57]

A fourth round of quantitative easing was voted for by the FOMC on December 12, 2012, and in addition to continuing its *open-ended* commitment to purchasing $40 billion of agency mortgage-backed securities each month, the FOMC committed to a bond-buying program which focused on the acquisition of long-term US government bonds.

"To support a stronger economic recovery and to help ensure that inflation, over time, is at the rate most consistent with its dual mandate, the Committee will continue purchasing additional agency mortgage-backed securities at a pace of $40 billion per month. The Committee also will purchase longer-term Treasury securities after its program to extend the average maturity of its holdings of Treasury securities is completed at the end of the year, initially at a pace of $45 billion per month. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and, in January, will resume rolling over maturing Treasury securities at auction. Taken together, these actions should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative."[58] (emphasis added)

The implementation of QE4 continued beyond the end of our sample period in January 2014 (a period which also which coincides with the end of the Bernanke's chairmanship of the Federal Reserve), and into the Chairmanship of his successor, Janet Yellen. However, we note here that during Bernanke's penultimate FOMC meeting on December 18, 2013, the FOMC voted in favor of *tapering* its QE stimulus levels of due to an improved economic outlook in January 2014:

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[57] http://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm
[58] http://www.federalreserve.gov/newsevents/press/monetary/20121212a.htm

"Beginning in January, the Committee will add to its holdings of agency mortgage-backed securities at a pace of $35 billion per month rather than $40 billion per month, and will add to its holdings of longer-term Treasury securities at a pace of $40 billion per month rather than $45 billion per month. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and of rolling over maturing Treasury securities at auction. The Committee's sizable and still-increasing holdings of longer-term securities should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative, which in turn should promote a stronger economic recovery and help to ensure that inflation, over time, is at the rate most consistent with the Committee's dual mandate."[59] (emphasis added)

This policy was also voted for in Bernanke's final FOMC meeting held January 28-29, 2014. We emphasize here that the above discussion has focussed almost exclusively on the *chronology* of unconventional policy actions taken by the FOMC post-2008, with scant discussion of the wider implications of pursuing such policies, or the economic data and macroeconomic circumstances which informed decisions. For complete details of the Federal Reserve's QE programme, and the economic and policy environment associated with unconventional monetary policies in the post-2008 period, the reader is hence referred to the Federal Reserve website (http://www.federalreserve.gov/) and in particular, the publicly available minutes of FOMC meetings.[60]

A.3   Japan, ZIRP and QE

The level of the policy interest rate set by the BoJ's nine-man PB is very different from the levels set by the MPC and FOMC. This reflects the fact that the (then) newly formed *nine-member* PB inherited an economy which in 1998 was characterized by deflation, and by international standards, exceptionally low interest rates. Under Governor Hayami, the PB voted over time to reduce the *uncollateralised overnight interest rate* (UOCR) from an initial rate of 0.5 percent in April 1998, culminating in the so-called *zero interest rate policy* (ZIRP) in February 1999. Under the ZIRP, the UOCR was reduced to a target *range* of 0 to 0.1 percent, a level which in the context of the Japanese monetary policy environment is synonymous with the effective nominal ZLB.[61] Figure 1 shows that the

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[59]http://www.federalreserve.gov/newsevents/press/monetary/20131218a.htm

[60]See especially http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm.

[61]What constitutes the 'effective' nominal ZLB is not the same across all countries. For instance, the Bank of England MPC deemed a (target) short-term interest-rate (called 'Bank Rate') of 0.5 percent as the effective ZLB. In relation to this, Bernanke and Reinhart (2004) consider the institutional barriers that may prevent the short-term policy rate from being reduced to zero per cent.

policy lasted from February 1999 to August 2000. As acknowledged by Fujiki and Shirat-suka (2002), shortly after the adoption of the ZIRP, the BoJ declared its commitment to ZIRP until deflationary worries dissipated, such that during the latter part of 2000, the majority of PB members began to hold the view that the economy was in the stages of recovery. Accordingly, it was decided by majority vote on the August 11th PB meeting that the UOCR should be increased to 0.25 percent, thereby terminating the ZIRP. The PB minutes show that a number of members - notably Nobuyuki Nakahara and Kazuo Ueda - as well as representatives from the Treasury disagreed with this policy action, arguing that the economy was not on a firm recovery path (Ito 2009). In this regard, Ito (2009) suggests that the termination of the ZIRP was 'a mistake'.

