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The Central Bank Governor and Interest Rate Setting by Committee

Abstract

This paper examines the role of central bank governors in monetary policy decisions taken by a committee. To carry out this analysis, we constructed a novel dataset of committee voting behaviour for six OECD countries for up to three decades. Using a range of Taylor-rule specifications, we show that a change in governor significantly affects the interest rate setting of the whole committee. We also observe systematic differences in the responsiveness to recent changes in the state of the economy based on the political party appointing the governor, with higher responsiveness under governors that are appointed by a left-wing political authority. In contrast, right wing appointed governors are more likely to consider expected economic developments in the future when deciding on the appropriate interest rate.

JEL-Codes: E000.

Keywords: monetary policy, Taylor rule, central bank governors.

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1. Introduction

The movement toward monetary policy decision-making by committee rather than by individuals is discussed in a growing amount of literature. Blinder (2004) refers to this worldwide trend in central banking as 'the quiet revolution'. Among the countries that have opted to establish monetary policy committees (MPCs) are Japan, the United Kingdom, Sweden, the Czech Republic and Hungary. In the United States, the Federal Open Market Committee (FOMC) oversees the nation's open market operations and was formed by the Banking Act of 1933. These committees consist of a small number of individuals who decide on the level of interest rates by majority voting, with varying degrees of transparency (Blinder, 2007). Minutes and press releases provide an outline of the discussions in the committee, and the attributed voting records are also released.

There is substantial literature that uses information from transcripts, minutes or voting records to study the committees' policy-making process (e.g. Bhattacharjee and Holly, 2006; Horváth et al., 2012; Riboni and Ruge-Murcia, 2014). The bulk of this literature focuses on the preferences of committee members and the impact on interest rate setting, often by estimating individual reaction functions. A related strand of papers deals with the effect of partisan and electoral considerations on voting behaviour, in which the appointment procedure of committee members plays a central role (e.g. Belke and Potrafke, 2012; McGregor, 1996). These studies shed light on de jure and de facto central bank independence.

Still others describe how the leadership of the governor might affect monetary policy outcomes (e.g. Chappell et al., 2014). The best-known case of a chairman[1] with tangible influence on the interest decision is probably Alan Greenspan, who chaired the FOMC for over eighteen years. According to Blinder (2007, p. 111), former vice chairman of the Federal

[1] We use the terms 'governor', 'chair' and 'chairman' interchangeably, referring to the person chosen to preside over the meetings of a particular MPC.

Reserve System, FOMC members had only one real choice: "to go on record as supporting or opposing the chairman's recommendation, which was certain to prevail." Evidence from simulation models on decision-making in committees suggests that chairman dominance may also be prevalent in other MPCs (see e.g. Gerlach-Kristen, 2008; Claussen et al., 2012).

Our study has two main purposes. The first one is to examine whether the chair has a significant impact on interest rate setting based on monetary policy functions. The second one is to examine whether the appointment of a chair by a particular political party can predict potential differences in monetary policy. Using voting records of six central banks (the Czech Republic, Hungary, Japan, Sweden, the United Kingdom and the United States) and linear (augmented) Taylor rules, this paper explores the chair's position and his role in the conduct of monetary policy. The Database of Political Institutions (DPI) is used to distinguish between left wing and right wing political parties.

The main results show that the replacement of a chair often leads to a change in the monetary policy reaction function. This implies that the chair plays a strong role in the decisions made by the committee. In addition, the responsiveness to *recent* changes in the state of the economy appears to be higher under governors that are appointed by a left wing political authority. In contrast, right wing appointed governors are more likely to consider *expected* economic developments when deciding on the appropriate interest rate.

The remainder of this paper is organized as follows. Section 2 undertakes a survey of the literature on the role of the chair in interest rate setting. We then provide information on the dataset we use and describe the institutional background of MPCs in Section 3. Section 4 presents the model and estimation of the Taylor rules under different governors. We then proceed to show empirical evidence on the potential influence of political appointments and ideologies on monetary policy in section 5. Section 6 concludes.

2. Monetary policy committees: a survey of current literature

This section provides a brief review of the literature on the position of the chair in monetary policy committees and the role of the appointment procedure. These contributions add context and motivation to the analysis presented in this paper.

2.1 The position of the chair

The idea behind decision-making by committee is that the quality of monetary policy improves by pooling members' information and knowledge. A theoretical study by Gerlach-Kristen (2006) shows that committees achieve better policy outcomes than individuals in the presence of uncertainty about the state of the economy. In addition, Blinder and Morgan (2005), in an experimental laboratory environment, find that groups reach decisions as fast as or even faster than individuals. Claussen et al. (2012) point out that a MPC with decision power can also be seen as an insurance mechanism against extreme actions from a single policymaker. Overall, economic theory and modelling are quite clear on the advantages of monetary policy decision-making by committee.

However, Blinder (2007) notes that the distinction between individual and group decision-making can be vague in practice. In earlier work, Blinder (2004) offers a typology of MPCs, where he distinguishes between three types of decision-making: individualistic, genuinely collegial and autocratically collegial. First, in an individualistic committee, members express their opinions in the policy debate and also vote according to their views. The committee's decision is made by literal majority vote, which means that unanimity is not necessarily expected (Blinder, 2007). This implies that the chair's views have no extra weight (Gerlach-Kristen, 2008). Second, internal procedures of a genuinely collegial committee may be similar to individualistic committees, but they ultimately compromise on a group decision. The chair gets the most public attention, because he or she communicates the committee's view to the public (Gerlach-Kristen, 2008). Third, Blinder (2004, p. 58) characterizes an autocratically collegial committee as a MPC where "the chairman's going-in position is the likely consensus, and he either persuades or browbeats the others into agreement." As stated by Blinder (2004), the FOMC is such a committee, in which the decision-making process is highly formal and very much controlled by the chair. Because the committee still has the possibility to block the proposal if it deviates too much from the majority's view, they still may have influenced the decision (Blinder, 2007).

More specifically, Gerlach-Kristen (2008) argues that 'economic' and 'moderating' abilities of the chair may lead to a disproportionate influence on the interest rate setting. The former refers to the chair's expertise on the monetary policy area, the latter to his talent for shaping the outcome by guiding the discussion. Gerlach-Kristen (2008) also finds that in some cases simply the authority arising from the chair's position affects the distribution of votes.

In addition, a certain tolerance toward the chair's view is often assumed because outvoting the chair can entail considerable costs. According to Claussen et al. (2012), the public may interpret this as a lack of trust in the chair, which can possibly weaken the credibility of the central bank. Besides, voting down the chair may hurt the collegial spirit and it could undermine the chair's position as a facilitator for (unanimous) decisions. Therefore, committee members might have a tendency to go along with the chair despite of having different views on the optimal interest rate. An extra layer of decision power can emerge from the chair's agenda-setting right. A chair with agenda-setting rights, which is common to the FOMC and the Bank of Japan, proposes a policy action that other members must vote for or against. This way, the chair can approach his optimal interest rate after the policy discussion, conditional on the other members' tolerance intervals (Gerlach-Kristen, 2008).

For this reason, the position of the chair relative to the other committee members should also be taken into account. Eijffinger et al. (2013) infer individual policy preferences of committee members based on voting records and place them on a dove-hawk scale. All other things equal, doves prefer lower interest rates on average than hawkish members. They show that the chair (internal) of the Hungarian National Bank is always on the hawkish side of the board, while the majority lies at the more dovish externals. For Sweden they find that governor Ingves is significantly more hawkish than his predecessors Heikensten and Backström. As claimed further by Eijffinger et al. (2013), the Czech central bank's chairman Singer is more dovish relative to chairman Tuma. In a subsequent paper, Eijffinger et al. (2015) reveal similar (centrist) positions for Greenspan and Bernanke in the FOMC board. In contrast, Yellen is identified as the most dovish chair since 1958 (Wilson 2014). Lastly, Eijffinger et al. (2018) state that King, at the MPC of the Bank of England, preferred tighter policies than governor Carney. Such a categorization for the Bank of Japan is not available in the existing literature.

A hawkish reputation can be valuable to a central bank due to a lower expected inflation and, therefore, higher future expected welfare (Sibert, 2003). Hence, Sibert (2003) states that central bankers might have an incentive to establish this reputation early in their tenure. Neuenkirch (2015) tested this proposition in a study on 15 OECD countries and 50 changes in central bank head's office and finds that governors fight inflation more aggressively during the first four to eight quarters of their time in office. Also, monetary policy is more proactive in the beginning of a chair's tenure, which supports the idea of reputation building (Neuenkirch, 2015).

2.2 Governor appointments

Based on the literature on the chair's dominance and the differences in preferences, one might expect changes in the conduct of monetary policy when a new governor is appointed. Some studies on financial markets show that bond yields, exchange rates and stock prices react to governor replacements, which also suggests that it matters *who* the governor of the central bank is (see e.g. Kuttner and Posen, 2010; Moser and Dreher, 2010). But when is a governor replaced? An obvious moment is after the expiration of a chair's term of office. However, Vuletin and Zhu (2011) find that in advanced economies about 58 percent of the central bank governor exits are irregular. Only half of these early departures occurred during the first term. Many of the irregular exits after the first term took place in Sweden and in other Scandinavian countries. Furthermore, the average turnover ratios in the Czech Republic, Hungary, and Japan are considerably higher than in the United Kingdom and the United States. Moreover, Dreher et al. (2010) demonstrate that the likelihood that a central bank governor will be replaced increases with a new government and with upcoming elections.

