Nijmegen School of Management

Department of Economics and Business Economics

Master's Thesis Economics (MAN-MTHEC)

Real Interest Rates Tend to be Higher When the Central Bank Chief and the Head of Government Have a Different Political Orientation

By Aise J. O'Neil s1103184

Nijmegen, 17 June 2023

Program: Master's Program in Economics

Specialisation: Financial Economics

Supervisor: Frank Bohn

Radboud Universiteit

Table of Contents

1. Introduction

The consensus of economists seems to be that a more independent central bank chief produces better outcomes. Researchers have argued that independent central bankers will generally focus on getting inflation to be at a low and stable level (Alesina & Gatti, 1995). Other researchers argue independent central banks will lead to greater economic stability (Debelle & Fischer, 1994).

However, this paper presents a finding which challenges the view of apolitical central bank chiefs. It finds statistically significant evidence that the stance of monetary policy tightness is influenced by the level of political agreement between the head of government and central bank chief. When a central bank chief and a head of government have a different political ideology (defined as either leftist, centrist or rightist), this leads to tighter monetary policy. Additionally, this paper finds statistically significant evidence that fiscal policy is tighter and the unemployment rate is higher when the central bank chief and head of government have a different political ideology. Hence, not only does this paper demonstrate that the political views of a central bank chief affect the stance of policy, it also demonstrates real world consequences.

This paper serves a second, technical purpose as well: it suggests a resolution to the issue of endogeneity which makes identifying the effects of monetary policy problematic. Endogeneity is a major issue in estimating the effect of public policy. Figure 1, on the next page, presents my thinking on how macroeconomic variables are all endogenously determined by each other and how this makes economic research difficult. Economic variables, such as the unemployment rate; measures of the stance of monetary policy, such as interest rates; and measures of the stance of fiscal policy all impact each other. This is because economic policy has an impact on the economy but different economic policy is implemented depending on what economic conditions look like. For example, higher interest rates may raise unemployment but higher unemployment rates may make the central bank set lower interest rates. Meanwhile, the stance of fiscal policy likely affects but is also affected by interest rates and the unemployment rate. This issue is further complicated by the fact that these variables (fiscal policy, monetary policy and economic conditions) can affect each other with a lag. It is complicated even more that expectations of

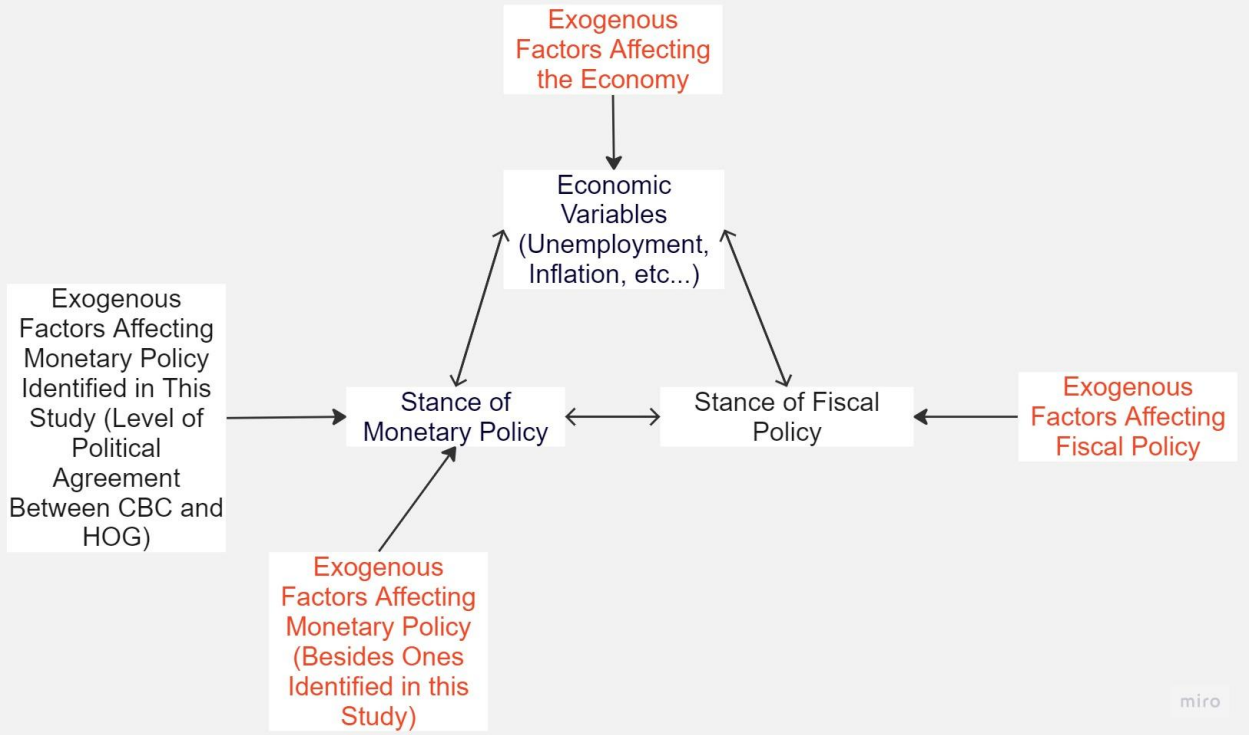

Figure 1: Model of Causal Effects Relevant to This Study

future values of these variables can impact present value (for example, interest rates can be lower if unemployment is expected to get higher).

In attempting to understand the causal relationship between endogenous variables, researchers may rely on instrumental variables which capture some exogenous component of the variance of one of the endogenous variables. However, as the literature review (next section) will cover, macroeconomic modeling shows a shortage of exogenous instrumental variables and this creates problems for research. Hence, the second goal of this paper is to use the fact that central bank chiefs are apparently politically motivated as a tool to study the effects of monetary policy.

This paper deliberately does not cover data from countries which might be impacted by unconventional monetary policy. For this reason, the findings of this paper should not be assumed to generalize to such countries.

This paper is divided into six sections. Section 2 gives a literature review, which covers the political business cycle model literature and the fiscal-financing channel literature, as well as two recent studies which indicate that the level of agreement between the head of government and central bank chief impacts the stance of monetary policy. Section 2 also gives a literature overview of the endogeneity issue and how it has impacted past macroeconomic research. Section 3 states the hypotheses, and Section 4 describes methods of data collection and the data

collected. Section 5 gives an overview of all the statistical testing that was performed. Section 6 concludes by summarizing the empirical results and giving implications for future public policy and research.

2. Literature Review

The literature review is divided into 3 subsections. The first subsection surveys past literature on how political factors impact the stance of monetary policy. The second subsection covers past research on how tighter monetary policy may induce tighter fiscal policy by making the cost of government borrowing more expensive (the "fiscal-financing channel:). The third subsection describes some previous occurrences of the issue of endogeneity which makes inferring and estimating causal effects a dubious task.

a. Political Determinants of Monetary Policy

Nordhaus (1975), introduced a new wave of research into macroeconomic fluctuations, by emphasizing the role political actors played in intentionally creating fluctuations. In a theoretical model of a democratic government and an economy, he showed the ruling party would always be incentivized to create macroeconomic fluctuations to secure re-election. The reason for this is that some of the inflationary costs of an economic boom are felt in the future. Meanwhile, voters are assumed to display greater support for the incumbent party on election day if recent economic conditions were good. In other words, low unemployment and low inflation are good for politicians seeking re-election. The logical implication for this model is that the incumbent politicians should always want to create election-year economic booms because voters like low unemployment and will not experience the inflationary cost until later. Nordhaus' model also assumes that the incumbent politician can set unemployment at any level and successfully create election-year booms. So, the Nordhaus (1975) model should be less accurate if something else interferes, such as an unhelpful central banker, keeping the incumbent head of government from setting the rate of unemployment.

Abrams & Butkiewicz (2012), find anecdotal evidence that incumbent politicians desire to create election-year booms in recorded audiotapes from the Nixon Administration. In particular, it confirms that Nixon put pressure on the FED Chairman, Arthur Burns, to adopt an

accommodative monetary policy stance. This pressure was applied from February 1971 until December 1971. This period started twenty one months before Nixon's reelection and ended eleven months before.[1] Because the peak effects of monetary policy shocks on the economy generally take at least a year to materialize (Batini & Nelson, 2012), it is understandable that the pressure applied by the Nixon administration on the FED occurred well before the election rather than during the election.

While the incumbent president might wish to have accommodative monetary policies a year before (or earlier) the election, this might not be in keeping with the partisan agenda of the chief central banker. Dentler (2019) finds that monetary policy in the US is generally tighter before an election if the FED chairman is in a different political party than the president. Essentially, while the President may want an election-year boom, his political opposition may want an election-year bust. This result is also borne out by a study of elections in Africa (Strong, 2023) which finds that the relationship between the central bank chief and head of government is significant in predicting economic variables around an election.

Both studies mentioned in the previous paragraph assume that monetary policy is well-timed to affect the economy before an election. Dentler (2019) investigates the possibility of political-affiliation driven shocks to the FED's policy interest rate occurring in the 8 quarters before an election. Strong (2023) investigated the effect of a difference in CBC and HoG political affiliation on economic outcomes during an election year. This means that, so far, the impact of the level of agreement between a CBC and HoG on monetary policy in general (even when an election will not happen soon) has not been sufficiently tested. Given the uncertain lags from monetary policy to economic outcomes and the uncertain lags from economic outcomes to popular support for the HoG's political affiliation, it is not entirely clear that monetary policy can be well-timed to influence an election.

b. Fiscal-Financing Channel

In this paper, the term "fiscal-financing channel" refers to the idea that governments borrow more money when borrowing costs are lower. Hence, fiscal policy might loosen when monetary policy loosens or tightens when monetary policy tightens. This definition of

[1] By "Nixon's reelection" I mean the process of voters submitting their votes to electoral authorities which happened in November 1972.

"fiscal-financing channel" is used by Strong (2023), Alpanda and Honig (2010), Alpanda & Honig (2009) and Leeper (1991). However, this term may have different meanings in other papers. The fiscal-financing channel is often researched in the context of political business cycles (the idea that the economy is stimulated before an election, mentioned in the previous sub-section).

Strong (2023), Leeper (1991) and Alpanda & Honig (2009) all research the possibility of a fiscal-financing channel. Strong (2023) finds significant evidence of a fiscal-financing channel. The evidence is that an ally central bank chief is associated with a higher debt-to-GDP ratio growth rate in election years. Alpanda & Honig (2010) fail to find significant evidence of a fiscal-financing channel. Leeper (1991) helps to develop mathematical models of the economy in the event that fiscal financing occurs.

c. The Endogeneity Issue in Macroeconomic Research

Macroeconomic research is often conducted by regressing endogenous variables against each other. For example, there is a large body of literature which relies upon vector autoregressive (VAR) and structural vector autoregressive (SVAR) models (Bernanke, Getler, Watson, Sims & Friedman, 1997; Bernanke & Milhov, 1998; Balke & Emery, 1998; Hansen, 2004, Sims, 1992).

However, such research methods are known to create biased results. For example, these research methodologies historically tended to conclude that, in the very short term, tighter monetary policy led to higher rates of inflation - a result described as the "price puzzle" (Balke & Emery, 1998; Hansen, 2004). It was called a puzzle because tighter monetary policy is usually thought to lead to lower inflation. Sims (1992) finds that the price puzzle is less strong when commodity prices and exchange rates are included in VAR or SVAR models. Hansen (2004) discusses the commonly held belief in economics that the "price puzzle" is a problem which must be solved by including commodity prices in a VAR or SVAR model.

The commonly held explanation of the price puzzle is that it was created by an omitted variable bias. Commodity prices are a useful variable for predicting future inflation, but that means they also are an important variable for determining current monetary policy. The reason is that central bankers will make decisions based upon their predictions of the future and will often use relevant economic data to form predictions. Because higher commodity prices indicate

upward pressure on inflation in the future they also lead to tighter monetary policy in the present. Because commodity prices are good predictors of inflation, any VAR or SVAR model which fails to include them creates a positive correlation between the error term for future inflation (the unexplained component of future inflation) and commodity prices. Commodity prices are also positively correlated with interest rates because central bankers are using them to predict future inflation. This can make the error term for future inflation positively correlated with interest rates. All that contributed to an endogeneity (omitted variable bias) issue which ostensibly invalidates all the empirical findings behind the "price puzzle."