The two months following the termination of ZIRP witnessed the CPI inflation rate turn negative and the economy return to recession. The general economic malaise continued into early 2001, at which point the PB began to explore the possibility of adopting unconventional policy measures to stimulate the economy. March 19th 2001 - March 9th 2006 witnessed the main operating target of monetary policy change from the UOCR to so-called outstanding *current account balances* (CABs) at the Bank, one of three components said to characterize the Bank of Japan's 2001-2006 quantitative easing (QE) policy (see Bowman, Cai, Davies, and Kamin (2011) for more details). As depicted in Figure 2, the principal effect of this policy was to increase CABs significantly beyond required reserves. The remaining two components were a significant rise in long-term Japanese government bond purchases aimed at inducing falls in long-term interest rates; other riskier long-term assets were targeted too, and undertaken with a view to accomplishing the targeted increases in CABs. Third, the PB made a commitment to maintain QE until the *core* consumer price index (CPI) - which in Japan excludes perishables but not energy - stopped declining (Bowman, Cai, Davies, and Kamin 2011).

A second bout of unconventional policy measures was introduced on 5th October 2010 under the title *comprehensive monetary easing* (CME). This was introduced with three goals in mind: first, it would act to encourage the UOCR to remain between 0 to 0.1 percent; second, to it would set out to maintain a virtually zero interest-rate policy, until was judged that medium- to long-term price stability was in sight;[62] and third, the establishment of an *asset purchase program* (APP), which from a technical standpoint, would function in much the same way as the APF at the Bank of England and the LSAP at the Federal Reserve. Unlike the first bout of QE at the BoJ, PB members did vote for explicit CAB target bands; however, from Figure 2, it is clearly evident that excess reserves increased dramatically over this period. The CME policy continued until the end of our sample period, which ends immediately prior to the introduction of a new (and highly aggressive) raft of unconventional monetary policy measures. Entitled "*quantitative and*

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[62] The second measure was decided on the condition that "no problem will be identified when examining risk factors, including the accumulation of financial imbalances."

qualitative monetary easing", and announced 4th April 2013, this policy innovation was introduced by the (new) BoJ Governor Haruhiko Kuroda, following the end of Governor Masaaki Shirakawa's tenure at the BoJ.[63] We do not examine any of the BoJ's policies under Governor Kuroda in this paper.

A.4   Nobuyuki Nakahara and Quantitative Easing

Based on the published minutes of meetings (MPM) of the three committees under scrutiny in this paper, the term 'quantitative easing' is first mentioned during a policy meeting - *and recommended as a policy action* - by Bank of Japan PB member Nobuyuki Nakahara in the meeting held on February 12th 1999. The MPM state that "...[Nakahara] expressed the opinion that, with interest rates already extremely low, the Bank should explicitly implement a *quantitative easing* by targeting the monetary base (the sum of currency in circulation and reserves)."[64] This view was stated as a main reason for Nakahara's decision to cast a dissenting vote on the side on monetary accommodation, and heralded the start of a dissent voting pattern characterized by Nakahara calling for further monetary accommodation through the adoption of QE. It was a pattern that continued until the March 19th 2001 PB meeting, when the Bank of Japan changed its main operating target for money market operations to the outstanding balance of the current accounts at the Bank of Japan. Nakahara is hence notable for continually calling for unconventional policy measures over a two-year period whilst under a 'conventional' policy regime, measures that were ultimately adopted by the BoJ between 2001-2006. In this regard, he stands as the only committee member we know of who actively called for QE measures *outside* of a period when unconventional policies were being used by their institution.