In line with this result, Vuletin and Zhu (2011) show that a premature exit of a chair is often associated with the replacement of an 'ally' (a high official) of the government. Adolph (2013) reports that changes in the partisan composition of governments have an effect on tenures of central bank' governors. Ennser-Jedenastik (2014), in a study conducted over 195 central bank governors in 30 European countries, establishes that affiliation with the government makes a chair almost twice as likely to remain in office in a given period of time. He further notes that even in the absence of formal removal authority, political pressures can cause governors to resign before the end of their term. Criticizing a chair publicly, for instance, can undermine the credibility of the central bank, forcing the governor to step down (Ennser-Jedenastik, 2014). Instead of premature replacement of a chair, politicians can also choose not to reappoint the sitting governor. After his term expires, the authorities can nominate someone who is favourably predisposed towards the policies put forward by the government (Ennser-Jedenastik, 2014).

These studies illustrate how the appointment process can be a mechanism through which party ideologies might play a role in central bank decision-making. As stated by Göhlmann and Vaubel (2007), nominated central bankers feel loyal to the party that has appointed them. According to Belke and Potrafke (2012) it is, therefore, possible that governors attempt to manipulate the economy to increase the election prospects of their party. Some evidence that committee members follow a specific party line is provided by Chappell et al. (1993), who find that Democratic Party appointees vote significantly different from Republican Party appointees in the FOMC. Tootell (1996) also finds that partisan affiliation seems to affect FOMC voting, and notes that "politics do, and should, play a role" (p. 204) because the democratic process shapes the central bank's long run goals.

Nonetheless, empirical studies on partisan tendencies in interest setting behaviour are scarce and investigations for the United States and Germany dominate (Belke and Potrafke, 2012). For the Bundesbank, Berger and Woitek (2005) show that the more conservative members react stronger to changes in inflation and output. Sakamoto (2008) analyses panel data for 18 OECD countries and finds that central banks under leftist governments carried out looser monetary policy. Contrarily, results from a study by Clark (2003) suggest that central banks under left-labour power are associated with higher interest rates. Belke and Potrafke (2012) add an institutional dimension and conclude that interest rates under leftist governments are somewhat lower than under right wing governments when central bank independence is low. However, they find opposite results in case of high central bank independence in a country. Finally, Neuenkirch and Neumeier (2013) find no evidence for a specific partisan ideology effect of politically affiliated governors in their monetary policy reaction function. To put it mildly, studies on partisan monetary policy have provided mixed evidence when it comes to interest rate setting.

In these papers, political affiliation of central bankers (like party membership) or the difference in interest rates between incumbent governments is used as the foundation of partisan monetary policy analysis. Interestingly, none of these studies has examined whether the left wing or right wing *appointment* of a chair has an impact on interest rates during his or her tenure. Therefore, this study not only examines *if* the conduct of monetary policy is affected by changes in the chair, but also whether political appointments are *driving* these potential differences. To date, scholars have dealt with differences in the chairs' preferences and political involvement in the appointment procedure as two separate phenomena. This study takes a first step to integrate these two strands of literature.

3. Description of the Dataset and Institutional setting

The sample consists of six OECD countries: the Czech Republic, Hungary, Japan, Sweden, the United Kingdom and the United States. These are the only central banks that publish voting records for a sufficiently long time period. The data are monthly and the period covered depends on the availability of voting records. An overview of the sample periods is given in table 1.

[Table 1]

The establishment of MPCs in the last two decades went closely together with the spread of central bank independence (Blinder, 2007). Almost all MPCs are operationally independent from the government and they have the responsibility for the conduct of monetary policy. MPCs meet on a regular and pre-announced basis, but the frequency of policy meetings varies. The FOMC, the Sweden's Riksbank and the Czech National Bank meet approximately eight times a year, whereas the Bank of England and the Hungarian National Bank meet monthly. The Bank of Japan comes together most frequently with around fifteen policy meetings a year. On occasions, for example during crisis periods, the central banks organize extraordinary policy meetings.

The number of committee members ranges between six and thirteen. The smallest MPCs are located in Sweden and the Czech Republic, with six and seven board members, respectively. The medium-sized MPCs of Japan and the United Kingdom consist of nine members. In the United States, the Federal Reserve Act requires all of the monetary policy-makers to have some regional identity. As a result, the FOMC consists of seven members of the Board of Governors, the president of the Federal Reserve Bank of New York as well as four presidents of the remaining district banks, chosen according to an annual rotation scheme. The Hungarian central bank was composed of thirteen voting members in 2005. However, institutional changes decreased the number of voting members to nine today.

Decisions are based on a majority vote and the chair has the casting vote in the event of a tie. The decision is released in a statement on the same day and the minutes generally follow one or two weeks later. These minutes and attributed voting records show that dissent is common in MPCs (Riboni and Ruge-Murcia, 2014). Table 2 indicates that the frequency of dissenting differs across countries, but also across different governors. For example, 73 percent of the decisions under Alan Greenspan (AG) where reached by unanimity, while only 38 percent of the decisions where unanimous under Ben Bernanke (BB) as FOMC chairman.

[Table 2]

Even though dissents occur frequently, it is remarkable that the governor is almost never on the losing side of the vote (see table 3). There are some notable differences across countries. For instance, the governors of the Hungarian National Bank and the Czech National Bank are outvoted more often than governors at other central banks. On the other side of the spectrum, the governors of the FOMC and the Bank of Japan were always in the winning coalition. In Sweden and the United Kingdom, the chair's views also have a strong tendency to prevail.

[Table 3]

Scholars have paid special attention to appointment procedures in explaining voting behaviour in policy committees. Due to a substantial degree of legal independence from elected politicians, the appointment of central bankers becomes a main source of influence for the government on monetary policy (Ennser-Jedenastik, 2014). In all countries discussed in this paper, except from Sweden, the chair is directly appointed by a political authority. In the case of the FOMC and the Czech National Bank, the President nominates the chair of the central bank. The Chancellor of the Exchequer appoints the governor of the Bank of England. The prime minister nominates the chair of the central bank in Japan and Hungary. In Sweden, central bank governors are appointed by the General Council of the Riksbank. Since the members of this council are selected by the parliament after each general election, political involvement in the appointment procedure of the Riksbank's chair can also not be ruled out.

4. Monetary Policy functions under different governors

The conduct of monetary policy is often described by means of Taylor rules (Neuenkirch and Neumeier, 2013). In this section, we specify and estimate Taylor rules in the traditional forms (Taylor, 1993), and forward looking versions (Clarida et al. (1998)) for the six central banks.

4.1 The backward-looking Taylor rule

The assumption that central banks have a target for the nominal short-term interest rate, i_t^*, that is based on the state of the economy, is essential to all monetary policy functions. In academic research, the Taylor rule has been used on an ex post basis to assess the weights on inflation and output for many central banks and time periods. 'The rule', along with some augmented versions, has become the default empirical specification for the estimation of reaction functions (Chappell and McGregor, 2017).

Following Taylor (1993), the state of the economy is represented by inflation (π_t) and output (y_t):

$$i_t^* = r + \beta(\pi_t - \pi^*) + \gamma(y_t - y_t^*), \tag{1}$$

where i_t^* rises when inflation exceeds its target (π*) or if output increases above its trend or potential value (y_t^*). The long-run equilibrium nominal (or natural) rate of interest, *r*, is defined as the equilibrium real rate (*rr*) plus the inflation rate. According to equation (1), the target interest rate is equal to its natural rate in equilibrium (π_t - π* and $y_t - y_t^*$ equal zero).

Therefore, the parameters ß and γ indicate the sensitivity of the policy rate to changes in inflation and output, respectively. In theory, these parameters should be positive. This implies that relatively high interest rates are needed when inflation and output are above target in order to reduce inflationary pressure. On the other hand, central banks are likely to ease monetary policy to stimulate the economy when inflation is below its target or when output has not reached its potential value. Taylor (1999) finds that policy makers at the Federal Reserve place positive weights on both factors. Moreover, he considered past values of inflation to test the validity of the rule.

Equation (1) will be estimated for all central banks, but the main focus will be on potential differences in weights for inflation and output under two different governors in the same country. To test for these differences in the interest rate setting between central bank governors, this augmented equation will also be estimated:

$$i_t^* = r + \beta_1(\pi_t - \pi^*) + \gamma_1(y_t - y_t^*) + D_t[\beta_2(\pi_t - \pi^*) + \gamma_2(y_t - y_t^*)], \quad (2)$$

where D_t is a dummy variable taking the value 1 during the time period in which the newly appointed governor is in office, and 0 at the time his predecessor was chair of the committee. When ß$_2$ and γ_2 are taking values other than zero, this will support the idea that the monetary policy committee puts different weights on inflation and output under these two governors.