The "price puzzle" points to a wider issue that many VAR and SVAR model regressions have even if commodity prices are included. The reason commodity prices need to be included as control variables for monetary policy is that they indicated something about the economy and therefore were used by central bankers to predict the future. However, there has never been a VAR or SVAR model comprehensive enough to entirely include all economic information used by central bankers to predict the future. Until such a model is created, all the existing VAR and SVAR models suffer from endogeneity.

Central banks now use even more complicated statistical approaches than VAR and SVAR to estimate causal relationships. Currently, the FED employs a Dynamic Stochastic General Equilibrium ("DSGE") model which is largely based on earlier work done by Smets & Wouters (2007) and Christiano, Eichenbaum & Evans (2001) (*The New York Fed DSGE Model*). The variables used for the FED's DSGE model are all endogenous (*The New York Fed DSGE Model*). Christiano, Eichenbaum & Evans (2001) use a VAR model to estimate the effects of monetary policy on the economy as a starting point for their model. Meanwhile, Smets & Wouters (2007) also use only endogenous data to build their DGSE model. They also impose certain model assumptions to build out their model. For instance, they write on page 558: "We assume that exogenous spending follows a first-order autoregressive process with an IID-Normal error term." On page 590 they write: "The price mark-up disturbance is assumed to follow an ARMA(1, 1) process," and, on page 592 they write: "The depreciation rate is fixed at 0.025 (on a quarterly basis) and the exogenous spending-GDP ratio is set at 18 percent."

Overall, macroeconomic research is plagued by reliance on endogenous variables. This reliance leads to omitted variable bias and the seemingly arbitrary imposition of model assumptions. It would be helpful to develop some exogenous variables that could be used in macroeconomic research.

3. Hypotheses

The literature review above gives intuition behind the idea that a political disagreement between a central bank chief ("CBC") and a head of government ("HoG") of a democratic country should lead to tighter monetary policy, especially when an election will happen soon. The crucial idea is that looser monetary policy should help the people in charge win an election. Additionally, it summarizes two research papers which find that, before an election, monetary policy is tighter when the CBC and HoG belong to different political factions. To test the possibility that political disagreements between the CBC and HoG lead to tighter monetary policy, I created two hypotheses (hypothesis 1 and hypothesis 2) as follows:

> Hypothesis 1: *In a democracy, the stance of monetary policy should be tighter if the central bank chief and the head of government have a different political orientation.*
> Hypothesis 2: *The effect described by Hypothesis 1 should be more pronounced if an election will occur in 2 years or less.*

Hypothesis 1 is the idea that CBCs tighten policy when they have political disagreements with the HoG. Hypothesis 2 is the idea that central bank chiefs time their politically-motivated policy tightening or loosening. It says, if the CBC disagrees with the HoG, policy will tighten the most one or two years before the election so that the effects on the economy are mainly felt during or right before the election. The specific timeframe of 2 years chosen for Hypothesis 2 was motivated by two papers. First, it was motivated by Abrams & Butkiewicz (2012) which found that President Nixon put the most pressure on his central bank chief around 1 to 2 years before the 1972 election. Secondly, it matches the timeframe that Dentler (2019) chose to investigate (1 to 8 quarters before an election) in order to identify political effects on the Federal Funds Rate (America's central bank policy rate).

I was interested in following the effects of political variables on monetary policy through to their impacts on fiscal policy and the unemployment rate. Essentially, economic literature implies that an exogenous tightening of monetary policy will result in an increased level of unemployment and a tightening in fiscal policy (through the fiscal-financing channel covered in Subsection 2.b). This thinking leads to Hypothesis 3 and Hypothesis 4.

Hypothesis 3: *If exogenous shocks which lead to tighter monetary policy are observed (through testing hypothesis 1 and hypothesis 2); they should also then lead to higher unemployment.*
Hypothesis 4: *If exogenous shocks which lead to tighter monetary policy are observed (through testing hypothesis 1 and hypothesis 2); they should also then lead to tighter fiscal policy.*

The thinking behind hypothesis 3 and 4 is that if political variables do lead to policy tightening, they should lead to the presumed effects of policy tightening.

4. Data

This section describes the process of data collection employed in this paper. Subsection a gives an overview on which sources were used for macroeconomic data. Subsection b gives an overview of how political variables were defined and measured. Subsection c defines the boundaries of the dataset and gives a comprehensive list and justification for all the reasons I chose to exclude data from my dataset. Subsection d describes the process of identifying the years during which head of government elections occurred and a central bank chief was replaced.

a. Macroeconomic Data

I used the central bank's ex-post[2] real policy rate as the measure of the stance of monetary policy. The choice to use the ex-post real policy rate instead of the nominal or ex-ante real policy rate is justified in the appendix section (pages 39-40).

Despite the justification in the appendix section, The choice to use the real policy rate as the measure of monetary policy tightness meant that the measure was not appropriate in all cases. Unconventional monetary policy makes the real policy rate a bad measure of the stance of

[2] The ex-post real policy rate is the actual cost of borrowing, after adjusting for inflation. It can be computed in continuously compounded terms, as the interest rate one pays to borrow for a period minus the actual inflation rate experienced during that period. The ex-ante real policy rate is the anticipated cost of borrowing at the time someone borrows. It is calculated, in continuously compounded terms, as the interest rate minus the expected inflation rate. If the ex-ante and ex-post interest rates on a particular borrowing contract are not equal, it means that the people who made the agreement were incorrect when they attempted to forecast inflation.

monetary policy. Subsection c of this section explains the methodology used to address this issue.

Real central bank policy rate data was calculated on an annual basis using nominal policy rate data and cpi data. The choice to calculate values on an annual basis was motivated by a lack of available seasonally adjusted CPI data.

I collected the daily nominal policy rate data from the Bank for International Settlements (*Central Bank Policy Rates* 2023). I first converted the data from annual effective rates to annual continuously compounded rates and then I averaged values across calendar years, to get a continuously compounded nominal policy rate on an annual basis. I collected Monthly CPI indexes from the Bank for International Settlements (*Consumer Prices* 2023). I calculated the annual continuously compounded inflation rate for a country and year by taking the log change in the CPI index from January of the year until January of the next year. The real policy rate was calculated by subtracting the continuously compounded rate of inflation from the continuously compounded nominal policy rate.

The Bank for International Settlements provides data on the end-of-year exchange rate against the dollar for various countries (US Dollar Exchange rates 2023). This was used to calculate the continuously compounded nominal rate of appreciation of a country's currency against the dollar. The rate of appreciation was the log-change in its value against the dollar (minus one times the log-change in its exchange rate) from the end of the last year to the end of the current year.

The source I used for the unemployment rate was the OECD, 2023. I used only annual unemployment rate data and only data for both genders. The source I used to measure a country's primary budget surplus was the International Monetary Fund, 2023.

b. Measuring Political Variables

To define some political variables, I turned to Herre, 2021 which covers a large range of country-year data points. I used three variables from this dataset.[3] The first is the ideology of the political leader at the end of the year for various country-year data points. Leaders were defined

[3] This working paper would eventually be published as an article (Herre, 2022) in the Cambridge University press. However the data set drops certain variables including the "Head of Government Title" so I used the original working paper. The working paper and the published article datasets do not contradict each other, instead the working paper dataset simply gives extra information,

as either "leftist", "rightist" or "centrist". Secondly, it had a binary value for whether a country is a democracy at the end of the year. Thirdly, it has a categorical variable called "Head of Government Title" including values such as "President," "King," etc…

The political orientation of a central bank chief is equally as important to my study as the political orientation of the head of government. But, there are no large databases on central bank chief ideologies.Dentler, 2019 who coded a Federal Reserve Chairman as Democrat or Republican depending on whether the President was a Democrat or Republican when they were first appointed to their position. I adopted a similar approach, coding a central bank chief "leftist," "centrist" or "rightist" based on who I assumed was in charge at the time of the appointment.[4]

c. Defining the Boundaries of the Dataset

The dataset included as much data as possible, given four constraints. The first constraint was the level of data availability. Additionally, I excluded data from non-democratic nations as they were not relevant to my hypothesis. I excluded data from Switzerland as Switzerland's head of government (as defined by Herre (2021)) is a largely non-political seven-man executive.[5] Fourthly, I excluded data for which the real central bank policy rate is not a good measure of the stance of monetary policy. A description of how that was done follows:

The real policy rate becomes a bad measure of the stance of monetary policy when governments choose to rely on other (unconventional) policy tools to adjust the stance of monetary policy. For instance, a central bank may hold its real policy rate constant but begin a large corporate bond buying program, thereby loosening policy without signaling this loosening through its real policy rate. Today, we generally associate this state of affairs with policy responses some governments employed in response to both COVID-19 and the GFC. But it goes back further: Japan has been relying on unconventional monetary policy tools since the 1990s, while America appeared to use such policy tools historically as well. There was a cap on

[4] I was not always able to find the precise date a central bank chief was appointed and the Herre, 2021 dataset did not give specific dates that heads of government came to power. I assume that when a switch in central bank chief occurred, the appointer was the head of government in charge at the end of the year. This assumption is motivated by the idea that new officials are more likely to be appointed by an incoming rather than outgoing head of government.
[5] Since 1959, the seven-member Swiss Federal Council has always had two members from the Social Democrats, two from the Radicals and the remaining three belonging to either Christian Democrats, the Swiss People's Party or the Conservative Democratic Party (*History of the federal presidency* 2020).

long-term interest rates in the US in the late 1940s and early 1950s (Eichengreen & Garber 1990). And, in the 1930s, there were large asset purchases in the context of near-zero interest rates that flooded the banking system with excess reserves (Eichengreen & Sachs 2009).

Unconventional monetary policy seems to be initiated when the nominal policy rate drops close to 0%. For example, many central banks implemented unconventional monetary policy in 2008 after dropping their policy rates below 1%. However unconventional monetary policy will gradually (not immediately) get rolled back as the nominal policy rate rises away from 0%. An example of this is the current gradual reduction in the US Federal Reserve's balance sheet which started after the FED began hiking its policy rate. Hence I assume for this paper that if a country's nominal policy rate was close to 0% recently this would mean that a country was experiencing unconventional monetary policy (either it was currently being implemented or in the process of being rolled back). Given this assumption, I excluded any country-year data point for which the nominal policy rate was below 1% in the last 10 years. I included data-points where the current nominal policy rate was below 1% to avoid survivorship bias.

d. Identifying Election and New Central Bank Chief Years

I relied on numerous sources to identify the specific years that a new central bank chief was appointed and the specific years that an election for head of government occurred, which are laid out in table A1 in the appendix section (pages 44-47). They are limited to a country's own government websites, the International Parliamentary Union (*Parliamentary elections* 2023), the CIA world factbook (*CIA World Factbook* 2023), the International Monetary Fund, Yale University (Ortiz, 2013), the European Central Bank (*Agustín Guillermo Carstens* 2019) and newspapers. Although, occasionally I had to rely on the WayBack Machine (2023). I lay out the specific assumptions I used to identify such years in the appendix section (pages 40-41). I also record the years that I find a central bank chief is replaced in table A2 in the appendix section (pages 48-49) and the years that I find an election has occurred in table A3 in the appendix section (pages 50-51).