What is interesting about Nakahara's early dissents is that his position on the nature of the type of QE required seemingly become more concrete over time. At the PB meeting held on February 25th 1999, one of the grounds on which he dissented was that "...it was disadvantageous to give the impression that the previous monetary easing was the final one, and therefore, it was important to clearly indicate that *various other monetary easing measures could be utilized by the Bank even if interest rates touched zero percent*" (emphasis added by the authors). In the following meeting held on March 12th 1999, Nakahara dissented again, calling for the "regime of monetary policy be changed to quantitative easing with a specific price target," stressing that "it was therefore necessary to promptly implement a quantitative easing." In the subsequent meeting of March 25th 1999, Nakahara again called for QE, albeit on this occasion he *explicitly identified* the

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[63]http://www.boj.or.jp/en/announcements/release_2013/k130404a.pdf

[64]The MPM go onto state that "This member, while recognizing that there were various arguments against quantitative easing, further added that information obtained from corporate interviews suggested that, if reserves were increased, funds would be channeled to overseas affiliates and to healthy small firms with financing demand."

level and form of QE required, proposing that "...the Bank would increase the amount of excess reserves by about 500 billion yen in the inter-meeting period ahead, and by continuing to increase the amount thereafter, induce a 10 percent annual growth of the monetary base (change from the average for the October-December quarter of 1999 to the average for the same quarter of 2000) to realize quantitative easing (expansion of the monetary base)."

A.5 Ambiguous dissents and unscheduled policy meetings

Not all dissents were straight-forward to classify; for instance, during the FOMC meeting of January 27th-28th, 2009, Jeffrey Lacker, President of the FRB Richmond dissented because he preferred to expand the monetary base by purchasing U.S. Treasury securities rather than through targeted credit programs. This was despite Lacker being fully supportive of (i) the significant expansion of the Federal Reserve's balance sheet coupled with (ii) the intention to maintain the size of the balance sheet at a high level. This type of behavior was therefore not deemed as being an unconventional dissent on the side of monetary ease or tightness *per se*. Likewise, some members of the PB also cast dissents which did not obviously reflect a tighter or easier policy stance relative to other committee members. As an example, on October 28th 2010, Miyako Suda dissented from the inclusion of Japanese government bonds and treasury discount bills as part of the Bank of Japan's Asset Purchase Program, which formed part of its *comprehensive monetary easing* (CME) strategy. The MPM reveal that this was done on the grounds that "First, the Bank's purchases could be misunderstood as monetization. Second, the financial intermediary function could be impaired by the lower returns of financial institutions. And third, this could lead to the risk of a bubble in the bond market." We suggest that none of these stated reasons might clearly be interpreted as dissents in favor of monetary ease or tightness. In practice, where such difficulties in interpretation were encountered, the vote was omitted from the estimation sample.

In some instances, monetary policy decisions were taken during unscheduled or emergency meetings which were called as a result of unexpected financial shocks or other events. For instance, the FOMC held two unscheduled telephone conferences in the week following the terrorist attacks of 11th September 2001. In the second of these meetings held 17th September 2001, the FOMC voted to reduce the FFR by 0.5 per cent. Similarly, on the 18th September 2001, a special meeting of the Bank of England MPC was called in response the same events, at which members voted to cut the repo-rate by 0.25 percent. In the case of the FOMC, there are also documented cases where a decision to change the FFR was still taken *without* a formal vote being taken. For example, during an unscheduled FOMC conference call held 15th October 1998, a decision was made to reduce the FFR by 0.25 percent to 5 percent. Despite no formal vote being taken, the meeting

transcript reveals that FRB Cleveland president Jerry Jordan indicated a preference for no rate reduction. In practice where transcripts for unscheduled FOMC meetings exist, and where it is possible to map members' verbal statements to monetary policy decisions, this information is included in our panel data observations used in estimation.