Equations (1) and (2) will be estimated using ordinary least squares (OLS). In practice, past values (one lag) of inflation and output will be used in the regression analysis. Robust standard errors will be implemented to account for possible heteroscedasticity. Following Taylor (1993), the inflation target will be constant over time. Some central banks do not publish a target. If the target is not clearly stated by the central bank, we pin it down through narrative evidence and in any case it is often close to the sample average of inflation (see annex II). The long-term trend of the observed real interest rate, using kernel-weighted local polynomial smoothing, is considered as the equilibrium real rate, allowing for the possibility that the natural rate changes over time (see Leigh, 2005).[2]

4.2 The forward-looking Taylor rule

[2] Leigh (2005) uses a Kalman Filter to uncover the path of the natural rate of interest over time.

Clarida et al. (1998) suggested the use of a forward-looking specification of the Taylor (1993) rule. According to Castro (2011), this version better reflects central banking practice and the specification also allows taking other relevant variables (e.g. interest rate smoothing) into account. Evidence shows for example that the ECB seems to follow forward looking rules (Gorter et al., 2008). Furthermore, by incorporating forecasts, the model indirectly considers a broad array of information, which is a realistic feature of policy making (Clarida et al., 1998). Instead of describing interest rate setting by using past or current values for inflation and output, Clarida et al. (1998) proposed the following rule:

$$i_t^* = r + \beta(E[\pi_{t+k}|\Omega_t] - \pi^*) + \gamma\left(E\left[y_{t+p}|\Omega_t\right] - y_{t+p}^*\right), \qquad (3)$$

where E is the expectations operator and Ω_t represents the information available to the central bank at time t. As a result, the target for the short-term nominal interest rate (i_t^*) depends on the expected inflation gap k periods ahead and on the expected output gap p periods ahead. The horizons of inflation and output gap were chosen to be one year (k = 12) and three months (p = 3), respectively. Following Castro (2011) these horizons represent a reasonable description of the way the Federal Reserve and the ECB operate.

Equation (3) cannot capture the tendency of central banks to gradually adjust interest rates towards the desired level (Clarida et al., 1998). Castro (2011) advances some explanations for smoothing interest rate changes, like the fear of disrupting capital markets, the existence of a zero nominal interest rate lower bound or uncertainty about the impact of economic shocks. Other potential reasons are the need for consensus building to change the policy rate and the loss of credibility due to sudden large adjustments in monetary policy (Clarida et al., 1998). Thus, a term that captures interest rate smoothing is generally added to the model and is given by (Goodfriend, 1991):

$$i_t = (1-\rho)i_t^* + \rho i_{t-1} \text{ with } \rho \in [0,1], \quad (4)$$

where ρ displays the degree of interest rate smoothing. The introduction of interest rate smoothing to monetary policy reaction functions is also a common procedure to control for autocorrelation in interest rates.

Defining $\alpha = rr + (1 - ß)\pi^*$ and $x_{t+p} = y_{t+p} - y_{t+p}^*$ and combining equation (3) with the interest rate smoothing term, yields the well-known form below (Castro, 2011):

$$i_t = (1-\rho)\left[a + \beta E(\pi_{t+k}|\Omega_t) + \gamma E(x_{t+p}|\Omega_t)\right] + \rho i_{t-1} + u_t, \quad (5)$$

hereby assuming that central banks can only control interest rates up to an independent and identically distributed stochastic error (u_t). Following Clarida et al. (1998) and Castro (2011), the elimination of unobserved forecast variables from the expression leads to a policy rule in terms of realized variables:

$$i_t = (1-\rho)\left[a + \beta\pi_{t+k} + \gamma x_{t+p}\right] + \rho i_{t-1} + \varepsilon_t, \text{ with}$$
$$\varepsilon_t = -(1-\rho)\{\beta(\pi_{t+k} - E[\pi_{t+k}|\Omega_t]) + \gamma(x_{t+p} - E[x_{t+p}|\Omega_t])\} + u_t, \quad (6)$$

which shows that the error term (ε_t) is a linear combination of the forecast errors. Equation (6) does not allow testing for differences in interest rate setting between two periods. We introduce a dummy variable (D_t) as in equation (2):

$$i_t = (1-\rho_1)\left[a_1 + \beta_1\pi_{t+k} + \gamma_1 x_{t+p}\right] + \rho_1 i_{t-1} + D_t\{(1-\rho_2)\left[a_2 + \beta_2\pi_{t+k} + \gamma_2 x_{t+p}\right] + \rho_2 i_{t-1}\} + \varepsilon_t, \quad (7)$$

where ρ_2, β_2 and γ_2 measure the change in interest rate smoothing, and the reaction to inflation and output, respectively. We use the generalized method of moments (GMM) to estimate equations (6) and (7). Clarida et al. (1998) and Castro (2011) note that this method is well suited for analysing interest rate setting based on regressions with variables that are not known by the central bank at the decision-making moment. For the application of GMM, we impose a set of moment conditions. Therefore, we write both equations as follows:

$$E_t\langle i_t - (1-\rho)\left[a + \beta\pi_{t+k} + \gamma x_{t+p}\right] - \rho i_{t-1} | \nu_t\rangle = 0, \text{ and} \tag{8}$$

$$E_t\langle i_t - (1-\rho_1)\left[a_1 + \beta_1\pi_{t+k} + \gamma_1 x_{t+p}\right] - \rho_1 i_{t-1} - D_t\{(1-\rho_2)\left[a_2 + \beta_2\pi_{t+k} + \gamma_2 x_{t+p}\right] + \rho_2 i_{t-1}\} | \nu_t\rangle = 0, \tag{9}$$

where ν_t contains a set of (instrumental) variables of central bank's information at the time it chooses the interest rate. Those are lagged variables that are potentially useful for forecasting inflation and output and should not be correlated with the error term (given the exogeneity assumption). The set of instruments always includes a constant and lags 1-6, 9 and 12 of *Inflation*, *OutpGap*, *Yield10yr*, *Shareprices* and *M3growth*, similar to Clarida et al (1998).[3] The 10-year government bond yield contains useful information about the future evolution of the interest rate (Castro, 2011). In addition, past developments in financial conditions can be useful in forecasting future inflationary pressures. Furthermore, Castro (2011) added identical lags of the *M3* growth rate to capture the role of money, given the extensive use of quantitative easing as an expansionary form of monetary policy after the financial crisis. Furthermore, an optimal kernel-weighted matrix is used in the estimation, which accounts for possible heteroskedasticity

[3] Clarida et al. (1998) use lags 1-6, 9 and 12 of the output gap, inflation, the log difference of a world commodity price index, the day-to-day rate and the log difference of the dm/dollar real exchange rate.

and serial correlation. In this optimal weighting matrix, moment conditions with large variances receive relatively less weight in the estimation, because they contain less information about the population parameters than moment conditions with small variances (Wooldrigde, 2001). For a similar reason, we assign a lower weight to moment conditions with farther lagged instruments (Kuersteiner, 2012). In addition, Hansen's (1982) overidentification test statistics are reported after each regression to assess the validity of the specification and the set of instruments. If the null hypothesis of Hansen's J test is rejected, the set of instruments is not valid and the moment conditions are violated. In this case, the model fails to explain forward-looking interest rate setting behaviour based on the set of instrumental variables.

Although the forward-looking Taylor rule is widely used, its empirical estimation may contain some caveats. One drawback of GMM is that it can lead to poor results when the number of parameters is large. To avoid this problem, we restrict the sample to two governors in the estimation of the forward-looking Taylor rule (see table 4), Moreover, Woodford (2000) mentions that purely forward-looking procedures more easily result in indeterminacy of equilibrium, which means that the model might exhibit an infinitely large number of equilibria. As a consequence, the model can be too sensitive to arbitrarily small changes in parameters. Woodford (2000) concludes that the optimal procedure for analysing monetary policy also has to involve some backward-looking elements. For this reason, the analysis of interest rate setting in this paper is based on the backward-looking Taylor rule as well as the forward-looking Taylor rule.

[Table 4]

4.3 Empirical results

Table 5 sets out the results of the backward-looking Taylor rule estimations for all six central banks and under different chairs. Column 1 presents the results for the OLS estimation of the basic linear Taylor. In column 2, we extend the baseline model with a lagged nominal *InterestR, Yield10yr, Shareprices* and *M3growth* as control variables. The estimations in columns 3 and 4 include dummy variables to observe potential differences in interest rate setting between different governors. We discuss the results of each central bank in turn.

Czech Republic. The Czech National Bank responds to changes in inflation and output by changing the nominal interest rate. Government bond yields and M3 growth do also seem to affect monetary policy decisions. Moreover, the estimations show that monetary policy under governor Singer (2) is most responsive to recent changes in inflation, while Rusnok (3) attaches relatively low weights to output and inflation.

Hungary. The negative weight on output in the first column is not in line with theory and a potential reason for this result is that this central bank may have increased interest rates in the pursuit of price stability while output was below its potential value. In this conflict of monetary policy goals, reaching the inflation target prevails over achieving full employment or higher economic growth. The highest weight on inflation is observed under governor Matolcsy (3) and governor Jarái (1) seems to respond most strongly to changes in the output gap.