5. Empirical Testing

Empirical results were strongly in support of hypothesis 1. There was some significant evidence in support of hypothesis 3 and hypothesis 4, whereas hypothesis 2 has no significant support in the data. This section explains those results and is divided into 3 subsections. The first subsection, subsection a, covers early regressions performed to test hypothesis 1 and hypothesis 2. Subsection b covers robustness checks of the initial strong finding in support of hypothesis 1. Subsection c covers empirical tests of hypothesis 3 and hypothesis 4.

a. Initial Tests of Hypothesis 1 and Hypothesis 2

In order to perform statistical tests to test for hypothesis 1 and hypothesis 2, I defined two dummy variables: "ElecSoon" and "Dif." ElecSoon has a value of 1 if and only if there will be an election for the head of government in the next year or the year after the next year. Dif has a value of 1 if and only if the head of governments and central bank chief are classified as having a different political orientation ("left," "center" or "right"). If hypothesis 1 is correct, dif should have a positive effect on the real policy rate. If hypothesis 2 is correct, the interaction between ElectionSoon and Dif should have a positive effect on the real policy rate. Normally in political business cycle research, a measure of the stance of monetary policy is regressed against monetary policy-relevant macroeconomic variables and dummy variables representing political considerations. Dentler (2019), for example, regressed the Federal Funds Rate against Taylor rule variables (inflation and the output gap in one regression, inflation and the unemployment gap in another regression) and political dummy variables. While such regressions may be problematic due to endogeneity issues which I discussed in Section 3, Subsection b, I run these regressions in order to conform to existing literature and to show that the empirical results remain robust regardless of if macroeconomic control variables are included.

All regressions presented in this subsection and the next are tested only using fixed effect and two way fixed effect regressions.. This means any country-specific time-invariant effect is accounted for with the regression technique. A fixed effect regression is computationally equivalent to a regression which includes country-specific dummy variables. A two-way fixed effect regression is computationally equivalent to a regression which includes country-specific

dummy variables and year-specific dummy variables. The choice to stick to these regression methods specifically was motivated by the nature of hypothesis 1 and hypothesis 2. The core idea is to investigate whether political factors cause monetary policy to tighten or loosen relative to the neutral real policy rate. This study was not intended to test whether political factors could get real interest rates to be higher or lower in the long run. Hence I choose to employ regression techniques which demean the data for a country.

I constructed two equations to test hypothesis 1. The first equation, equation 1, is shown below. It regresses the real policy rate (R) against dif. In other equations which are meant to test hypothesis 2, I include ElecSoon and the interaction of the two dummies as explanatory variables. Equation 1 does not include any macroeconomic control variables. It simply tests for whether the stance of central bank policy is generally tighter when the head of government and central bank chief have a different political affiliation.

\

1) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + u_{i,t}$

In addition to equation 1, I developed another equation to test hypothesis 1. This equation, equation 2, is shown on the next page. U represents the unemployment rate and π represents the inflation rate. If one grants that the unemployment rate is a good indicator for the output gap and the inflation rate is a good indicator for the difference between the inflation rate and a central bank inflation target, equation 2 is very similar to a taylor rule equation, except with the inclusion of Dif as an additional explanatory variable.

2) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 U_{i,t} + \beta_3 \pi_{i,t} + u_{i,t}$

I constructed two more equations to test hypothesis two. The first of those equations, equation 3, is shown below. Equation 3 is similar to equation 1 except that it adds ElecSoon and the interaction between ElecSoon and Dif as explanatory variables. It tests for whether the real policy rate can be predicted purely with political variables, regardless of the stance of the economy. If the effect of the interaction term is positive, hypothesis 2 is supported by the data/

3) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 ElecSoon_{i,t} + \beta_3 Dif_{i,t} * ElecSoon_{i,t} + u_{i,t}$

Equation 4, which I employed to test hypothesis 2 is shown below. It is similar to equation 2 except that it adds ElecSoon and the interaction of ElecSoon with Dif as explanatory variables. If one accepts the unemployment rate as a measure of the output gap and the inflation rate as a measure of the difference between inflation and unemployment, this equation resembles a taylor rule equation. The most relevant difference is the inclusion of Dif, ElecSoon and the interaction term for the two. If the interaction term has a positive effect on the real policy rate, this is a finding in support of hypothesis 2.

4) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 ElecSoon_{i,t} + \beta_3 Dif_{i,t} * ElecSoon_{i,t} + \beta_4 U_{i,t} + \beta_5 \pi_{i,t} + u_{i,t}$

The results of fixed effect regressions of equations 1, 2, 3 and 4 are shown in table 1 on the next page. The results of two way fixed effect regressions of equations 1, 2, 3 and 4 are shown in table 2 on the next page. All regressions meant to test hypothesis 1 (in both tables 1 and 2) show strong evidence in favor of hypothesis 1 (suggest a higher dif leads to a higher real policy rate). Meanwhile, all regressions conducted to tests of hypothesis 2 produce an insignificant result (do not indicate the interaction between dif and ElecSoon significantly impacts the real policy rate).

In order to test the validity of the regressions which support hypothesis 1, I investigated the regressions for issues relating to stationarity, heteroskedasticity and autocorrelation. All the equations which were meant to test hypothesis 1 seem to have issues with heteroskedasticity according to the Studentized Breusch-Pagan test. I ran the Breusch Pagan test on all four regressions. With a null hypothesis of no heteroskedasticity, the least significant of the four tests had a p-value of 0.00003.

To test against the null hypothesis of no autocorrelation in a regression, I employed the Breusch-Godfrey/Wooldridge test (Croissant, 2008) for the fixed effect and two ways fixed effect regressions conducted on equation 1 and equation 2. The least significant result was p=0.0089. Hence, the equations which support hypothesis 1 also have a problem of autocorrelation.

Table 1: Fixed Effect Regressions Testing Hypothesis 1 and Hypothesis 2				
	Equation 1	Equation 2	Equation 3	Equation 4
Dif	0.0121 p<0.0001 ***	0.0085 p=0.0015 **	0.0121 p=0.0046 **	0.0080 p=0.0459 *
ElecSoon			0.0004 p=0.8977	-0.0019 p=0.4927
Dif * ElecSoon			-0.0000 p=0.9990	0.0008 p=0.8822
Inflation		-0.3089 p<0.0001 ***		-0.3120 p<0.0001 ***
Unemployment		0.2936 p<0.0001 ***		0.2932 p<0.0001 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				
Table 2: Two Way Fixed Effect Regressions Testing Hypothesis 1 and Hypothesis 2				
	Equation 1	Equation 2	Equation 3	Equation 4
Dif	0.0062 p=0.0103 *	0.0086 p=0.0015 **	0.0065 p=0.0701	0.0084 p=0.0021
ElecSoon			-0.0001 p=0.9629	-0.0013 p=0.5232
Dif * ElecSoon			-0.0000 p=0.9961	-0.0004 p=0.9122
Inflation		-0.5500 p<0.0001 ***		-0.5523 p<0.0001 ***
Unemployment		-0.0014 p=0.9763		0.0014 p=0.9777
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

To test for non-stationarity in my data, I intended to apply a panel-series unit root test on my dependent variable, real central bank policy rates. However, missing data made that infeasible (each year was missing data from at least one country). This was still an issue even after including data from country-year data points which were coded as undemocratic at the beginning of the year and including data from Switzerland. To get around this issue I limited the panel stationarity test to only countries which had available real policy rate data since 1956 (the beginning of my dataset) including real policy rate data from years coded as undemocratic. After running the Levin-Lin-Chu Unit-Root Test (Croissant, 2008) I can ($p<0.0001$) reject the null hypothesis of a unit root and accept the alternative hypothesis of stationarity. Six countries were included in this dataset: Denmark, India, Japan, Sweden, Switzerland and the UK. Data on all these countries is available from the year 1956 until the year 1997 (subsequent data from Japan is excluded as the Japanese nominal policy rate drops below 1% in 1997). I also ran an augmented dickey fuller test on the real policy rate of India which was available from the year 1956 through to 2021 (the full length of my dataset). When adding 0, 1, 2, 3 or 4 lagged difference terms I found, with a 99% confidence level, that I could reject the null hypothesis of a unit root to accept the alternative of stationarity (in the case of no drift and no trend). With 5 lagged difference terms this finding was significant at only a 90% confidence level. However, with 6 or more lagged difference terms, I cannot find this within even a 90% confidence level. Overall, there is no strong statistical evidence that non-stationarity issues invalidate the early results in support of hypothesis 1.

To deal with the issue of heteroskedasticity and autocorrelation present in my data, I employed the Newey & West, 1987 heteroskedasticity and autocorrelation robust standard errors for panel data (Millo, 2017). I used the default weighting method and varied the lags from 1 through 20 yearly data points. The results of these Newey & West, 1987 regressions confirm that even when controlling for heteroskedasticity and autocorrelation, Dif has a significant positive impact on the real policy rate (hypothesis 1 is supported by the data). The Newey & West, 1987 significance levels for the effect of Dif on the real policy rate for each equation, regression method and lag amount is available on table A4 in the appendix (page 52).

To summarize this subsection, 8 regressions were run employing two regression methods and 4 regression equations. 4 regressions were run to test hypothesis 2. None of those regressions produced significant results in support of hypothesis 2. The remaining 4 regressions were run to

test hypothesis 1. The results of these 4 equations significantly supported hypothesis 1. This statistical support for hypothesis 1 is complicated by the fact that they all seem to display high levels of autocorrelation and heteroskedasticity. However, when running those regressions over and reporting the significance level of the relevant model parameter using Newey & West (1987) heteroskedasticity and autocorrelation robust standard errors, I find the initial finding in favor of hypothesis 1 remains robust. Therefore the apparent statistical support for hypothesis 1 is likely not attributable to autocorrelation or heteroskedasticity. The next section performs robustness checks for the finding in favor of hypothesis 1. After running those robustness checks, I am left to conclude that hypothesis 1 is strongly supported by the data.

b. Robustness Checking of Hypothesis 1

The purpose of this subsection is to investigate the strong finding in support of hypothesis 1 from the earlier section. By introducing new control variables and removing portions of the dataset I found that the positive effect of Dif on the real central bank policy rate is reasonably robust. Hence hypothesis 1 is strongly supported by the data.

The new variables I introduce are dummies for the political affiliation of the head of government and central bank chief. "HOGleft" and "HogRight".are dummy variables for the head of government's political orientation. HOGleft has a value of 1 if and only if the head of government is a leftist. HOGRight has a value of 1 if and only if the head of government is a rightist. They are both equal to 0 if and only if the head of government is a centrist. Additionally, "CBCleft" and "CBCRight" are dummy variables for the central bank chief's political orientation. CBCleft has a value of 1 if and only if the central bank chief is a leftist. CBCright has a value of 1 if and only if the central bank chief is a rightist. They both are equal to 0 if and only if the central bank chief is a centrist.

I created six new regression equations with these dummy variables. The six regression equations are shown below. Equation 5 is formed by adding the dummy variables for central bank chief affiliation to equation 1. Equation 6 is formed by adding the dummy variables for head of government affiliation to equation 1. Equation 7 is formed by adding all four dummy variables to equation 1. Equation 8 is formed by adding the dummy variables for central bank chief affiliation to equation 2. Equation 9 is formed by adding the dummy variables for head of government affiliation to equation 2. Equation 10 is formed by adding all four dummy variables

to equation 2. R represents the real central bank policy rate. U represents the unemployment rate. π represents the inflation rate.

5) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 CBCleft_{i,t} + \beta_2 CBCright_{i,t} + u_{i,t}$

6) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 HOGleft_{i,t} + \beta_2 HOGright_{i,t} + u_{i,t}$

7) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 CBCleft_{i,t} + \beta_2 CBCright_{i,t} + \beta_3 HOGleft_{i,t} + \beta_4 HOGright_{i,t} + u_{i,t}$

8) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 CBCleft_{i,t} + \beta_2 CBCright_{i,t} + \beta_3 U_{i,t} + \beta_4 \pi_{i,t} + u_{i,t}$

9) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 HOGleft_{i,t} + \beta_2 HOGright_{i,t} + \beta_3 U_{i,t} + \beta_4 \pi_{i,t} + u_{i,t}$

10) $R_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + \beta_2 CBCleft_{i,t} + \beta_2 CBCright_{i,t} + \beta_3 HOGleft_{i,t} + \beta_4 HOGright_{i,t} + \beta_5 U_{i,t} + \beta_6 \pi_{i,t} + u_{i,t}$

The results of the fixed effect regressions on equation 5 through 10 are shown in table 3, on the next page. The results of the two way fixed effect regressions on equations 5 through 10 are shown in table 4, on the page afterwards. The results of all these additional regressions (12 in total) continue to significantly support hypothesis 1.