A.6 Member's voting by policy regime: QE versus non-QE

Table 15: FOMC Dissents during the non-QE period, August 1987- November 2008

Governors		Non-QE votes	Conventional		QE		Broad	
			Tighten	Ease	Tighten	Ease	Hawk	Dove
Governor	Angell	52	7	1	0	0	7	1
	Bernanke	46	0	0	0	0	0	0
	Bies	42	0	0	0	0	0	0
	Blinder	13	0	0	0	0	0	0
	Duke	4	0	0	0	0	0	0
	Ferguson	71	0	0	0	0	0	0
	Gramlich	66	0	1	0	0	0	1
	Greenspan	153	0	0	0	0	0	0
	Heller	14	0	0	0	0	0	0
	Johnson	23	0	1	0	0	0	1
	Kelly	118	1	1	0	0	1	1
	Kohn	53	0	0	0	0	0	0
	Kroszner	24	0	0	0	0	0	0
	LaWare	53	6	0	0	0	6	0
	Lindsey	41	2	2	0	0	2	2
	Meyer	49	0	0	0	0	0	0
	Mishkin	16	0	0	0	0	0	0
	Mullins	29	0	0	0	0	0	0
	Olson	36	0	1	0	0	0	1
	Phillips	52	0	0	0	0	0	0
	Rivlin	25	0	0	0	0	0	0
	Seger	29	0	11	0	0	0	11
	Warsh	24	0	0	0	0	0	0
	Yellen▽	20	0	0	0	0	0	0
Presidents								
Atlanta	Forrestal	24	0	0	0	0	0	0
	Guynn	32	0	0	0	0	0	0
Boston	Syron	15	0	0	0	0	0	0
	Minehan	40	0	0	0	0	0	0
	Rosengren	5	0	1	0	0	0	1
Chicago	Keehn	28	0	0	0	0	0	0
	Moskow	57	0	0	0	0	0	0
	Evans	4	0	0	0	0	0	2
Cleveland	Hendricks	1	0	0	0	0	0	0
	Hoskins	16	0	7	0	0	0	7
	Jordan	47	6	2	0	0	6	2
	Pianalto	24	0	0	0	0	0	0
Dallas	Boykin	13	3	0	0	0	3	0
	McTeer	30	0	3	0	0	0	3
	Fisher	14	5	0	0	0	7	0
Kansas	Guffey	7	2	0	0	0	0	0
	Hoenig	53	4	0	0	0	12	0
Minneapolis	Stern	61	3	0	0	0	3	0
	Kocherlakota	0	0	0	0	0	2	0
New York	Corrigan	47	0	0	0	0	0	0
	McDonough	83	0	0	0	0	0	0
	Geithner	42	0	0	0	0	0	0
	Oltman▲	1	0	0	0	0	0	0
	Stewart▲	4	0	0	0	0	0	0
Philadelphia	Boehne	37	0	1	0	0	0	1
	Santomero	16	0	0	0	0	0	0
	Plosser	8	4	0	0	0	4	0
Richmond	Black	16	0	0	0	0	0	0
	Broaddus	32	6	0	0	0	6	0
	Lacker	8	4	0	0	0	12	0
San Francisco	Parry	48	2	1	0	0	0	0
	Yellen▽	8	0	0	0	0	0	0
St. Louis	Melzer	23	5	1	0	0	5	1
	Poole	38	3	0	0	0	3	0
Totals								
Governors		1053	16	18	0	0	16	18
Presidents		885	53	9	0	0	53	9
All members		1938	69	27	0	0	69	27

▲ Otman and Cumming voted as alternate FOMC members; Stewart voted as acting President of FRB NY.
▽ Yellen also served as a member of the Board of Governors. Her votes corresponding to this position are given above.