Japan. Japan is a country that is characterized by uncommon (negative) inflation rates and nominal interest rates at (or close to) the zero-lower bound. Nevertheless, governor Hayami (1) appears to be strongly committed to reaching the inflation target, while the other governors show a lower degree of responsiveness with respect to changes in inflation. The coefficient on interest rate smoothing is high because the nominal interest rate has hardly changed over time.

Sweden. 'To maintain price stability' is clearly the primary objective of the Riksbank as almost all other variables lack statistical significance. Furthermore, the OLS regression displays that governor Bäckström (1) attaches the highest weight to changes in inflation. No difference is detected in monetary policy reactions to output fluctuations.

United Kingdom. The backward-looking Taylor rule shows that the Bank of England reacts to developments in both output and inflation. More specifically, governor George (1) seems to react relatively strong to recent changes in inflation compared to governors King (2) and Carney (3). Other factors, such as share prices and bond yields, do not seem to play a major role in The Bank's policy decisions.

United States. In contrast, the FOMC appears to take wider range of factors into account when deciding on the appropriate interest rate, responding not only to changes in inflation and output, but also to changes in the Treasury rate and money supply. The dummy variables identify that the weights on inflation and the output gap are highest under the chairmanship of Greenspan (1), while there is a strong decrease in the weight on inflation under governor Yellen (3). Different priorities or interpretations of the dual mandate[4] could potentially cause this result.

[Table 5]

Results for the GMM-estimation are presented in table 6. The Hansen's J-statistic confirms the validity of the instruments in all estimations. The coefficients on inflation and output are generally in line with prior estimations, though the size of the weights appears to be strongly affected by the inclusion of the interest rate smoothing term (column 2). Columns 3 and 4 show the estimated differences between the forward-looking monetary policy reaction functions

[4] The two legislated goals of the Federal Reserve currently are price stability and full employment. The statutory mandate of the other central banks is solely maintaining price stability.

under different governors. As noted earlier, the sample is restricted to two governors (see table 4).

<u>Czech Republic.</u> We find that monetary policy at the Czech National Bank can be well explained by a forward-looking model. The degree of interest rate smoothing is high, indicating that the central bank tends to set the interest rate close to the interest rate in the previous month. Just as in the OLS estimation, we observe that monetary policy under governor Rusnok (3) is less responsive to changes in inflation than under governor Singer (2). The governors appear to react similar to expected changes in the output gap.

<u>Hungary.</u> The results exhibit that the Hungarian National Bank reacts strongly to expected changes in inflation. This seems to be especially the case for governer Simor (2), because the weight on expected inflation is considerably lower in the period under governor Matolcsy (3). This result, however, does not hold when the interest rate smoothing term is added to the estimation in the fourth column.

<u>Japan.</u> The estimated weights on inflation and output under both chairmen in Japan show again that reaching the inflation target is their top priority, but this result only follows when the smoothing term is included in the estimation. In pursuing their annual goal for inflation, Kuroda (4) seems to be the least concerned about the developments regarding the output of the economy.

<u>Sweden.</u> The GMM-estimation for Sweden displays mixed results for the differences in monetary policy reactions under governors Heikenstein (2) and Ingves (3). If interest rate smoothing is added to the model we observe more hawkish behaviour under governor Ingves (3), which would align with the findings of Eijffinger et al. (2013), but we observe the opposite result in the third column.

<u>United Kingdom.</u> From the third column of the United Kingdom, it becomes clear that governor Carney (3) attaches lower weights to inflation and the output gap than governor King

(2), though we do not observe these differences in forward-looking behaviour in the fourth column. Again, it seems that interest rate smoothing is an important determinant that also affects other parameters in the forward-looking model.

United States. The GMM results for the FOMC are largely in line with the OLS results. Compared to other central banks, the degree of interest rate smoothing is relatively low, which can be possibly ascribed to a series of large rate cuts during the economic downturn from 2007 to 2009. The results further indicate that monetary policy under governor Yellen (3) has been less recession-averse than under governor Bernanke (2).

[Table 6]

In sum, the analysis of the monetary policy reaction functions shows that a change in governor often involves a change in the interest rate setting behaviour of the committee.[5] This alternation of monetary policy can be captured by differences in the weights on inflation and output. This is the first study in which differences in interest rate preferences between governors (individuals) are translated into changes in committee (group) decision-making at central banks. However, an important question remains: can political appointments explain the direction of these differences in monetary policy? The next section aims to answer this question.

5. Monetary Policy functions based on political appointment

[5] Following Neuenkirch (2015), we also examined whether this change can be attributed to the first eight quarters of newly appointed governors that want to establish a hawkish reputation. However, except for Hungary, we observed no higher weights on inflation in this period compared to the remaining incumbency. We performed this analysis for the governors Ingves, Simor, Singer, Bernanke, King and Shirakawa as they are the longest-serving chairs in our restricted sample.

To assess whether political appointments play a role in the interest rate setting by central banks, we specify and estimate a panel data model. Following this, we also provide an overview of governor inaugurations and a distinction between left and right wing parties.

5.1 Revision of the Taylor rule specifications

The decision to use a panel data model in this section mainly rests on two considerations. First, in some countries nearly all governors in the sample are appointed by the same political party, which makes it difficult to examine potential political influence *within* the country. Second, a panel data analysis *across* countries and over time includes more observations for the estimation of the Taylor rules, thereby improving the precision of the measurement system. A loss of accuracy is a potential disadvantage of a panel data model, because individual central banks with various traditions and mandates are estimated in one monetary policy reaction function. Therefore, the focus in the section is on the difference in coefficients related to political appointments rather than clarifying on the usefulness of the monetary policy reaction function.

Similarly to the previous section, we estimate both backward-looking and forward-looking Taylor rules. Equation (1) for panel data becomes:

$$i_{i,t}^{*} = r_i + \beta(\pi_{i,t} - \pi_i^{*}) + \gamma(y_{i,t} - y_{i,t}^{*}), \qquad (10)$$

where $i_{i,t}^{*}$ is the target for the nominal short-term interest rate at central bank *i* at time *t*. To discover whether political appointments affect monetary policy, equation (10) has a dummy variable, which yields a specification comparable to equation (2):

$$i_{i,t}^{*} = r_i + \beta_1(\pi_{i,t} - \pi_i^{*}) + \gamma_1(y_{i,t} - y_{i,t}^{*}) + D_{i,t}[\beta_2(\pi_{i,t} - \pi_i^{*}) + \gamma_2(y_{i,t} - y_{i,t}^{*})], \qquad (11)$$

Here, $D_{i,t}$ is an indicator for a central bank governor who is nominated by a right wing political party representative. If ß$_2$ and γ_2 are different from zero, this suggests that the political party appointing the governor matters for the conduct of monetary policy. We use a pooled OLS regression to estimate equations (10) and (11).

Next, we also estimate a panel data version of the forward-looking Taylor rule in equation (6):

$$i_{i,t} = (1-\rho)\left[\alpha + \beta\pi_{i,t+k} + \gamma x_{i,t+p}\right] + \rho i_{i,t-1} + \varepsilon_{i,t}, \qquad (12)$$

where the short-term nominal interest rate ($i_{i,t}$) in country *i* at time *t* is explained by the lagged interest rate ($i_{i,t-1}$), a (rr_i + (1 – ß)π_i*) and forecasts of inflation ($\pi_{i,t+k}$) and the output gap ($x_{i,t+p}$). The inclusion of a dummy variable for political appointment yields the following equation:

$$i_{i,t} = (1-\rho_1)\left[\alpha_1 + \beta_1\pi_{i,t+k} + \gamma_1 x_{i,t+p}\right] + \rho_1 i_{i,t-1} + D_{i,t}\left\{(1-\rho_2)\left[\alpha_2 + \beta_2\pi_{i,t+k} + \gamma_2 x_{i,t+p}\right] + \rho_2 i_{i,t-1}\right\} + \varepsilon_{i,t}, \qquad (13)$$

in which the error term ($\varepsilon_{i,t}$) is correlated with the lagged dependent variable by construction. In dynamic panel data models in which the error term ($\varepsilon_{i,t}$) is correlated with the lagged dependent variable, a GMM estimator is a more robust choice (Neuenkirch and Neumeier, 2013). The set of instruments always includes a constant and lags 1-6, 9 and 12 of *Inflation*, *OutpGap*, *Yield10yr*, *Shareprices* and *M3growth*.

5.2. Data on governor appointments

This part of the analysis contains considerably more observations (n=1404) than section 4. All time periods for which voting records are available are included in the estimation. The same variables are used for the estimation of the Taylor rules.

The main difference lies in the treatment of the dummy variable in the specification. For a correct application of the dummy variable, three pieces of information have to be combined: when is the governor inaugurated, who nominated him or her, and which political party does this authority represent? We find this information from Neuenkirch (2015) and from central bank websites. An overview in available in annex III.