Another element of my robustness checking involved examining if the apparent strong statistical evidence in support of hypothesis 1 was attributable to a single country with oddly behaved data. This was done by checking each country in my dataset individually by running regressions on all data in the dataset except that one country. All four regressions meant to test hypothesis 1 in the previous section are run. The results of that process are available in table A5 in the appendix (pages 53-55). No single country appears to be the sole cause of the finding in favor of hypothesis 1. However, the exclusion of data from Sweden causes one of the four regressions (the two way fixed effects regression using equation 1) to no longer have a significantly non-zero effect of Dif on the real central bank policy rate with a 95% confidence level. The effect of Dif on the real central bank policy rate is still significantly different from 0 with a 94% confidence level. Additionally, to the extent any one country appears to be an outlier which skews the results it appears that the UK may be skewing the results against hypothesis 1.

Table 3: Fixed Effect Regression Performed to Robustness Check Hypothesis 1 By Adding Additional Parameters

	Equation 5	Equation 6	Equation 7	Equation 8	Equation 9	Equ. 10
Dif	0.0112 p=0.0002 ***	0.0114 p=0.0001 ***	0.0110 p=0.0002 ***	0.0080 p=0.0032 **	0.0085 p=0.0017 **	0.00080 p=0.0031 **
CBCleft	-0.0148 p=0.0080 **		-0.0115 p=0.0736	-0.0116 p=0.0644		-0.0116 p=0.0775-
CBCright	-0.0088 p=0.0976		-0.0066 p=0.2680	-0.093 p=0.0862		0.0096 p=0.0932
HOGleft		-0.0111 p=0.0278 *	-0.0061 p=0.2930		-0.0030 p=0.5867	0.0002 p=0.9669
HOGright		-0.0063 p=0.1887	-0.0032 p=0.5540		-0.0016 p=0.7419	0.0011 p=0.8378
π				-0.3239 p<0.0001 ***	-0.3095 p<0.0001 ***	-0.3243 p<0.0001 ***
U				0.2950 p<0.0001 ***	0.2945 p<0.0001 ***	0.2917 p<0.0001 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1						

Table 4: Two Way Fixed Effect Regression Performed to Robustness Check Hypothesis 1 By Adding Additional Parameters

	Equation 5	Equation 6	Equation 7	Equation 8	Equation 9	Equ. 10
Dif	0.0057 p=0.0183 *	0.0058 p=0.0170 *	0.0056 p=0.0221 *	0.0083 p<0.0001 ***	0.0086 p<0.0001 ***	0.0082 p<0.0001 ***
CBCleft	-0.0107 p=0.0228 *		-0.0075 p=0.1600	-0.0075 p=0.0892		-0.0068 p=0.1324
CBCright	-0.0064 p=0.1486		-0.0040 p=0.4239	0.0012 p=0.7519		0.0019 p=0.6289
HOGleft		-0.0090 p=0.0352 *	-0.0060 p=0.2128		-0.0032 p=0.4169	-0.0025 p=0.5281
HOGright		-0.0054 p=0.1907	-0.0038 p=0.3993		-0.0008 p=0.8235	-0.0024 p=0.5017
π				-0.5775 p<0.0001 ***	-0.5524 p<0.0001 ***	-0.5760 p<0.0001 ***
U				-0.0348 p=0.4702	-0.0042 p=0.9330	-0.0287 p=0.5590
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1						

Finally, I test whether the apparent finding in support of hypothesis 1 is attributable to one or more influential outlier data points. To address this issue I recursively drop the biggest outlier (defined as the data point with the largest absolute value residual) and report the new regression result with that outlier dropped. This process is performed until 20 outliers are dropped. I engage in this exercise with four of my regressions: fixed effect and two way fixed effect regressions using equation 1 and equation 2. The estimated impact of Dif on the Real Policy Rate, and its level of significance, as outliers are dropped, is published in table A6 in the appendix (pages 56-57). The dropping of outlier data points does not impact the significant finding that Dif positively affects the real policy rate. This implies that the finding in favor of hypothesis 1 is not driven by outlier data points.

c. Testing Hypothesis 3 and Hypothesis 4

The previous two subsections find that hypothesis 1 is strongly supported by the data, while hypothesis 2 is not supported by the data. Given that result, hypothesis 3 can be interpreted as the claim that a political disagreement between the central bank chief and the head of government should lead to higher unemployment rates. Meanwhile hypothesis 4 can be interpreted as the claim that a political disagreement between the central bank chief and the head of government should lead to a tighter fiscal policy. The intuition behind hypothesis 3 and hypothesis 4 is that if an exogenous shock causes tighter monetary policy, that shock should then lead to the effects of tighter monetary policy suggested by the literature. Those effects are a higher unemployment rate (due to tight monetary policy's tendency to contract the economy) and a higher unemployment rate (through a "fiscal-financing channel").

To test hypothesis 3 I regressed the unemployment rate against Dif (a dummy variable for whether the central bank chief and head of government hold different political affiliations). I used fixed effects and two way fixed effects regressions. Those are the same regressions methods I used when examining the relationship between the real central bank policy rate and Dif. The intuition behind hypothesis 3 is that I expect to see the unemployment rate rise because of an exogenous shock to monetary policy. However the lag from monetary policy shocks to the labor market is uncertain. Hence I regress the unemployment rate against Dif over a range of lags from 0 to 3 years. The regressions I run to test hypothesis 3 are described by equations 11 through 14, below. In the equations below u is an error term and U is the unemployment rate. The regression

results are available in table 5 which shows the results of fixed effect regressions and table 6, on the next page, which shows the results of two way fixed effect regressions.

11) $U_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + u_{i,t}$

12) $U_{i,t} = \beta_0 + \beta_1 Dif_{i,t-1} + u_{i,t}$

13) $U_{i,t} = \beta_0 + \beta_1 Dif_{i,t-2} + u_{i,t}$

14) $U_{i,t} = \beta_0 + \beta_1 Dif_{i,t-3} + u_{i,t}$

The results in tables 5 and 6 imply that Dif is a good predictor of the contemporaneous unemployment rate and not as good of a predictor of future unemployment rates. This was a surprising result as it seemingly implied monetary policy did not act with a long lag.

Table 5: Fixed Effect Regression of the Unemployment Rate Against Dif

	Equation 11	Equation 12	Equation 13	Equation 14
Dif 0 year lag	0.0068 p=0.0021 **			
Dif 1 year lag		0.0053 p=0.0145 *		
Dif 2 year lag			0.0029 p=0.1728	
Dif 3 year lag				0.0009 p=0.6447
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table 6: Two Way Fixed Effect Regression of the Unemployment Rate Against Dif				
	Equation 11	Equation 12	Equation 13	Equation 14
Dif 0 year lag	0.0056 p=0.0077 **			
Dif 1 year lag		0.0051 p=0.0118 *		
Dif 2 year lag			0.0039 p=0.0487 *	
Dif 3 year lag				0.00311 p=0.1017
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

In order to test hypothesis 4, I used a government primary budget deficit[6] as a measure of fiscal policy. I employed fixed effect and two way fixed effect regressions. I wanted to test whether Dif predicted the stance of fiscal policy with a lag of 0 years, 1 years, 2 years or 3 years. The reason I did this is that I was unsure how long the fiscal-financing channel took to work. If an exogenous shock to monetary policy caused fiscal policy to tighten in the next year, I might miss it by regressing the stance of fiscal policy against the contemporaneous value of that exogenous shock. The equations used to test hypothesis 4, equations 15 through 18, are shown on the next page. The results of the fixed effect regressions of equations 15 through 18 are shown in table 7, on the next page. The results of the two way fixed effect regressions of equations 15 through 18 are shown in table 8, on the page after the next page. The effect of Dif on the stance

[6] A primary budget surplus is like a country's surplus, but it accounts out for the effects of interest costs. A budget surplus is equal to all revenue minus all non-interest expense minus all interest expense and a primary budget surplus is just revenue minus non-interest expense. I chose the primary surplus over the regular budget surplus as my measure of the stance of fiscal policy because I wanted to exclude a big and variable component of a budget with a presumably low fiscal multiplier that fiscal authorities have no direct control over (the interest expense). Additionally, interest payments on the debt do not reflect the true inflation-adjusted borrowing cost of national debt.

of fiscal policy seems significant without any lag. Additionally, it appears to be most significant without any lag.

15) $PrimaryDeficit_{i,t} = \beta_0 + \beta_1 Dif_{i,t} + u_{i,t}$

16) $PrimaryDeficit_{i,t} = \beta_0 + \beta_1 Dif_{i,t-1} + u_{i,t}$

17) $PrimaryDeficit_{i,t} = \beta_0 + \beta_1 Dif_{i,t-2} + u_{i,t}$

18) $PrimaryDeficit_{i,t} = \beta_0 + \beta_1 Dif_{i,t-3} + u_{i,t}$

19)

Table 7: Fixed Effect Regression of the Primary Budget Surplus Against Dif

	Equation 15	Equation 16	Equation 17	Equation 18
Dif 0 year lag	-0.0085 p=0.0010 **			
Dif 1 year lag		-0.0075 p=0.0044 **		
Dif 2 year lag			-0.0083 p=0.0022 **	
Dif 3 year lag				-0.0075 p=0.0075 **
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table 8: Two Way Fixed Effect Regression of the Primary Budget Surplus Against Dif				
	Equation 15	Equation 16	Equation 17	Equation 18
Dif 0 year lag	-0.0066 p=0.0031 **			
Dif 1 year lag		-0.0046 p=0.0041 **		
Dif 2 year lag			-0.0042 p=0.0727	
Dif 3 year lag				-0.0025 p=0.2934
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

While it is odd that monetary policy appears to impact the unemployment rate and stance of fiscal policy without any lag, the results of this subsection provide significant support for hypothesis 3 and hypothesis 4.

After finding strong evidence in support of hypothesis 1 and reasonably strong evidence in support of hypothesis 3 and 4, I ran two instrumental variable regressions to measure the impacts of the real policy rate on the contemporaneous unemployment rate and primary deficit. I used Dif as the instrument (the variable meant to capture the exogenous component of the variance of the real policy rate). A full explanation of my thinking in setting up the instrumental regressions can be found in the appendix section (pages 41-43). I estimated that a 1% increase in the real policy rate leads to an increase in the unemployment rate by 0.75% (p=0.0253) and a decrease in the primary deficit by 1.07% (p=0.0442).

6. Conclusion

This paper finds significant evidence that a difference in political affiliation between the central bank chief and head of government leads to tighter monetary policy. Unexpectedly, there is no evidence that this effect is more pronounced prior to an election. Additionally, this paper finds that a political disagreement between the central bank chief and head of government is also associated with higher unemployment rates and tighter fiscal policy, which are the effects of tighter monetary policy that one would anticipate from economic literature. This can be interpreted as evidence in favor of the initial finding - further proof that monetary policy really does get tighter when the central bank chief and head of government hold different political affiliations.

The direct policy implications of this paper is that the political beliefs of the central bank chiefs affect the stance of monetary policy. Hence, central bank chiefs may be political actors who deliberately engage in politically motivated monetary policy. Essentially, this paper presents evidence against the notion that independent central banks are less political. It may suggest that more public oversight is needed for central banks because central bank chiefs make political decisions.

Furthermore, this paper had a clear implication for future research. A lot of the economic literature aimed at estimating the effects of macroeconomic policy relies on regressions which include only endogenous variables. The problem with regressing endogenous variables against each other is they create biased estimates. This paper identifies an exogenous shock which may be put to use estimating the effects of monetary policy on macroeconomic variables.