Table 16: FOMC Dissents in the QE period, December 2008 - January 2014

Governors		QE votes	Conventional		QE		Broad	
			Tighten	Ease	Tighten	Ease	Hawk	Dove
Governor	Bernanke	43	0	0	0	0	0	0
	Duke	39	0	0	0	0	0	0
	Kohn	14	0	0	0	0	0	0
	Kroszner	1	0	0	0	0	0	0
	Powell	14	0	0	0	0	0	0
	Raskin	24	0	0	0	0	0	0
	Stein	14	0	0	0	0	0	0
	Tarullo	40	0	0	0	0	0	0
	Warsh	18	0	0	0	0	0	0
	Yellen[▽]	26	0	0	0	0	0	0
Presidents								
Atlanta	Lockhart	16	0	0	0	0	0	0
Boston	Rosengren	16	0	0	0	0	0	1
Chicago	Evans	24	0	0	0	2	0	2
Cleveland	Pianalto	18	0	0	0	0	0	0
Dallas	**Fisher**	10	0	0	1	0	2	0
Kansas	**Hoenig**	8	0	0	1	0	8	0
	George	8	0	0	0	0	0	0
Minneapolis	Stern	1	0	0	0	0	0	0
	Kocherlakota	2	0	0	2	0	2	0
New York	Dudley	41	0	0	0	0	0	0
	Cumming[▲]	1	0	0	0	0	0	0
Philadelphia	Plosser	10	0	0	2	0	2	0
Richmond	Lacker	16	0	0	8	0	8	0
San Francisco	Yellen[▽]	8	0	0	0	0	0	0
	Williams	8	0	0	0	0	0	0
St. Louis	Bullard	16	0	0	0	0	0	0
Totals								
Governors		230	0	0	0	0	0	0
Presidents		210	0	0	17	3	28	3
All members		440	0	0	17	3	28	3

[▲] Otman and Cumming voted as alternate FOMC members; Stewart voted as acting President of FRB NY.
[▽] Yellen also served as a member of the Board of Governors. Her votes corresponding to this position are given above.

Table 17: Dissents - Votes cast by Bank of England MPC Members during the non-QE regimes: June 1997 - February 2009

		Dissent by type					
		Conventional		Unconventional		Broad	
Internals[P]	Meetings	Tightness	Ease	Tightness	Ease	Hawk	Dove
King$^{\diamond,\dagger}$	142	14	0	0	0	14	0
George$^{\diamond}$	74	0	0	0	0	0	0
Davies$^{\diamond}$	2	0	0	0	0	0	0
Clementi$^{\diamond}$	61	3	1	0	0	3	1
Large$^{\diamond}$	40	9	0	0	0	9	0
Lomax$^{\diamond}$	60	2	3	0	0	2	3
Gieve$^{\diamond}$	37	1	2	0	0	1	2
Tucker$^{\diamond}$	81	6	1	0	0	6	1
Bean$^{\diamond,\dagger}$	102	0	5	0	0	0	5
Internals[NP]							
Plenderleith$^{\diamond}$	61	3	2	0	0	3	2
Vickers$^{\diamond}$	28	5	0	0	0	5	0
Dale$^{\diamond}$	8	0	0	0	0	2	0
Externals[P]							
Buiter$^{\diamond\diamond}$	36	9	8	0	0	9	8
Goodhart$^{\diamond\diamond}$	36	3	0	0	0	3	0
Julius$^{\diamond\diamond,\dagger}$	45	0	14	0	0	0	14
Budd$^{\diamond\diamond}$	18	4	0	0	0	4	0
Wadhwani$^{\diamond\diamond}$	37	0	13	0	0	0	13
Nickell$^{\diamond\diamond,\dagger}$	73	4	13	0	0	4	13
Allsopp$^{\diamond\diamond}$	37	0	11	0	0	0	11
Barker$^{\diamond\diamond,\dagger}$	94	1	4	0	0	1	4
Bell$^{\diamond\diamond}$	36	0	5	0	0	0	5
Lambert$^{\diamond\diamond}$	34	0	0	0	0	0	0
Walton$^{\diamond\diamond,**}$	12	2	1	0	0	2	1
Blanchflower$^{\diamond\diamond}$	33	0	18	0	0	0	18
Besley$^{\diamond\diamond}$	30	7	0	0	0	7	1
Sentance$^{\diamond\diamond}$	29	5	0	0	0	5	0
Totals							
All Internals	696	43	14	0	0	43	14
Internals[P]	599	35	12	0	0	35	12
Internals[NP]	97	8	2	0	0	8	2
Externals[P]	550	35	87	0	0	35	87
All members	1246	78	101	0	0	78	101