Thereafter, one has to distinguish between left wing and right wing political parties. We do this using the Database of Political Institutions (DPI). In most cases the choice between left wing and right wing political party representatives is quite trivial. For example, a Chancellor of the Exchequer from the Conservative Party in the United Kingdom is considered more right wing than a representative of the Labour Party. The General Council of the Riksbank appoints the central bank governor in Sweden. The parliament names the members of the General Council after each general election. We assume that the ideology of the political party that has reached the highest number of seats in the parliament is reflected in the view of the members of the General Council. However, the lines of political affiliation of the authorities that nominate central bank governors in the Czech Republic are less clearly drawn. The presidents Havel and Klaus were officially 'independent' when they nominated governors Kysilka, Tosovsky, Tuma and Singer. Based on this political status, the DPI addresses a centrist view to both presidents. According to a characterization by Myant (2005, p. 249), Havel "saw himself maintaining a position derived ultimately from fundamental moral principles", while Klaus "was a disciple of the monetarist economist Milton Friedman and admirer of the British prime minister, Margaret Thatcher." For this reason, president Klaus is considered more right wing.[6]

[6] Potuček (1999) also notes that Havel's politics are led by spiritual and moral values, while Klaus presents himself as an orthodox neoliberal, both in economic and in political terms.

As stated earlier, the dummy variable takes the value of 1 if the governor is nominated by a right wing authority and 0 otherwise. Except from the implementation of this new dummy variable, the estimations of the backward-looking and the forward-looking Taylor rules involve no changes.

5.3 Empirical results

This empirical estimates of the models above show evidence of significant differences in the interest rate setting between committees based on which political party appointed the governor. The full results are presented in tables 7 and 8.

Table 7 displays the results of the pooled OLS estimations. The set of control variables encompasses a lagged nominal *InterestR*, *Yield10yr, Shareprices*, *M3growth* and governor fixed effects. In this backward-looking Taylor rule, an increase in inflation above target is accompanied by a rise in the interest rate. The coefficients on the output gap are also positive, but are considerably lower, suggesting that reaching the inflation target generally prevails over achieving higher economic growth. Columns 3 and 4 present the pooled OLS results with a dummy variable for right wing appointed governors. A similar weight on inflation is observed under right and left wing appointed governors. Moreover, the results on the output gap indicate that monetary policy under right wing appointed governors is less responsive to recent changes in output than under left wing appointed governors.

[Table 7]

Table 8 reports on the results of the GMM estimations. As earlier, the interest rate dynamics are highly persistent, as described by a high degree of smoothing in the sample. Furthermore, the central banks react to changes in both inflation and output in this forward-looking Taylor rule. Especially the response to fluctuations in inflation is of remarkable size in the second column. An increase in the inflation rate by one p.p. above target generates a raise in the interest rate by around 2.10 points. Results for the forward-looking Taylor rule with a dummy variable for political appointment are provided in the third and fourth columns. We observe higher weights on expected inflation and the output gap under right wing appointed governors than under left wing appointed governors. Interestingly, right wing appointed governors thus appear to be *more* concerned about the potential inflation and output gap in the *future*, while left wing appointed governors tend to react *stronger* to *past* changes. While this does not hold in all cases, as can be seen from the earlier Simor (left) vs. Matolcsy (right) comparison, the observed estimated differences are significant at the 1% and 5% level. In addition, the degree of interest rate smoothing appears to be higher under right wing appointed governors.

[Table 8]

In short, monetary policy under left wing appointed governors tends to be more responsive to past changes in the state of the economy than under right wing appointed governors. The latter, in contrast, consider the expected output and inflation when deciding on the appropriate interest rate.

6. Conclusions

The responsibility for the conduct of monetary policy in many countries lies with a committee rather than a single individual. Even though dissents occur frequently in these committees, it is remarkable that the chair is almost never on the losing side of the vote. This could mean that the chair has high power over the committee, or it could imply that the chair aligns with the sentiment of the majority.

To address this issue, this paper explores whether a change in central bank governor has an impact on the interest rate setting behaviour of the committee. In addition, we show the extent to which these differences can be explained by the political appointment of the governor.

In the first part of the analysis, we add a dummy variable for a change in governor to the traditional monetary policy functions. The results show that the replacement of a governor often involves a change in the interest rate setting behaviour of the committee. The different monetary policy stances between governors become apparent in the weights on inflation and output and in the degree of interest rate smoothing. This result can be an indication of a disproportionate influence of the chair on monetary policy decisions.

This study also inquired whether these differences are based on political appointment. For this reason, we included a dummy variable for right wing appointed governors in the second part of the analysis. The results provide evidence for a stronger reaction to recent changes in output under left wing appointed governors than under right wing appointed governors. Rather than *reacting* to past changes, right wing appointed governors are more likely to *anticipate* future developments in the state of the economy. It is unclear whether this results from the political appointment of the governors, that is to say, whether this has been the *intention* of the appointment. This new insight, therefore, must definitely be explored further before any inferences regarding political *influence* can be made.

In the light of increasing central bank transparency, future research may deal with larger sample periods and a higher number of central banks. Moreover, some studies use real-time data for inflation and output to estimate Taylor rules (see Orphanides, 2001). This study has not used real-time data. However, Castro (2011) notes that the differences between real-time data and ex-post data are less significant nowadays because the quality of predictions has increased.

Still, future research on governor changes may use real-time data to further test the robustness of the results.

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Annex I

[Table 9]

Description of economic variables

Most data are from national central banks and the OECD's Monthly Financial Statistics. Figures 1-6 show the evolution of the main variables in the dataset.

Various measures of interest rates and inflation are used in this study, depending on central bank characteristics. For the central banks of the Czech Republic and Hungary, the two-week repo rate is used. The three-month Treasury bill rate of Sweden and the United Kingdom has a close relationship with the multiple official interest rates instruments of the central banks from these countries. The interest rate for Japan is the respective uncollateralized overnight call rate. For the United States, we use the effective Federal funds rate. The main reference for inflation for all central banks but the Federal Reserve is the consumer price index (CPI).[7] The definition of inflation that the Federal Reserve has been following is the core inflation rate, which excludes food and energy prices. The equilibrium real rate is defined as the long-term trend of nominal interest rates minus inflation. For all countries, the output gap is derived from the percentage deviation of the log industrial production index from its Hodrick-Prescott (1997) trend.[8] All data for inflation and the output gap are seasonally adjusted.

[Figures 1-6]

[7] Until December 2003, the Bank of England targeted retail price index excluding mortgage interest payments (RPIX inflation). However, Castro (2011) showed that both RPIX and CPI yield consistent results with respect to monetary policy reaction functions. For this reason, only one measure (CPI) for inflation is chosen.
[8] See Castro (2011) and Neuenkirch (2015).

Stationarity is required for all variables included in the estimated model. If a variable is non-stationary, the regression analysis may produce unreliable and spurious results. Therefore, a unit root test (Dickey and Fuller, 1979) and a KPSS (1992) stationarity test is performed over the variables in the estimation. The results are given in table 10.

[Table 10]

The evidence in favour of the stationarity hypothesis is consistent for the output gap. There is, however, no proof for a stationary process of inflation in Hungary and the United Kingdom. Furthermore, unit root in the interest rates is an issue for Hungary, the United Kingdom and Japan.

Annex II

[Table 11]

[Figure 7]

Annex III

[Table 12]

Table 1: Overview of sample periods

Central bank	*Sample period*	*Chairs*
Czech National Bank	Dec 2000 – Dec 2017	Tuma - Singer - Rusnok
Hungarian National Bank	Jan 2005 – Dec 2017	Jarái - Simor - Matolcsy
Bank of Japan	Mar 1998 – Dec 2017	Hayami - Fukui - Shirakawa - Kuroda
Sweden's Riksbank	Jan 1999 – Dec 2017	Bäckström - Heikenstein - Ingves
Bank of England	Jan 1998 – Dec 2017	George - King - Carney
Federal Reserve System	Jan 1992 – Dec 2017	Greenspan - Bernanke - Yellen

Table 2: Unanimous and majority decisions under different governors

	Sweden (1999-2017)			Hungary (2005-2017)			Czech Republic (1998-2017)				
	UB	LH	SI	ZJ	AS	GM	PK	JT	ZT	MS	JR
U	28	17	43	10	12	40	7	19	53	33	11
M	18	6	33	7	61	18	0	13	54	15	2
T	46	23	76	17	73	58	7	32	107	48	13
	United States (1992-2017)			United Kingdom (1998-2017)			Japan (1998-2017)				
	AG	BB	YL	EG	MK	MC	YM	MH	TF	MS	HK
U	84	25	16	23	64	31	4	25	47	76	22
M	31	41	15	44	56	18	0	64	28	1	23
T	115	66	31	67	120	49	4	89	75	77	55

U= Unanimous decisions, M=Majority decisions, T= Total number of decisions. The initials represent the incumbent chair. Source: Central bank websites

Table 3: Voting statistics for chairs' and other committee members

	Sweden (1999-2017)		Hungary (2005-2017)		Czech Republic (1998-2017)	
	C	M	C	M	C	M
W	140 (99.3%)	618 (87.4%)	123 (88.5%)	1007 (78.6%)	189 (95.5%)	953 (86.0%)
L	1 (0.7%)	89 (12.6%)	16 (11.5%)	274 (21.4%)	9 (4.5%)	156 (14.0%)
T	141	707	139	1281	198	1113
	United States (1992-2017)		United Kingdom (1998-2017)		Japan (1998-2017)	
	C	M	C	M	C	M
W	212 (100%)	1949 (94.5%)	234 (99.2%)	1657 (88.7%)	299 (100%)	2112 (91.7%)
L	0 (0%)	114 (5.5%)	2 (0.8%)	211 (11.3%)	0 (0%)	191 (8.3%)
T	212	2063	236	1868	299	2303

C= Chair, M= Other committee members, W= Winning side, L=Losing side, T= Total number of votes. Source: Central bank websites

Table 4: Overview of the restricted sample (GMM)*

Central bank	*Sample period*	*Chairs*
Czech National Bank	Jul 2010 – Dec 2017	Singer - Rusnok
Hungarian National Bank	Mar 2007 – Dec 2017	Simor - Matolcsy
Bank of Japan	Apr 2008 – Dec 2017	Shirakawa - Kuroda
Sweden's Riksbank	Feb 2003 – Dec 2017	Heikenstein - Ingves
Bank of England	Jul 2003 – Dec 2017	King - Carney
Federal Reserve System	Feb 2006 – Dec 2017	Bernanke - Yellen

* Only the two latest governors are considered in the GMM estimation of the reaction function.