References

Abrams, B. A., & Butkiweicz, J. L. (2012). The Political Business Cycle: New evidence from the nixon tapes. *Journal of Money, Credit and Banking*, 44(2-3), 385–399. https://doi.org/10.1111/j.1538-4616.2011.00492.x

Alesina, A. (1987). Macroeconomic policy in a two-party system as a repeated game. *The Quarterly Journal of Economics*, 102(3), 651. https://doi.org/10.2307/1884222

Alesina, A., & Gatti, R. (1995). Independent Central Banks: Low Inflation at No Cost? The *American Economic Review*, 85(2), 196–200. http://www.jstor.org/stable/2117918

Alesina, A., & Summers, L. H. (1993). Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence. Journal of Money, Credit and Banking, 25(2), 151–162. https://doi.org/10.2307/2077833

Alpanda, S., &; Honig, A. (2009). The impact of central bank independence on political monetary cycles in advanced and developing nations. Journal of Money, Credit and Banking, 41(7), 1365–1389. https://doi.org/10.1111/j.1538-4616.2009.00260.x

Alpanda, S., &; Honig, A. (2010). Political monetary cycles and a de facto ranking of central bank independence. Journal of International Money and Finance, 29(6), 1003–1023. https://doi.org/10.1016/j.jimonfin.2010.02.001

Ana Carolina Garriga (2016) Central Bank Independence in the World: A New Data Set, International Interactions, 42:5, 849-868, DOI: 10.1080/03050629.2016.1188813

Argentine National Electoral Directorate. (2023, April 26). *Resultados Electorales*. Argentina.gob.ar. https://www.argentina.gob.ar/interior/dine/resultadosyestadisticas

Balke, N. S., & Emery, K. M. (1994). Understanding the Price Puzzle. Dallas Fed. https://doi.org/https://www.dallasfed.org/~/media/documents/research/er/1994/er9404b.pdf

Balogh, E. S. (2021, November 19). György Surányi Raises the Alarm on Inflation in Hungary. *HungarianSpectrum.org*. Retrieved May 28, 2023, from https://hungarianspectrum.org/2021/11/19/gyorgy-suranyi-raises-the-alarm-on-inflation-in-hungary/.

Banca Naţională a României. (2019, October). *Guvernatorii BNR*. bnr.ro. https://www.bnr.ro/Guvernatorii-BNR--1060.aspx

Banco Central de Chile. (2016). *Nómina de Autoridades del Banco Central de Chile Desde Su Fundación*. BCentral.cl. https://www.bcentral.cl/documents/33528/42247/HistoricoAutoridades02042019.pdf

Banco Central de la República Argentina. (n.d.). *Authorities*. Banco Central de la República Argentina. https://www.bcra.gob.ar/Institucional/Autoridades_Detalle_i.asp?Nombre=Miguel+%C1ngel+Pesce

Banco Central de la República Argentina. (2018b, December 9). *Former Governors' Terms*. Banco Central de la República Argentina. https://www.bcra.gob.ar/Institucional/Presidentes_Anteriores_i.asp

Banco Central do Brasil. (2016, August 6). *Galeria de ex-Presidentes do Banco Central do Brasil*. Banco Central do Brasil. https://www.bcb.gov.br/acessoinformacao/legado?url=https%3A%2F%2Fwww.bcb.gov.br%2Fpre%2FGaleriadosPresidentes%2Fdefault-p.asp

Banco Central do Brasil. (2019, February 28). *Roberto Campos Neto*. Banco Central do Brasil. https://www.bcb.gov.br/en/about/orgchart?modalAberto=Presi_BC

Banco de la República Colombia. (2021, January 4). *¿Quiénes Han sido los gerentes del banco?*. BanRep.gov.co. https://www.banrep.gov.co/es/preguntas-frecuentes/quienes-han-sido-gerentes-del-banco

Bangko Sentral ng Pilipinas. (2022, June 30). *Governance of the Bank - the Governor*. bsp.gov.ph. https://www.bsp.gov.ph/Pages/AboutTheBank/WhoWeAre/OrganizationAndGovernance/TheGovernor/PastGovernors.aspx

Bank of Canada. (2020). *Our History*. Bank of Canada. https://www.bankofcanada.ca/about/our-history/

Bank of England. (2023, January 31). *Governors*. BankofEngland.co.UK. https://www.bankofengland.co.uk/about/people/governors

Bank of Indonesia. (2018). *Board of Governor Profile: Perry Warjiyo*. bi.go.id. https://www.bi.go.id/en/tentang-bi/profil/details.aspx?id=33

Bank of Israel. (2018, December). *About the Bank of Israel*. https://www.boi.org.il/en/bank-of-israel/about-the-bank-of-israel/

Bank of Japan. (2023, April 9). *List of Governors*. BoJ.or.Jp. https://www.boj.or.jp/en/about/outline/history/pre_gov/index.htm

Bank of Korea. (2022, March 31). *Former Governors*. bok.or.kr. https://www.bok.or.kr/eng/main/contents.do?menuNo=400240

Bank of Thailand. (2023, April 10). *List of Governors of the Bank of Thailand*. bot.or.th. https://www.bot.or.th/English/AboutBOT/RolesAndHistory/Governor/Pages/default.aspx

Banxico. (2015, September 23). *Miguel Mancera*. Banxico.org.Mx. http://www.banxico.org.mx/publicaciones-y-discursos/publicaciones/seminarios/banco-de-mexico_-independencia-de-los-bancos-centr/%7B2F41CA09-8780-8A5A-5463-9231579E8041%7D.pdf

Bernanke, B. S., Gertler, M., Watson, M., Sims, C. A., & Friedman, B. M. (1997). Systematic Monetary Policy and the Effects of Oil Price Shocks. Brookings Papers on Economic Activity, 1997(1), 91–157. https://doi.org/10.2307/2534702

Bernanke, B. S., &; Mihov, I. (1998). The liquidity effect and long-run neutrality. Carnegie-Rochester Conference Series on Public Policy, 49, 149–194. https://doi.org/10.3386/w6608

Blundell, Richard & Bond, Stephen, 1998. "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics*, Elsevier, vol. 87(1), pages 115-143, August.

Board of Governors of the Federal Reserve System. (2023, February 21). *Board of Governors Members, 1914-Present*. Board of governors of the Federal Reserve System. https://www.federalreserve.gov/aboutthefed/bios/board/boardmembership.htm

Bogov, D., Goshev, P., Trpeski, L., & Stanoevski, B. (2018). *Speeches: Previous Governors*. nbrm.mk. https://www.nbrm.mk/ghovori-en-ns_article-speeches-previous-governors-content.nspx

Budapest Business Journal. (2007, March 2). Zsigmond járai, government critic, exits hungary's central bank - extended. *Budapest Business Journal*. Retrieved May 28, 2023, from https://bbj.hu/business/people/interview/zsigmond-jarai-government-critic-exits-hungary-s-central-bank-extended7017.

Central Bank of Iceland. (2009, June 26). Már Guðmundsson appointed Governor of the Central Bank of Iceland. Cb.Is. Retrieved May 28, 2023, from https://www.cb.is/publications/news/news/2009/06/26/M%C3%A1r-Gu%C3%B0mundsson-appointed-Governor-of-the-Central-Bank-of-Iceland/.

Central Bank of the Republic of Turkey. (2021). *Governors of the CBRT*. tcmb.gov.tr. https://tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/About+the+Bank/History/Governors

Central Intelligence Agency. (2023). *CIA World Factbook*. Central Intelligence Agency. https://www.cia.gov/the-world-factbook/

Central Reserve Bank of Peru. (2022, April 21). *Julio Velarde Flores*. gob.pe. https://www.gob.pe/institucion/banco-central-de-reserva-del-peru/funcionarios/26766-julio-velarde-flores

Chilean Government. (2022). *Ministry of Finance*. Gob.cl. https://www.gob.cl/en/ministries/ministry-of-finance/

Christiano, L. J., Eichenbaum, M., & Evans, C. (2001). Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy. National Bureau of Economics Working Papers, (8403). https://doi.org/10.3386/w8403

Conti-Brown, P. (2022, March 9). What happens if Trump tries to fire fed chair Jerome Powell? *Brookings*. Retrieved March 24, 2023, from https://www.brookings.edu/blog/up-front/2019/09/09/what-happens-if-trump-tries-to-fire-fed-chair-jerome-powell/

Cornell University. 12 (2023). US Federal Reserve Act. Accessed at the link: https://www.law.cornell.edu/uscode/text/12/chapter-3

Croatian National Bank. (2020, July 7). *Former governors*. HNB.hr. https://www.hnb.hr/en/o-nama/funkcije-i-struktura/savjet-i-rukovodstvo/former-governors

Croissant Y, Millo G (2008). "Panel Data Econometrics in R: The plm Package." *Journal of Statistical Software*, **27**(2), 1–43. doi:10.18637/jss.v027.i02.

Cukierman, A., Webb, S. B., & Neyapti, B. (1992). Measuring the independence of central banks and its effect on policy outcomes. *The World Bank Economic Review*, 6(3), 353–398. https://doi.org/10.1093/wber/6.3.353

Czech National Bank. (2019, March 6). *List of Representatives of the CNB and its Legal Predecessors*. CNB.cz. https://www.cnb.cz/cs/o_cnb/archiv-cnb/prehled-predstavitelu-cnb/

Danmarks Nationalbank. (2013). *List of Governors in Period From 1907*. nationalbanken.dk. https://www.nationalbanken.dk/en/publications/Documents/2021/03/2021-03-12%20DN__Annual%20Report__2020__Final-2100178_(1).pdf

De Haan, J., Leertouwer, E., Meijer, E. and Wansbeek, T. (2003), Measuring central bank independence: a latent variables approach. *Scottish Journal of Political Economy*, 50: 326-340. https://doi.org/10.1111/1467-9485.5003005

Dentler, A. (2019). Did the Fed raise interest rates before elections? *Public Choice*, 181(3-4), 239–273. https://doi.org/10.1007/s11127-019-00653-z

Drazen, A. (2000). The political business cycle after 25 years. *NBER Macroeconomics Annual*, *15*, 75–117. https://doi.org/10.1086/654407

Dvorsky, Sandra, Measuring Central Bank Independence in Selected Transition Countries and the Disinflation Process (December 12, 2000). BOFIT Discussion Paper No. 13/2000, Available at SSRN: https://ssrn.com/abstract=1016043 or http://dx.doi.org/10.2139/ssrn.1016043

Dye, J. (2017, November 29). Diaz de Leon Picked to Head Mexico's Central Bank. *FT.com*. Retrieved May 28, 2023, from https://www.ft.com/content/34544304-1a10-367b-af4a-394481e501b9.

Eichengreen, B., &; Garber, P. (1990). Before the Accord: U.S. monetary-financial policy 1945-51. *National Bureau of Economic Research*, 3380. https://doi.org/10.3386/w3380

Eichengreen, B., & Sachs, J. (1985). Exchange Rates and Economic Recovery in the 1930s. *The Journal of Economic History*, 45(4), 925-946. doi:10.1017/S0022050700035178

Electoral Commission of South Africa. (2019). *National and Provincial Election Results*. results.elections.org.za. https://results.elections.org.za/home/downloads/npe-results

European Central Bank. (2019, April 9). *Agustín Guillermo Carstens*. ecb.europa.eu. https://www.ecb.europa.eu/pub/conferences/ecbforum/previous_fora/2014/html/biographies/carstens.en.html

Federal Reserve. (n.d.). The New York Fed DSGE model. NewYorkFed.org. https://www.newyorkfed.org/research/policy/dsge#/overview

Federal Reserve. (2023, April 3). *Board of Governors Members, 1914-Present*. Board of governors of the Federal Reserve System. Retrieved April 3, 2023, from https://www.federalreserve.gov/aboutthefed/bios/board/boardmembership.htm

Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015), "The Next Generation of the Penn World Table" *American Economic Review*, 105(10), 3150-3182, available for download at www.ggdc.net/pwt

Former Prime Minister Davíð Oddsson retires from politics. (2005, September 7). Iceland Review. Retrieved May 28, 2023, from https://www.icelandreview.com/news/former-prime-minister-davio-oddsson-retires-politics/.

Gabriel Mangano, Measuring central bank independence: a tale of subjectivity and of its consequences, *Oxford Economic Papers*, Volume 50, Issue 3, July 1998, Pages 468–492, https://doi.org/10.1093/oxfordjournals.oep.a028657

Government of Iceland. (2009, February 27). Kristin Halvorsen congratulates Svein Øygard. Regjeringen.No. Retrieved May 28, 2023, from https://www.regjeringen.no/no/dokumentarkiv/stoltenberg-ii/fin/Nyheter-og-pressemeldinger/nyheter/2009/kristin-halvorsen-gratulerer-svein-oygar/id547406/.