$^{\diamond}$/$^{\diamond\diamond}$Denotes internal/external member. *Continued to serve on the MPC after June 2013.
†Reappointed. [P]Political appointment. [NP]Non-political appointment.
* Denotes total number of votes cast by each member.

Table 18: Dissents - Votes cast by Bank of England MPC Members during the QE regime: March 2009 - June 2014

		Conventional		Unconventional		Broad	
Internals[P]	Meetings	Tightness	Ease	Tightness	Ease	Hawk	Dove
King$^{\diamond,\dagger}$	52	0	0	0	6	0	6
Tucker$^{\diamond}$	52	0	0	0	0	0	0
Bean$^{\diamond,\dagger}$	52	0	0	0	0	0	0
Internals[NP]							
Dale$^{\diamond}$	52	6	0	2	0	8	0
Fisher$^{\diamond}$	52	0	0	0	6	0	6
Externals[P]							
Barker$^{\diamond\diamond}$	15	0	0	0	0	0	0
Blanchflower$^{\diamond\diamond}$	3	0	0	0	0	0	0
Besley$^{\diamond\diamond}$	6	0	0	0	1	0	1
Sentance$^{\diamond\diamond}$	27	12	0	0	0	12	0
Miles$^{\diamond\diamond}$	49	0	0	0	15	0	15
Posen$^{\diamond\diamond}$	36	0	0	0	14	0	14
Weale$^{\diamond\diamond}$	35	7	0	0	0	7	0
Broadbent$^{\diamond\diamond}$	25	0	0	1	0	1	0
McCafferty$^{\diamond\diamond}$	10	0	0	0	0	0	0
Totals							
All Internals	260	6	0	8	12	8	12
Internals[P]	156	0	0	0	6	0	6
Internals[NP]	104	6	0	2	6	8	6
Externals[P]	205	19	0	1	30	20	30
All members	466	25	0	3	42	28	42

$^{\diamond}$/$^{\diamond\diamond}$Denotes internal/external member. *Continued to serve on the MPC after June 2013.
†Reappointed. [P]Political appointment. [NP]Non-political appointment.
* Denotes total number of votes cast by each member.

Table 19: Dissents under conventional policy regimes - Bank of Japan Policy Board members, April 1998 - March 2014

| | Meetings | Dissent by type | | | | | |
| | | Conventional | | Unconventional | | Broad | |
Troika	Non-QE	Tighten	Ease	Tighten	Ease	Hawk	Dove
Hayami[G]	55	0	0	0	0	0	0
Fujiwara[DG]	55	0	0	0	0	0	0
Yamaguchi[DG]	55	0	0	0	0	0	0
Fukui[G]	29	0	0	0	0	0	0
Muto[DG]	29	0	0	0	0	0	0
Iwata[DG,◇]	29	0	1	0	0	0	1
Shirakawa[G,♣]	41	0	0	0	0	0	0
Nishimura[DG,▽][■]	70 (41,29)	0	0	0	0	0	0
Yamaguchi[DG]	31	0	0	0	0	0	0
Rank-and-File							
Goto	29	0	0	0	0	0	0
Taketomi	55	0	0	0	0	0	0
Miki	55	0	0	0	1*	0	1
N.Nakahara	55	0	9	0	40	0	58
Shinotsuka	55	38	0	0	0	38	0
Ueda	55	0	1	0	0	0	1
Taya[Ψ]	22	0	1	0	0	0	1
Suda	71	1	1	0	0	1	1
S.Nakahara	5	0	0	0	0	0	0
Fukuma	14	0	0	0	0	0	0
Haru	15	0	0	0	0	0	0
Mizuno	58	8	0	0	0	8	0
Noda	65	2	0	0	0	2	0
Kamezaki	56	0	1	0	0	0	1
Nakamura	56	0	1	0	0	0	1
Miyao	9	0	0	0	0	0	0
Morimoto	4	0	0	0	0	0	0
Totals							
Troika	365	0	1	0	0	0	1
Rank-and-File	708	49	14	0	41	49	53
All members	1073	49	15	0	41	49	54