Table 5: Results from the OLS estimation of the monetary policy reaction functions

	Czech Republic (n=204)				*Hungary (n=155)*			
	1	2	3	4	1	2	3	4
InflGap (1)	0.458***	0.397***	0.420***	0.329***	0.848***	0.492***	0.589***	0.272***
	(0.023)	(0.025)	(0.030)	(0.032)	(0.026)	(0.038)	(0.088)	(0.071)
OutpGap (1)	0.036***	0.039***	0.044***	0.034***	-0.041**	0.015	0.102**	0.181***
	(0.009)	(0.010)	(0.015)	(0.011)	(0.019)	(0.013)	(0.043)	(0.031)
InterestR (1)		-0.058		0.090		0.293***		0.396***
		(0.039)		(0.059)		(0.066)		(0.052)
InflGap (2)			0.167***	0.031			-0.023	-0.144*
			(0.046)	(0.040)			(0.082)	(0.087)
OutpGap (2)			-0.003	-0.074***			-0.116**	-0.142***
			(0.024)	(0.024)			(0.048)	(0.033)
InterestR (2)				0.949***				0.123***
				(0.233)				(0.034)
InflGap (3)			-0.053	-0.152***			0.569***	0.255***
			(0.066)	(0.058)			(0.133)	(0.089)
OutpGap (3)			-0.059*	-0.052*			-0.150***	-0.283***
			(0.034)	(0.027)			(0.055)	(0.039)
InterestR (3)				2.313***				-0.216***
				(0.396)				(0.052)
Yield10yr		0.143***		0.072**		0.123		-0.125**
		(0.040)		(0.051)		(0.077)		(0.058)
Shareprices		-0.008		-0.008		-0.012		-0.001
		(0.007)		(0.007)		(0.013)		(0.010)
M3growth		0.022***		0.033***		-0.034***		0.014
		(0.005)		(0.006)		(0.012)		(0.011)
_cons	-0.257***	-0.821***	-0.233***	-1.038***	0.045	-2.333***	0.675***	-1.067***
	(0.032)	(0.093)	(0.035)	(0.092)	(0.073)	(0.300)	(0.146)	(0.243)
DW	0.233	0.260	0.257	0.285	0.287	0.289	0.675	0.697
	Japan (n=237)				*Sweden (n=227)*			
	1	2	3	4	1	2	3	4
InflGap (1)	0.381***	0.321***	0.529***	0.219***	0.709***	0.643***	0.660***	0.742***
	(0.023)	(0.025)	(0.036)	(0.036)	(0.028)	(0.026)	(0.051)	(0.057)
OutpGap (1)	-0.001	-0.005	-0.003	0.005	0.038***	0.034***	0.008	0.014
	(0.004)	(0.005)	(0.006)	(0.005)	(0.009)	(0.011)	(0.030)	(0.024)
InterestR (1)		1.147***		1.139***		0.086*		0.052
		(0.169)		(0.197)		(0.050)		(0.056)
InflGap (2)			-0.095***	-0.255***			0.085	-0.185**
			(0.031)	(0.035)			(0.071)	(0.079)
OutpGap (2)			0.040***	0.068***			0.039	0.060
			(0.011)	(0.018)			(0.045)	(0.036)
InterestR (2)				-0.718**				-0.200***
				(0.343)				(0.040)
InflGap (3)			-0.214***	-0.103***			0.040	-0.147**
			(0.037)	(0.031)			(0.057)	(0.067)
OutpGap (3)			0.001	-0.006			0.034	0.034
			(0.009)	(0.006)			(0.031)	(0.025)
InterestR (3)				-0.322				-0.003
				(0.229)				(0.030)
InflGap (4)			-0.149***	-0.078*				
			(0.053)	(0.045)				
OutpGap (4)			-0.105**	-0.096***				
			(0.050)	(0.033)				
InterestR (4)				10.606***				
				(0.859)				
Yield10yr		-0.329***		-0.321***		0.009		0.076
		(0.064)		(0.060)		(0.046)		(0.053)
Shareprices		0.015**		0.010***		-0.005		-0.003
		(0.006)		(0.003)		(0.007)		(0.006)
M3growth		-0.014		0.042***		0.004		0.002
		(0.017)		(0.020)		(0.005)		(0.006)
_cons	-0.639***	-0.441***	-0.611***	-0.827***	-0.228***	-0.493***	-0.232***	-0.613***
	(0.037)	(0.080)	(0.053)	(0.082)	(0.037)	(0.085)	(0.038)	(0.098)
DW	0.128	0.164	0.225	0.423	0.503	0.499	0.492	0.534
	United Kingdom (n=233)				*United States (n=311)*			

	1	2	3	4	1	2	3	4
InflGap (1)	0.710***	0.704***	0.937***	0.812***	0.818***	0.560***	0.944***	0.708***
	(0.037)	(0.037)	(0.088)	(0.209)	(0.037)	(0.040)	(0.043)	(0.059)
OutpGap (1)	0.119***	0.122***	0.150***	0.145***	0.082***	0.042***	0.157***	0.092***
	(0.023)	(0.025)	(0.054)	(0.056)	(0.010)	(0.009)	(0.020)	(0.017)
InterestR (1)		-0.019		-0.046				0.138***
		(0.042)		(0.050)				(0.023)
InflGap (2)			-0.360***	-0.292			-0.483***	-0.425***
			(0.121)	(0.232)			(0.078)	(0.099)
OutpGap (2)			-0.013	-0.004			-0.069***	-0.053***
			(0.060)	(0.057)			(0.024)	(0.018)
InterestR (2)				0.052				0.070***
				(0.040)				(0.016)
InflGap (3)			-0.135*	-0.488**			-1.354***	-0.583***
			(0.077)	(0.229)			(0.132)	(0.116)
OutpGap (3)			-0.132	-0.261***			-0.253***	-0.084***
			(0.086)	(0.087)			(0.022)	(0.022)
InterestR (3)				-1.781***		0.178***		0.365***
				(0.342)		(0.022)		(0.069)
Yield10yr		0.042		0.020		-0.124***		-0.061*
		(0.057)		(0.054)		(0.026)		(0.032)
Shareprices		0.011		0.004		0.010		0.010
		(0.012)		(0.011)		(0.007)		(0.007)
M3growth		0.006		-0.010		-0.093***		-0.059***
		(0.009)		(0.009)		(0.009)		(0.012)
_cons	-0.034	-0.181	0.061	-0.148	0.041*	0.678***	-0.003	0.223
	(0.034)	(0.140)	(0.047)	(0.173)	(0.024)	(0.106)	(0.025)	(0.135)
DW	0.220	0.235	0.262	0.273	0.136	0.211	0.162	0.219

Notes: Columns 1 & 2 present the baseline OLS results; columns 3 & 4 show the OLS results with dummy variables for different governors. Standard errors are reported in parentheses, the Durbin-Watson (DW) test statistic is reported for each estimation. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Results from the GMM estimation of the monetary policy reaction functions