Grant, J. (2013, May 21). Indonesia approves DBS acquisition of 40% of Bank Danamon. *FT.Com*. Retrieved May 28, 2023, from https://www.ft.com/content/3f8296c2-c21b-11e2-ab66-00144feab7de.

Guy Debelle & Stanley Fischer, 1994. "How independent should a central bank be?," Conference Series ; [Proceedings], Federal Reserve Bank of Boston, vol. 38, pages 195-225.

Hanson, M. S. (2004). The "Price puzzle" reconsidered. Journal of Monetary Economics, 51(7), 1385–1413. https://doi.org/10.1016/j.jmoneco.2003.12.006

Herre, Bastian. 2021. Identifying Ideologues: A Global Dataset on Political Leaders, 1945-2020. Working Paper.

Herre, B. (2023). Identifying Ideologues: A Global Dataset on Political Leaders, 1945–2020. *British Journal of Political Science*, 53(2), 740-748. doi:10.1017/S0007123422000217

Iceland Monitor. (2019, July 25). Ásgeir Jónsson appointed governor of central bank. IcelandMonitor.Mbl.Is. Retrieved May 28, 2023, from https://icelandmonitor.mbl.is/news/news/2019/07/25/asgeir_jonsson_appointed_governor_of_central_bank/ .

Indonesian Election Commission. (2019). *Elections in History*. kpu.go.id. https://www.kpu.go.id/page/read/12/pemilu-dalam-sejarah

International Monetary Fund. (2021, September 13). IMF Managing Director Appoints Ilan Goldfajn as Director of the Western Hemisphere Department. *IMF.org*. Retrieved May 28, 2023, from https://www.imf.org/en/News/Articles/2021/09/13/pr21260-imf-md-appoints-ilan-goldfajn-as-director-of-the-western-hemisphere-department.

International Monetary Fund. (2023, April). *Fiscal Monitor*. International Monetary Fund. https://www.imf.org/external/datamapper/datasets/FM

International Parliamentary Union. (2023). *Parliamentary elections*. International Parliamentary Union. https://data.ipu.org/elections

Jónsson, Á. (2023, March 30). *Governor Ásgeir Jónsson's Speech at the Annual Meeting of the Bank*. cb.is. https://www.cb.is/publications/news/news/2023/03/30/Governor-Asgeir-Jonssons-speech-at-the-Annual-Meeting-of-the-Bank/

Kh, T. D. I. (2023, February 9). Profile of Agus Martowardojo, New Commissioner of Goto and ex-Governor of BI. *Fortuneidn.Com*. Retrieved May 28, 2023, from https://www.fortuneidn.com/business/tanayastri/profil-agus-martowardojo-komisaris-baru-goto-dan-eks-gubernur-bi.

Krugman, P. (2000). Thinking about the liquidity trap. *Journal of the Japanese and International Economies*, 14(4), 221–237. https://doi.org/10.1006/jjie.2000.0458

La Republica. (2021, August 6). Óscar Dancourt Masías is Appointed as Cabinet Advisor in the MEF. *Larepublica.Pe*. Retrieved May 28, 2023, from https://larepublica.pe/economia/2021/08/06/oscar-dancourt-masias-es-designado-como-asesor-de-gabinete-en-el-mef.

Leeper, E. M. (1991). Equilibria under 'active' and 'passive' monetary and fiscal policies. Journal of Monetary Economics, 27(1), 129–147. https://doi.org/10.1016/0304-3932(91)90007-b

Magyar National Bank. (2015). *Curriculum Vitae of György Matolcsy*. MNB.hu. https://www.mnb.hu/en/the-central-bank/management-and-control-of-the-mnb/management-of-mnb/curriculum-vitae-of-gyorgy-matolcsy

Manuel Arellano, Stephen Bond, Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, *The Review of Economic Studies*, Volume 58, Issue 2, April 1991, Pages 277–297, https://doi.org/10.2307/2297968

Merrick, J. J., & Saunders, A. (1986). International expected real interest rates: New tests of the parity hypothesis and U.S. fiscal policy effects. Journal of Monetary Economics, 18(3), 313–322. https://doi.org/10.1016/0304-3932(86)90043-7

Millo G (2017). "Robust Standard Error Estimators for Panel Models: A Unifying Approach." *Journal of Statistical Software*, 82(3), 1–27. doi:10.18637/jss.v082.i03.

Murray, C. (2021, December 27). Mexico's outgoing central bank governor calls to protect its independence. FT.com. Retrieved May 28, 2023, from https://www.ft.com/content/6fedba11-25ca-4db5-92dd-73bd82633dae.

Narodowy Bank Polski. (2022, June 22). *Presidents of the National Bank of Poland since 1945*. nbp.pl. https://nbp.pl/o-nbp/prezes-nbp/poczet-prezesow-narodowego-banku-polskiego-od-1945-r/

National Bank of Serbia. (2012, August 6). *Governors*. nbs.rs. https://nbs.rs/en/o_nbs/istorijat-NBS/guverneri/index.html

National Bank of the Republic of North Macedonia. (2018). *Governor*. nbrm.mk. https://www.nbrm.mk/guverner-en.nspx

National Election Commission of South Korea. (2020, April 15). *Election Calendar*. nec.go.kr. https://www.nec.go.kr/site/eng/02/10203000000002020070611.jsp

Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica*, 49(6), 1417–1426. https://doi.org/10.2307/1911408

Nordhaus, W. D. (1975). The political business cycle. *The Review of Economic Studies*, 42(2), 169. https://doi.org/10.2307/2296528

Norges Bank. (2022, April 1). *Governors of Norges Bank*. Norges-Bank.no. https://www.norges-bank.no/en/topics/about/history/Chairs-of-Norges-Banks-Executive-Board-/

OECD (2023), Unemployment rate (indicator). doi: 10.1787/52570002-en (Accessed on 28 May 2023)

Oficina Nacional de Procesos Electorales. (2023, February 26). *Histórico de Elecciones*. onpe.gob.pe. https://www.onpe.gob.pe/elecciones/

Ortiz, G. (2013, December 18). *Interview with Guillermo Ortiz*. SoM.Yale.edu. https://som.yale.edu/blog/interview-with-guillermo-ortiz

Profit Line. (2012, July 5). Ferenc bartha dies. *Profitline.Hu*. Retrieved May 28, 2023, from https://profitline.hu/Elhunyt-Bartha-Ferenc-287080.

Reserve Bank of Australia. (2023, March 20). *Past & Present Governors*. Reserve Bank of Australia. https://www.rba.gov.au/about-rba/history/governors/of

Reserve Bank of India. (2018, December 12). *Past Governors*. rbi-ind.org. https://www.rbi-ind.org/Scripts/AboutUsDisplayfc49.html?pg=PastGovernors.htm#1

Reserve Bank of New Zealand. (2022, December 2). *Chronology of Reserve Bank Governors*. rbnz.govt.nz. https://www.rbnz.govt.nz/education/our-history/chronology-of-reserve-bank-governors

Riksbanken. (2023, January 1). *Former Governors of the Riksbank*. riksbank.se. https://www.riksbank.se/en-gb/about-the-riksbank/history/former-governors-of-the-riksbank/

Servicio Electoral de Chile. (2022, December 29). *Resultados Electorales históricos*. Servicio Electoral de Chile. https://www.servel.cl/centro-de-datos/resultados-electorales-historicos-gw3/

Sims, C. A. (1992). 'interpreting the macroeconomic time series facts: The effects of monetary policy.' European Economic Review, 36(5), 975–1000. https://doi.org/https://doi.org/10.1016/0014-2921(92)90041-T.

Smets, Frank, and Rafael Wouters. 2007. "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach." American Economic Review, 97 (3): 586-606. DOI: 10.1257/aer.97.3.586

South African Reserve Bank. (2020, September 21). *Previous Governors*. resbank.co.za. https://www.resbank.co.za/AboutUs/History/PreviousGovernors/Pages/PreviousGovernors-Home.aspx

South African Reserve Bank. (2021, January 17). *Mr. Lesetja Kganyago*. resbank.co.za. https://www.resbank.co.za/en/home/about-us/mr-lesetja-kganyago-biography

Strong, C. (2023). What type of central banker dampens the political business cycle? The case of Africa. *International Journal of Finance & Economics*, 1– 27. https://doi.org/10.1002/ijfe.2769

Swiss Government. (2020, December 11). *History of the federal presidency*. Federal presidents and Swiss history. https://www.admin.ch/gov/en/start/federal-presidency/history-federal-presidency.html

The Bank for International Settlements. (2023a, May 17). *US Dollar Exchange Rates*. The Bank for International Settlements. https://www.bis.org/statistics/xrusd.htm?m=2675

The Bank for International Settlements. (2023b, May 25). *Central Bank Policy Rates*. The Bank for International Settlements. https://www.bis.org/statistics/cbpol.htm

The Bank for International Settlements. (2023c, May 25). *Consumer Prices*. The Bank for International Settlements. https://www.bis.org/statistics/cp.htm?m=2678

The Constitution of the Republic of Poland (1997). https://trybunal.gov.pl/en/about-the-tribunal/legal-basis/the-constitution-of-the-republic-of-poland

Tribunal Superior Eleitoral. (2022). *Cronologia das Eleições*. Justiça Eleitoral. https://www.tse.jus.br/eleicoes/historia/cronologia-das-eleicoes

Wagstyl, S. (2013, March 27). Hungary: simor finds a safe haven. FT.Com. Retrieved May 28, 2023, from https://www.ft.com/content/60a07647-5c36-3012-9739-4ac5fffafd5c.

Wayback Machine. (2023, May 28). Wayback Machine. http://web.archive.org/

White, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica*, 48(4), 817–838. https://doi.org/10.2307/1912934

Who is Miguel Ángel Pesce, the new head of the Central Bank? (2019, December 1). *Ámbito*. Retrieved May 28, 2023, from

https://www.ambito.com/economia/miguel-angel-pesce/quien-es-el-nuevo-titular-del-banco-central-n5069692.

Appendix

a. Justification for the Use of Ex-Post Real Interest Rates

Ex-post real interest rates represent the real cost of borrowing after accounting for the level of inflation in hindsight. They stand in contrast to ex-ante real interest rates which account for the level of anticipated inflation when people make the decision of whether to borrow or lend. To measure the stance of monetary policy, I chose to use ex-post real central bank policy interest rates. This section justifies why I did not choose either ex-ante real or nominal central bank policy interest rates.

Why not nominal central bank policy interest rates?

Oftentimes the choice between nominal central bank policy interest rates and ex-post real central bank policy interest rates may not affect the research-relevant outcomes of a regression. As long as the inflation rate is included as a dependent variable in the regression, there should be no impact on the parameter estimates of other regressors (using simple OLS estimation). So, while I will argue that ex-post central bank policy rates are preferable to nominal central bank policy rates, it will not always make any difference (and does not make a difference in some of my regressions).

The same central bank policy interest rates can create different incentives depending on what the inflation rate is and give out a different signal. If the nominal policy rate is 10%, but the inflation rate is 100%, it could signal to the markets that the central bank is not serious about fighting inflation. If that state of affairs is expected to remain over an extended period of time, it incentives people to borrow money, knowing that their debts will be inflated away faster than they accrue with interest. The opposite could be said if the policy rate is 10% but the inflation rate is only 3%.

Why not ex-ante central bank policy interest rates?