* In addition to low interest rates, Miki wished to implement additional measures - specifically, a reduction in reserve ratio requirements - to reinforce the easy money policy associated with a near-zero UOCR. We therefore class this as an unconventional vote on the side of monetary ease. *G/DG* denotes Governor/Deputy Governor.

[▽] Nishimura was appointed to the Policy Board on 08/04/2005 as a *Rank-and-File* member before being promoted to Deputy Governor on 20/03/2008, serving until his term expired on 19/03/2013.

[■] For Nishimura, we show the total votes cast for each category irrespective of his status on the PB (upper figure), and using parentheses below each figure decompose these totals according to the scheme (*Troika, Rank-and-File*).

Table 20: Dissents under non-conventional policy regimes - Bank of Japan Policy Board members, April 1998 - March 2014

| | Meetings | Dissent by type | | | | | |
| | | Conventional | | Unconventional | | Broad | |
Troika	QE	Tighten	Ease	Tighten	Ease	Hawk	Dove
Hayami[G]	33	0	0	0	0	0	0
Fujiwara[DG]	33	0	0	0	0	0	0
Yamaguchi[DG]	33	0	0	0	0	0	0
Fukui[G]	46	0	0	0	0	0	0
Muto[DG]	46	0	0	0	0	0	0
Iwata[DG,◊]	46	0	0	0	0	0	0
Shirakawa[G]	36	0	0	0	0	0	0
Nishimura[DG,▽]	49■ (36,13)	0	0	0	0	0	0
Yamaguchi[DG]	36	0	0	0	0	0	0
Rank-and-File							
Taketomi	5	0	0	0	0	0	0
Miki	18	0	0	0	0	0	0
N.Nakahara	18	0	0	0	11	0	11
Shinotsuka	1	0	0	0	0	0	0
Ueda	66	0	0	1	0	1	0
Taya[Ψ]	61	0	0	3	0	3	0
Suda	85	0	0	3	0	3	0
S.Nakahara	74	0	0	0	0	0	0
Fukuma	61	0	0	14	2	14	2
Haru	61	0	0	0	0	0	0
Mizuno	18	0	0	13	0	13	0
Noda	11	0	0	0	0	0	0
Kamezaki	22	0	0	0	0	0	0
Nakamura	22	0	0	0	0	0	0
Miyao	35	0	0	0	0	0	0
Morimoto	36	0	0	0	0	0	0
Shirai	29	0	0	0	0	0	0
Ishida	25	0	0	0	0	0	0
Sato	9	0	0	0	0	0	0
Kiuchi	9	0	0	0	0	0	0
Totals							
Troika	345	0	0	0	0	0	0
Rank-and-File	679	0	0	34	13	34	13
All members	1024	0	0	34	13	34	13

G/DG denotes Governor/Deputy Governor.
[▽] A career central banker, Nishimura was appointed to the Policy Board on 08/04/2005 as a Rank-and-File member before being promoted to Deputy Governor on 20/03/2008, serving until his term expired on 19/03/2013. ■ For Nishimura, we show the total votes cast for each category irrespective of his status on the committee (upper figure), and using parentheses below each figure decompose these totals according to the scheme (*Troika, Rank-and-File*).