	Czech Republic (n=66)				*Hungary (n=106)*			
	1	2	3	4	1	2	3	4
InflGap (2)	0.150***	0.513***	0.194***	0.548***	1.648***	3.115***	1.727***	2.914***
	(0.009)	(0.040)	(0.002)	(0.054)	(0.047)	(0.308)	(0.056)	(0.510)
OutpGap (2)	0.025***	1.049***	0.024***	0.847***	-0.104***	0.781***	0.077***	0.444***
	(0.003)	(0.069)	(0.001)	(0.098)	(0.022)	(0.120)	(0.029)	(0.131)
InterestR (2)		0.992***		0.991***		0.971***		0.937***
		(0.001)		(0.002)		(0.004)		(0.017)
InflGap (3)			-0.197***	-0.505			-1.181***	22.343
			(0.010)	(0.336)			(0.108)	(21.873)
OutpGap (3)			-0.011	0.059			-0.011	7.305
			(0.013)	(0.036)			(0.136)	(7.558)
InterestR (3)				1.125***				0.956***
				(0.050)				(0.045)
Hansen J-stat	5.533	9.211	6.107	9.000	8.234	5.545	6.894	5.780
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]
	Japan (n=93)				*Sweden (n=155)*			
	1	2	3	4	1	2	3	4
InflGap (2,3)	0.021***	0.968***	-0.032***	1.179***	0.654***	1.424***	2.186***	1.781***
	(0.002)	(0.267)	(0.009)	(0.046)	(0.069)	(0.120)	(0.247)	(0.265)
OutpGap (2,3)	-0.006***	-0.510***	-0.005***	-0.060***	0.078***	0.640***	-0.700***	-0.090
	(0.001)	(0.154)	(0.001)	(0.011)	(0.012)	(0.055)	(0.219)	(0.094)
InterestR (2,3)		1.001***		1.008***		0.970***		0.118
		(0.000)		(0.002)		(0.003)		(0.579)
InflGap (3,4)			0.066***	0.249			-1.634***	1.257*
			(0.010)	(0.184)			(0.277)	(0.641)
OutpGap (3,4)			-0.010***	-0.100**			0.789***	0.109
			(0.003)	(0.048)			(0.220)	(0.245)
InterestR (3,4)				0.959***				1.640***
				(0.009)				(0.574)
Hansen J-stat	6.137	8.454	6.466	5.128	7.429	8.738	7.445	6.504
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]

	United Kingdom (n=150)				*United States (n=119)*			
	1	2	3	4	1	2	3	4
InflGap (2)	0.877***	-0.111	1.002***	0.013	0.379***	0.566***	0.698***	0.508***
	(0.066)	(0.239)	(0.057)	(0.131)	(0.075)	(0.110)	(0.068)	(0.043)
OutpGap (2)	0.436***	0.672***	0.460***	0.464***	0.151***	0.055***	0.210***	0.067***
	(0.043)	(0.210)	(0.029)	(0.100)	(0.055)	(0.014)	(0.034)	(0.007)
InterestR (2)		0.944***		0.917***		0.866***		0.813***
		(0.018)		(0.021)		(0.023)		(0.012)
InflGap (3)			-0.713***	-0.010			-0.678***	-0.027
			(0.080)	(0.056)			(0.099)	(0.033)
OutpGap (3)			-1.160***	-0.057			-0.415***	-0.058**
			(0.255)	(0.050)			(0.102)	(0.004)
InterestR (3)				1.497***				2.546***
				(0.031)				(0.056)
Hansen J-stat	7.291	16.698	7.163	17.640	5.269	18.693	5.354	6.714
	[1.000]	[0.999]	[1.000]	[0.994]	[1.000]	[0.996]	[1.000]	[1.000]

Notes: Columns 1 & 2 present the baseline GMM results; columns 3 & 4 show the GMM results with dummy variables for different governors. Standard errors are reported in parentheses, the p-value of the Hansen's J test for overidentification in square brackets.*** p<0.01, ** p<0.05, * p<0.1.

Table 7: Results from the OLS estimation of the monetary policy reaction functions based on political appointment (governor fixed effects)

	Left wing versus right wing appointed governors (n=1404)			
	1	2	3	4
InflGap	0.759***	0.406***	0.764***	0.329***
	(0.020)	(0.027)	(0.036)	(0.041)
OutpGap	0.061***	0.076***	0.100***	0.136***
	(0.013)	(0.010)	(0.024)	(0.019)
InterestR		0.135***		0.100**
		(0.026)		(0.043)
InflGap (d)			-0.064	0.069
			(0.042)	(0.048)
OutpGap (d)			-0.083***	-0.117***
			(0.025)	(0.020)
InterestR (d)				0.059
				(0.040)
Yield10yr		0.079		0.113**
		(0.048)		(0.046)
Shareprices		0.005		0.006
		(0.006)		(0.006)
M3growth		0.064***		0.057***
		(0.009)		(0.008)
_cons	-0.269***	-2.370***	-0.291***	-2.377***
	(0.031)	(0.282)	(0.034)	(0.322)

Notes: Columns 1 & 2 present the baseline OLS results; columns 3 & 4 show the OLS results with a dummy variable for right wing appointed governors. Standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Results from the GMM estimation of the monetary policy reaction functions based on political appointment

	Left wing versus right wing appointed governors (n=1245)			
	1	2	3	4
InflGap	1.573***	2.099***	0.904***	0.854
	(0.088)	(0.271)	(0.217)	(1.026)
OutpGap	-0.063**	0.328***	-0.260**	0.443**
	(0.031)	(0.093)	(0.105)	(0.212)
InterestR		0.968***		0.369
		(0.006)		(0.349)
InflGap (d)			1.332***	0.775**
			(0.460)	(0.311)
OutpGap (d)			0.381*	0.308***
			(0.198)	(0.116)
InterestR (d)				3.987***
				(0.853)
Hansen J-stat	38.644	38.046	27.178	37.607
	[0.486]	[0.467]	[0.882]	[0.351]

Notes: Columns 1 & 2 present the baseline GMM results; columns 3 & 4 show the GMM results with a dummy variable for right wing appointed governors. Standard errors are reported in parentheses, the p-value of the Hansen's J test for overidentification in square brackets.*** p<0.01, ** p<0.05, * p<0.1.

Table 9: Description of variables and sources

Country	*Variable*	*Description & source*
The Czech Republic	*InterestR*	Two-week repo rate (monthly average); central bank website (https://www.cnb.cz)
	Inflation	Inflation rate computed as the annual rate of change of the CPI, seasonally adjusted (X-12-ARIMA); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	OutpGap	Output gap calculated as the percentage deviation of the (log) industrial production index, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Yield10yr	Czech Republic 10-year government bond yield (monthly average); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	M3growth	Annual rate of change of the monetary aggregate M3, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Shareprices	Share prices computed as the monthly change of the share price index (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)
Hungary	*InterestR*	Two-week repo rate (monthly average); central bank website (http://english.mnb.hu)
	Inflation	Inflation rate computed as the annual rate of change of the CPI, seasonally adjusted (X-12-ARIMA); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	OutpGap	Output gap calculated as the percentage deviation of the (log) industrial production index, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Yield10yr	Hungary 10-year government bond yield (monthly average); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	M3growth	Annual rate of change of the monetary aggregate M3, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Shareprices	Share prices computed as the monthly change of the share price index (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)
Japan	*InterestR*	Uncollateralized overnight call rate (monthly average); central bank website (https://www.boj.or.jp)
	Inflation	Inflation rate computed as the annual rate of change of the CPI, seasonally adjusted (X-12-ARIMA); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	OutpGap	Output gap calculated as the percentage deviation of the (log) industrial production index, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Yield10yr	Japan 10-year government bond yield (monthly average); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	M3growth	Annual rate of change of the monetary aggregate M3, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Shareprices	Share prices computed as the monthly change of the share price index (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	InterestR	Swedish Treasury bills 3-month maturity (monthly average); central bank website (http://www.riksbank.se)

Sweden	*Inflation*	Inflation rate computed as the annual rate of change of the CPI, seasonally adjusted (X-12-ARIMA); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	OutpGap	Output gap calculated as the percentage deviation of the (log) industrial production index, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Yield10yr	Sweden 10-year Treasury bond yield (monthly average); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	M3growth	Annual rate of change of the monetary aggregate M3, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Shareprices	Share prices computed as the monthly change of the share price index (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)
The United Kingdom	*InterestR*	UK Treasury bills 3-month maturity (monthly average); central bank website (http://www.bankofengland.co.uk)
	Inflation	Inflation rate computed as the annual rate of change of the CPI, seasonally adjusted (X-12-ARIMA); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	OutpGap	Output gap calculated as the percentage deviation of the (log) industrial production index, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Yield10yr	British 10-year Government Securities yield (monthly average); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	M3growth	Annual rate of change of the monetary aggregate M3, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Shareprices	Share prices computed as the monthly change of the share price index (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)
The United States	*InterestR*	Effective Federal funds rate (monthly average); central bank website (http://www.federalreserve.gov)
	Inflation	Core inflation rate computed as the annual rate of change of the CPI less food and energy, seasonally adjusted (X-12-ARIMA); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	OutpGap	Output gap calculated as the percentage deviation of the (log) industrial production index, seasonally adjusted; OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Yield10yr	United States 10-year Treasury bond yield (monthly average). OECD, Monthly Financial Statistics (http://stats.oecd.org)
	M3growth	Annual rate of change of the monetary aggregate M3, seasonally adjusted (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)
	Shareprices	Share prices computed as the monthly change of the share price index (CPI deflated); OECD, Monthly Financial Statistics (http://stats.oecd.org)

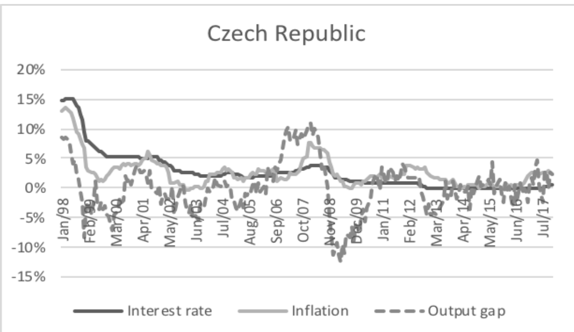

Figure 1. Czech Republic (Jan 1998 – Dec 2017).