The choice to use an ex-post real policy rate may come under criticism from people who argue that an ex-ante policy rate is more influential on economic decisions. However, the central bank policy rate covers borrowing costs for an overnight loan. The expected inflation rate and actual inflation rate for a 24 hour period are not likely to be substantially different. Furthermore the data I use in this study is annual averages of the overnight borrowing cost. We can expect that

market participants would not miss-estimate the inflation rate consistently to the upside or downside over the course of a year. This is because market participants constantly receive new information (commodity prices, CPI reports, etc…) which allows them to figure out whether they had miss-estimated inflation recently and correct their assumptions. Presumably the typical market participant who makes overnight loans, is heavily involved in financial markets and needs to update their financial and economic assumptions frequently as part of their job. Additionally, the practice of using ex-post real policy rates as a measure of monetary policy is used in the literature (Alesina & Summers, 1993; Merrick & Saunders, 1986). Furthermore, the current central bank policy rate (real or nominal) is not directly influential in decisions which impact variables like the GDP, unemployment rate or inflation rate. Instead, expectations of future central bank policy rates (covering periods of years) are highly relevant. This is because very few investments are likely to only need 1 day of financing and the currency market is unlikely to be heavily influenced if borrowing costs are 1% per year higher in a country for only one day. In terms of influencing expectations of the future, it is not clear whether ex-ante or ex-post central bank policy rates are more important.

b. Explanation of Assumptions for Identifying Dates

For the purpose of coding heads of government election and central bank switches certain decisions were made. Firstly, the first date that votes for the head of government election start getting collected by the government marks the date of the election. Hence, if votes are collected over a range of dates from December 25th 1998 to January 1st 1999, the election will be coded as having occurred in the year 1998. Secondly, if a central bank chief leaves office one year and his position is replaced the next year the change in office is coded as having taken place in the earlier year.[7] Thirdly, any acting central bank chief or temporary central bank chief is treated as if they are the equivalent of a full central bank chief. When they leave their job this gets counted as a switch in the central bank chief. Fourthly, in the case of Hungary, the first central bank chief who was in charge at the beginning of years in the dataset was originally appointed in 1990, left his position in 1991 and only returned in 1995. I coded him as being appointed in 1990 (meaning

[7] This fits well with my assumption - laid out in subsection b - that the central bank chief has the same political affiliation as that of the head of government at the end of year, this seems like a good way to code things. If a central bank chief leaves his position right before the start of a year and a new one takes his place right after, the new one is coded as having the political affiliation as the government in charge precisely during the start of the year.

that I assumed his political ideology was that of who was in charge when he was initially appointed). My dataset does not include data for Hungary during the period of time between 1991 through 1995, between the central bank chief's first and second period of service. Fifthly, I define a head of government election as being only either a Presidential election if a country has a President as the head of government (as identified by Herre, 2021) or an election for a unicameral or lower house of parliament if the country has a Prime Minister as a head of government (meaning Herre, 2021 identifies the head of government as "Prime Minister" or "Chairman of the Council of Ministers"[8]). This fifth assumption covers every country in my dataset.

c. Instrumental Variable Regressions

The empirical analysis section finds a higher Dif (a dummy for if the head of government and central bank chief have different political affiliations) is associated with tighter monetary policy. I assume this represents an exogenous shock to monetary policy. If it does represent an exogenous shock to monetary policy, I can calculate the effect of monetary policy on other variables using Dif as an instrumental variable. The purpose of this subsection is to show the equations I use to build an instrumental variable regression and the results I get.

Equations A1 and A2 on the next page show the equations I want to estimate. They show both the unemployment rate ($U_{i,t}$) and primary deficit ($PrimaryDeficit_{i,t}$) as a result of a country-specific effect ($a_i^{Unemployment}$ and $a_i^{PrimaryDeficit}$), a time-specific effect ($\lambda_t^{Unemployment}$ and $\lambda_t^{PrimaryDeficit}$), the effects of the real policy rate[9] ($R_{i,t}$) and an error term which has a distinct value for each data point ($\epsilon_{i,t}^{Unemployment}$ and $\epsilon_{i,t}^{PrimaryDeficit}$). The effects of the real interest rate on the dependent variable in equations A1 and A2 seem like they could be estimated with a two way

[8] Herre, 2021 only identifies one country as having "Chairman of the Council of Ministers" as their head of government and, according to the Polish constitution, this person is just a Prime Minister.
[9] The real policy rate is assumed to impact both the unemployment rate and the primary deficit without a lag. Thi is because when testing for the effects of Dif (the instrument for the real policy rate) on both unemployment and fiscal policy, I found the effect to be most significant without a lag.

fixed effect regression.[10] However, equations A3 and A4 show that this would pose an endogeneity problem (the error terms correlate with the explanatory variable).

A1) $U_{i,t} = a_i^{Unemployment} + \lambda_t^{Unemployment} + \beta_1^{Unemployment} R_{i,t} + \epsilon_{i,t}^{Unemployment}$

A2) $PrimaryDeficit_{i,t} = a_i^{PrimaryDeficit} + \lambda_t^{PrimaryDeficit} + \beta_1^{PrimaryDeficit} R_{i,t} + \epsilon_{i,t}^{PrimaryDeficit}$

A3) $Cov(\epsilon_{i,t}^{Unemployment}, R_{i,t}) \neq 0$

A4) $Cov(\epsilon_{i,t}^{PrimaryDeficit}, R_{i,t}) \neq 0$

To solve this problem, I rely on Dif which is meant to represent an exogenous shock to monetary policy. I assume it has a non-zero correlation with the error terms from equation A1 and equation A2 (equations A5 and A6). But, I also assume it helps to determine the real policy rate (A7) and that effect can be calculated using simple OLS methods (A8).

A5) $Cov(\epsilon_{i,t}^{Unemployment}, Dif_{i,t}) \neq 0$

A6) $Cov(\epsilon_{i,t}^{PrimaryDeficit}, Dif_{i,t}) \neq 0$

A7) $R_{i,t} = a_i^{PolicyRate} + \lambda_t^{PolicyRate} + \beta_1^{PolicyRate} Dif_{i,t} + \epsilon_{i,t}^{PolicyRate}$

A8) $Cov(\epsilon_{i,t}^{PolicyRate}, Dif_{i,t}) \neq 0$

With these assumptions, I can then set up an instrumental variable regression to estimate the effects of the real policy rate on the unemployment rate and the primary deficit. The two-stage instrumental variable regressions assume that the dependent variable (unemployment or primary deficit) is determined by a dummy for each country, a dummy term for each year (except 1 year to avoid collinearity issues) and the real policy rate. It assumed that all year and country dummies were exogenous variables, as was dif, but that the real policy rate was endogenous. With these regressions, I estimate that a 1% hike in the real policy rate leads to an

[10] A two way fixed effect regression of one variable against another is computationally equivalent to adding dummy variables for time and country as control variables. Hence the effects of the time-specific and country-specific effects could be taken out.

increase in the unemployment rate by 0.75% (p=0.0253) and a decrease in the primary deficit by 1.07% (p=0.0442).

Table A1 (Part 1 of 4): Sources Used to Identify When a Country Had a Head of Government Election or Switch in Their Central Bank Chief		
Country	Sources for CB Chief Switch	Sources for Elections
Argentina	Domestic Government (Former Governors' Terms 2018; Authorities); News Stories (Who is Miguel Ángel Pesce, the new head of the Central Bank? 2019)	Domestic Government (Resultados Electorales 2023)
Australia	Domestic Government (Past & Present Governors 2023)	International Parliamentary Union (Parliamentary elections 2023)
Brazil	Domestic Government (Galeria de ex-Presidentes do Banco Central do Brasil; 2016, Roberto Campos Neto 2019); International Monetary Fund (IMF Managing Director Appoints Ilan Goldfajn as Director of the Western Hemisphere Department 2021)	Domestic Government (Cronologia das Eleições 2022)
Canada	Domestic Government (Our History 2020)	International Parliamentary Union (Parliamentary elections 2023)
Chile	Domestic Government (Nómina de Autoridades del Banco Central de Chile Desde Su Fundación 2016; Ministry of Finance 2022)	Domestic Government (Resultados Electorales históricos, 2022)
Colombia	Domestic Government (¿Quiénes Han sido los gerentes del banco? 2021)	(CIA World Factbook 2023)
Croatia	Domestic Government (Former Governors 2020)	International Parliamentary Union (Parliamentary elections 2023)
Czechia	Domestic Government (List of Representatives of the CNB and its Legal Predecessors 2019) via WayBack Machine (2023)	International Parliamentary Union (Parliamentary elections 2023)

Table A1 (Part 2 of 4): Sources Used to Identify When a Country Had a Head of Government Election or Switch in Their Central Bank Chief		
Country	Sources for CB Chief Switch	Sources for Elections
Denmark	Domestic Government (List of Governors in Period From 1907 2013)	International Parliamentary Union (Parliamentary elections 2023)
Hungary	News Stories (Ferenc Bartha Dies 2012; Balogh, 2021; Zsigmond Járai, government critic, exits Hungary's Central Bank - extended 2007; Wagstyl, 2013; Ásgeir Jónsson Appointed Governor of Central Bank 2019); Domestic Government (Curriculum Vitae of György Matolcsy, 2015)	International Parliamentary Union (Parliamentary elections 2023)
Iceland	News Stories (Former Prime Minister Davíð Oddsson retires from politics 2005); Domestic Government (Kristin Halvorsen congratulates Svein Øygard 2009; Már Guðmundsson appointed Governor of the Central Bank of Iceland 2009; Jónsson, 2023)	International Parliamentary Union (Parliamentary elections 2023)
India	Domestic Government (Past Governors 2018)	International Parliamentary Union (Parliamentary elections 2023)
Indonesia	News Stories (Grant, 2013; Kh 2023); Domestic Government (Board of Governor Profile: Perry Warjiyo 2018)	Domestic Government (Elections in History 2019)
Israel	Domestic Government (About the Bank of Israel 2018)	International Parliamentary Union (Parliamentary elections 2023)

Table A1 (Part 3 of 4): Sources Used to Identify When a Country Had a Head of Government Election or Switch in Their Central Bank Chief		
Country	Sources for CB Chief Switch	Sources for Elections
Japan	Domestic Government (List of Governors 2023)	International Parliamentary Union (Parliamentary elections 2023)
Mexico	Domestic Government (Miguel Mancera 2015) via Wayback Machine (2023); An Interview at Yale University (Ortiz, 2013); ECB (Agustín Guillermo Carstens 2019); Newspapers (Dye, 2017; Murray, 2021)	(CIA World Factbook 2023)
New Zealand	Domestic Government (Chronology of Reserve Bank Governors, 2022)	International Parliamentary Union (Parliamentary elections 2023)
North Macedonia	Domestic Government (Bogov et al., 2018; Governor 2018)	International Parliamentary Union (Parliamentary elections 2023)
Norway	Domestic Government (Governors of Norges Bank 2022)	International Parliamentary Union (Parliamentary elections 2023)
Peru	NewsPapers (Óscar Dancourt Masías is Appointed as Cabinet Advisor in the MEF 2021); Domestic Government (Julio Velarde Flores 2022)	Domestic Government (Histórico de Elecciones 2023)
Philippines	Domestic Government (Governance of the Bank - the Governor 2022)	(CIA World Factbook 2023)
Poland	Domestic Government (Presidents of the National Bank of Poland since 1945 2022)	International Parliamentary Union (Parliamentary elections 2023)

Table A1 (Part 4 of 4): Sources Used to Identify When a Country Had a Head of Government Election or Switch in Their Central Bank Chief		
Country	Sources for CB Chief Switch	Sources for Elections
Romania	Domestic Government (Guvernatorii BNR 2019)	International Parliamentary Union (Parliamentary elections 2023)
Serbia	Domestic Government (Governors 2012)	International Parliamentary Union (Parliamentary elections 2023)
South Africa	Domestic Government (Previous Governors 2020) via Wayback Machine (2023); Domestic Government (Mr. Lesetja Kganyago 2021)	Domestic Government (National and Provincial Election Results 2021)
South Korea	Domestic Government (Former Governors 2022)	Domestic Government (Election Calendar 2020)
Sweden	Domestic Government (Former Governors of the Riksbank 2023)	International Parliamentary Union (Parliamentary elections 2023)
Thailand	Domestic Government (List of Governors of the Bank of Thailand 2023) via Wayback Machine (2023)	International Parliamentary Union (Parliamentary elections 2023)
Turkey	Domestic Government (Governors of the CBRT 2021)	International Parliamentary Union (Parliamentary elections 2023)
United Kingdom	Domestic Government (Governors 2023)	International Parliamentary Union (Parliamentary elections 2023)
United States	Domestic Government (Board of Governors Members, 1914-Present 2023)	common knowledge to the author