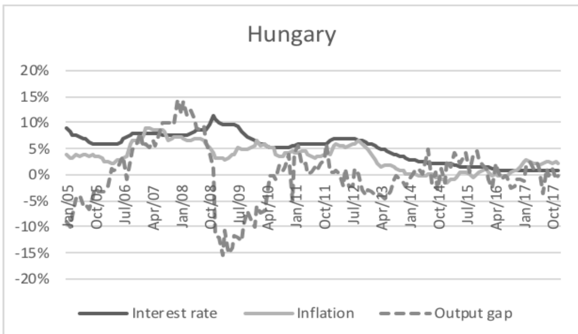

Figure 2. Hungary (Jan 2005 – Dec 2017).

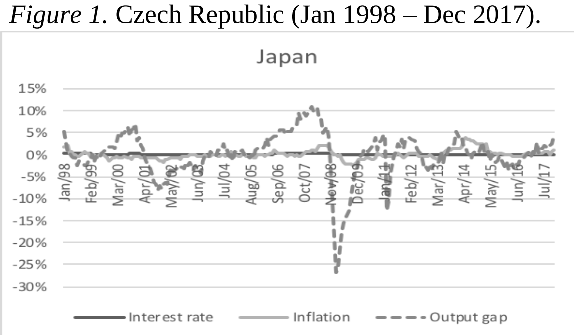

Figure 3. Japan (Jan 1998 – Dec 2017).

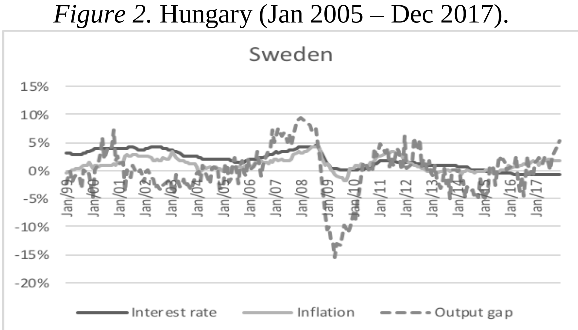

Figure 4. Sweden (Jan 1999 – Dec 2017).

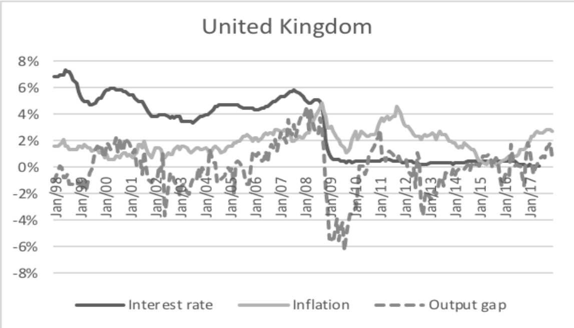

Figure 5. United Kingdom (Jan 1998 – Dec 2017).

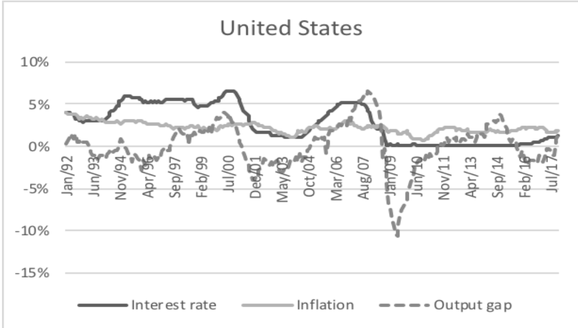

Figure 6. United States (Jan 1992 – Dec 2017).

Table 10: Unit root and stationarity tests

	Sweden		*Hungary*		*Czech Republic*	
	DF	KPSS	DF	KPSS	DF	KPSS
Interest rate	-0.156	0.076⁺	-0.434	0.238	-7.599*	0.252
Inflation	-2.497	0.073⁺	-1.269	0.142	-4.376*	0.101⁺
Outputgap	-3.794*	0.045⁺	-3.112*	0.065⁺	-3.790*	0.048⁺
1% crit.value	-3.468	0.216	-3.492	0.216	-3.464	0.216
5% crit.value	-2.882	0.146	-2.886	0.146	-2.881	0.146
10%crit.value	-2.572	0.119	-2.576	0.119	-2.571	0.119
	United States		*United Kingdom*		*Japan*	
	DF	KPSS	DF	KPSS	DF	KPSS
Interest rate	-0.648	0.116⁺	-1.177	0.124	-2.082	0.158
Inflation	-2.834*	0.189	-1.923	0.255	-2.901*	0.069⁺
Output gap	-1.908	0.043⁺	-4.012*	0.045⁺	-3.115*	0.041⁺
1% crit.value	-3.455	0.216	-3464	0.216	-3.464	0.216
5% crit.value	-2.878	0.146	-2.881	0.146	-2.881	0.146
10%crit.value	-2.570	0.119	-2.571	0.119	-2.571	0.119

* Unit root is rejected at a significance level of 10% = stationarity.
⁺ Stationarity is not rejected at a significance level of 10%

Table 11: Inflation targets in backward-looking model

Central bank	*Sample average π*	*Target π**
Czech National Bank⁺	2.63%	6% - 2%
Hungarian National Bank⁺	3.41%	3.5% - 3%
Bank of Japan*	0.05%	1% - 2%
Sweden's Riksbank⁺	1.20%	2%
Bank of England⁺	1.89%	2%
Federal Reserve System*	2.23%	2%

* Bank of Japan: Leigh (2009) displays some narrative evidence that the medium to long-term target for price stability lies with most committee members at 1%. In September 2016, the MPC adopted an explicit 2% target. Federal Reserve System: Leigh (2005) shows that the implicit inflation target of the United States fluctuates around 2% in the period 1995-2005.
⁺ Target retrieved from central bank website. Czech National Bank: Based on figure 7, a target of 6% is chosen until November 1998, a target of 4.5% until November 2000, and a target of 3% until November 2009. From December 2009 onwards, the target is set at 2%.

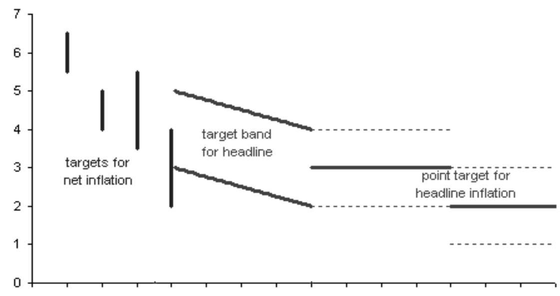

Figure 7. The Czech National Bank's inflation targets. Source: Central bank website.

Table 12: Central bank governor inaugurations

Czech Republic	*Inauguration*	*Nominated by*	*Political party*	*Ideology*	*DPI*	*Sample*
Kysilka	December 1997	Havel	Independent	N/A	Center	Left
Tosovsky	August 1998	Havel	Independent	N/A	Center	Left
Tuma	December 2000	Havel	Independent	N/A	Center	Left
Singer	July 2010	Klaus	Independent	N/A	Center	Right
Rusnok	August 2016	Zeman	SPO	Social Democratic	Left	Left

Hungary	*Inauguration*	*Nominated by*	*Political party*	*Ideology*	*DPI*	*Sample*
Jarái	March 2001	Orbán	Fidesz	Conservatism	Right	Right
Simor	March 2007	Gyurcsány	MSZP	Social Democratic	Left	Left
Matolcsy	March 2013	Orbán	Fidesz	Conservatism	Right	Right

Japan	*Inauguration*	*Nominated by*	*Political party*	*Ideology*	*DPI*	*Sample*
Matsushita	December 1994	Murayama	SDPJ	Social Democratic	Left	Left
Hayami	March 1998	Hashimoto	LDP	Conservatism	Right	Right
Fukui	March 2003	Koizumi	LDP	Conservatism	Right	Right
Shirakawa	April 2008	Fukuda	LDP	Conservatism	Right	Right
Kuroda	March 2013	Abe	LDP	Conservatism	Right	Right

Sweden	*Inauguration*	*Nominated by*	*Political party**	*Ideology*	*DPI*	*Sample*
Bäckström	January 1994	General Council	Moderate Party	Conservatism	Right	Right
Heikenstein	January 2003	General Council	SAP	Social Democratic	Left	Left
Ingves	January 2006	General Council	SAP	Social Democratic	Left	Left

* Party that has reached the highest number of seats in the latest elections.

United Kingdom	*Inauguration*	*Nominated by*	*Political party*	*Ideology*	*DPI*	*Sample*
George	July 1993	Clarke	Conservative Party	Conservatism	Right	Right
King	July 2003	Brown	Labour Party	Social Democratic	Left	Left
Carney	July 2013	Osborne	Conservative Party	Conservatism	Right	Right

United States	*Inauguration*	*Nominated by*	*Political party*	*Ideology*	*DPI*	*Sample*
Greenspan	August 1987	Reagan	Republican Party	Conservatism	Right	Right
Bernanke	February 2006	Bush	Republican Party	Conservatism	Right	Right
Yellen	February 2014	Obama	Democratic Party	Social Democratic	Left	Left