Table A2 (Part 1 of 2): Years That a Central Bank Chief Left Their Position				
Country	First Instance Before Start Year	Start Year	First Instance During or After Start Year Prior to End Year	End Date
Argentina	2004	2006	2010, 2013, 2014, 2015, 2018, 2019	2020
Australia	1982	1986	1989, 1996, 2006, 2016	2019
Brazil	1995	1996	1997, 1999, 2003, 2011, 2016, 2019	2020
Canada	1961	1970	1973, 1987, 1994, 2001, 2008	2008
Chile	2003	2007	2007, 2011, 2016	2019
Colombia	1993	2005	2005, 2017	2020
Croatia	2000	2003	None	2009
Czechia	2000	2005	2005	2009
Denmark	1949	1956	1964, 1994, 2005	2009
Hungary	1990	1997	2001, 2007, 2013	2016
Iceland	2005	2008	2009, 2019	2020
India	1949	1956	1957, 1962, 1967, 1970, 1975, 1977, 1982, 1985, 1990, 1992, 1997, 2003, 2008, 2013, 2016, 2018	2018
Indonesia	2013	2015	2018	2020
Israel	2000	2003	2005	2008
Japan	1954	1956	1956, 1964, 1969, 1974, 1979, 1984, 1989, 1994	1995
Mexico	1997	2008	2009, 2017	2020
New Zealand	1988	1995	2002, 2012, 2017, 2018	2019
North Macedonia	2004	2010	2011, 2018	2020

Table A2 (Part 2 of 2): Years That a Central Bank Chief Left Their Position				
Country	First Instance Before Start Year	Start Year	First Instance During or After Start Year Prior to End Year	End Date
Norway	1995	1996	1998, 2010	2015
Peru	2006	2013	None	2019
Philippines	1993	1996	1999, 2005, 2017	2017
Poland	2000	2003	2007, 2010, 2016	2019
Romania	1989	2013		2020
Serbia	2004	2007	2010, 2012	2012
South Africa	1989	1996	1999, 2009, 2014	2020
South Korea	2006	2009	2010, 2014	2019
Sweden	1955	1956	1973, 1976, 1979, 1982, 1993, 2002, 2005	2008
Thailand	2010	2013	None	2012
Turkey	2011	2012	None	2012
United Kingdom	1949	1956	1961, 1966, 1973, 1983, 1993, 2003	2008
United States	1951	1964	1970, 1978, 1979, 1987, 2006	2008

Table A3 (Part 1 of 2): Years That a Head of Government Election Started (Votes Were First Collected)			
Country	Start Year	Elections Occurring Between or During These Years	End Year
Argentina	2007	2007, 2011, 2015, 2019	2021
Australia	1987	1987, 1990, 1993, 1996, 1998, 2001, 2004, 2007, 2010, 2013, 2016, 2019	2021
Brazil	1997	1998, 2002, 2006, 2010, 2014, 2018	2021
Canada	1971	1972, 1974, 1979, 1980, 1984, 1988, 1993, 1997, 2000, 2004, 2006, 2008, 2011	2011
Chile	2008	2009, 2013, 2017, 2021	2021
Colombia	2006	2006, 2010, 2014, 2018,	2021
Croatia	2004	2007, 2011	2012
Czechia	2006	2006, 2010	2012
Denmark	1957	1957, 1960, 1964, 1966, 1968, 1971, 1973, 1975, 1977, 1979, 1981, 1984, 1987, 1990, 1994, 1998, 2001, 2005, 2007, 2011	2012
Hungary	1998	1998, 2002, 2006, 2010, 2014, 2018	2018
Iceland	2009	2009, 2013, 2016, 2017, 2021	2021
India	1957	1957, 1962, 1967, 1971, 1977, 1980, 1984, 1989, 1991, 1996, 1998, 1999, 2004, 2009, 2014, 2019	2019
Indonesia	2016	2019	2021
Israel	2004	2006, 2009	2011
Japan	1957	1958, 1960, 1963, 1967, 1969, 1972, 1976, 1979, 1980, 1983, 1986, 1990, 1993, 1996	1998
Mexico	2009	2012, 2018	2021
New Zealand	1996	1996, 1999, 2002, 2005, 2008, 2011, 2014, 2017, 2020	2021

Table A3 (Part 2 of 2): Years That a Head of Government Election Started (Votes Were First Collected)

Country	Start Year	Elections Occurring Between or During These Years	End Year
North Macedonia	2011	2011, 2014, 2016, 2020	2021
Norway	1997	1997, 2001, 2005, 2009, 2013, 2017	2018
Peru	2014	2016, 2021	2021
Philippines	1997	1998, 2004, 2010, 2016	2018
Poland	2004	2005, 2007, 2011, 2015, 2019	2021
Romania	2014	2016, 2020	2021
Serbia	2008	2008, 2012	2013
South Africa	1997	1999, 2004, 2009, 2014, 2019	2021
South Korea	2010	2012, 2017	2021
Sweden	1957	1960, 1964, 1968, 1970, 1973, 1976, 1979, 1982, 1985, 1988, 1991, 1994, 1998, 2002, 2006, 2010	2011
Thailand	2014	None	2013
Turkey	2013	None	2013
United Kingdom	1957	1959, 1964, 1966, 1970, 1974, 1979, 1983, 1987, 1992, 1997, 2001, 2005, 2010,	2011
United States	1965	1968, 1972, 1976, 1980, 1984, 1988, 1992, 1996, 2000, 2004, 2008,	2011

Table A4: Significance of the Effect of Dif on Real Policy When Using the Newey & West, 1987 Rhobust Standard Errors for Different Lag Lengths				
	Equation 1		Equation 2	
	Fixed Effect	Two-Way FE	Fixed Effect	Two-Way FE
1	p<0.0001 ***	p=0.0021 **	p=0.0035 **	p<0.0001 ***
2	p<0.0001 ***	p=0.0026 **	p=0.0059 **	p<0.0001 ***
3	p=0.0002 ***	p=0.0033 **	p=0.0078 **	p<0.0001 ***
4	p=0.0004 ***	p=0.0039 **	p=0.0088 **	p<0.0001 ***
5	p=0.0005 ***	p=0.0043 **	p=0.0092 **	p<0.0001 ***
6	p=0.0007 ***	p=0.0046 **	p=0.0093 **	p<0.0001 ***
7	p=0.0009 ***	p=0.0049 **	p=0.0093 **	p<0.0001 ***
8	p=0.0011 **	p=0.0052 **	p=0.0092 **	p<0.0001 ***
9	p=0.0013 **	p=0.0054 **	p=0.0089 **	p<0.0001 ***
10	p=0.0015 **	p=0.0056 **	p=0.0087 **	p<0.0001 ***
11	p=0.0017 **	p=0.0058 **	p=0.0086 **	p=0.0001 ***
12	p=0.0019 **	p=0.0059 **	p=0.0086 **	p=0.0001 ***
13	p=0.0022 **	p=0.0060 **	p=0.0088 **	p=0.0001 ***
14	p=0.0024 **	p=0.0062 **	p=0.0088 **	p=0.0002 ***
15	p=0.0026 **	p=0.0064 **	p=0.0087 **	p=0.0002 ***
16	p=0.0029 **	p=0.0066 **	p=0.0087 **	p=0.0002 ***
17	p=0.00032 **	p=0.0068 **	p=0.0087 **	p=0.0002 ***
18	p=0.0035 **	p=0.0072 **	p=0.0088 **	p=0.0002 ***
19	p=0.0039 **	p=0.0074 **	p=0.0089 **	p=0.0002 ***
20	p=0.0043 **	p=0.0077 **	p=0.0091 **	p=0.0003 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table A5 (Part 1 of 3): Estimated Effect of Dif on the Real Central Bank Policy Rate When a Country is Excluded From the Data - For Each Country and Regression				
Country Excluded	Equation 1		Equation 2	
	Fixed Effect	Two-Way FE	Fixed Effect	Two-Way FE
Argentina	0.0121 p<0.0001 ***	0.0065 p=0.0067 **	Dropping this country from the data has no effect	
Australia	0.0122 p<0.0001 ***	0.0053 p=0.0380 *	0.0077 p=0.0055 **	0.0070 p=0.0003 ***
Brazil	0.0121 p<0.0001 ***	0.0068 p=0.0039 **	Dropping this country from the data has no effect	
Canada	0.0120 p<0.0001 ***	0.0058 p=0.0197 *	0.0090 p=0.0011 **	0.0093 p<0.0001 ***
Chile	0.0128 p<0.0001 ***	0.0065 p=0.0085 **	0.0094 p=0.0007 ***	0.0086 p<0.0001 ***
Colombia	0.0129 p<0.0001 ***	0.0066 p=0.0085 **	Dropping this country from the data has no effect	
Croatia	0.0121 p<0.0001 ***	0.0061 p=0.0125 *	Dropping this country from the data has no effect	
Czechia	0.0123 p<0.0001 ***	0.0062 p=0.0104 *	0.0087 p=0.0015 **	0.0086 p<0.0001 ***
Denmark	0.0110 p=0.0006 ***	0.0054 p=0.0423 *	0.0078 p=0.0060 **	0.0103 p<0.0001 ***
Hungary	0.0118 p=0.0001 ***	0.0067 p=0.0061 **	0.0066 p=0.0155 *	0.0079 p<0.0001 ***
Iceland	0.0117 p=0.0001 ***	0.0062 p=0.0116 *	0.0073 p=0.0078 **	0.0077 p<0.0001 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table A5 (Part 2 of 3): Estimated Effect of Dif on the Real Central Bank Policy Rate When a Country is Excluded From the Data - For Each Country and Regression				
Country Excluded	Equation 1		Equation 2	
	Fixed Effect	Two-Way FE	Fixed Effect	Two-Way FE
Indonesia	0.0122 p<0.0001 ***	0.0068 p=0.0055 **	Dropping this country from the data has no effect	
Israel	0.0117 p<0.0001 ***	0.0058 p=0.0169 *	0.0082 p=0.0024 **	0.0082 p<0.0001 ***
Japan	0.0121 p<0.0001 ***	0.0060 p=0.0137 *	0.0085 p=0.0013 **	0.0084 p<0.0001 ***
Mexico	0.0122 p<0.0001 ***	0.0055 p=0.0246 *	0.0085 p=0.0020 **	0.0077 p<0.0001 ***
New Zealand	0.0120 p<0.0001 ***	0.0066 p=0.0089 **	0.0087 p=0.0017 **	0.0096 p<0.0001 ***
North Macedonia	0.0119 p<0.0001 ***	0.0062 p=0.0116 *	Dropping this country from the data has no effect	
Norway	0.0130 p<0.0001 ***	0.0065 p=0.0093 **	0.0096 p=0.0006 ***	0.0094 p<0.0001 ***
Peru	0.0122 p<0.0001 ***	0.0061 p=0.0127 *	Dropping this country from the data has no effect	
Philippines	0.0121 p<0.0001 ***	0.0063 p=0.0103 *	Dropping this country from the data has no effect	
Poland	0.0120 p<0.0001 ***	0.0065 p=0.0095 **	0.0093 p=0.0009 ***	0.094 p<0.0001 ***
Romania	0.0120 p<0.0001 ***	0.0607 p=0.0129 *	Dropping this country from the data has no effect	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table A5 (Part 3 of 3): Estimated Effect of Dif on the Real Central Bank Policy Rate When a Country is Excluded From the Data - For Each Country and Regression				
Country Excluded	Equation 1		Equation 2	
	Fixed Effect	Two-Way FE	Fixed Effect	Two-Way FE
South Africa	0.0104 p=0.0005 ***	0.0057 p=0.0202 *	Dropping this country from the data has no effect	
South Korea	0.0126 p<0.0001 ***	0.0064 p=0.0090 **	0.0093 p=0.0008 ***	0.0092 p<0.0001 ***
Sweden	0.0105 p=0.0008 ***	0.0049 p=0.0540	0.0100 p=0.0003 ***	0.0081 p<0.0001 ***
Thailand	Dropping this country from the data has no effect		Dropping this country from the data has no effect	
Turkey	0.0121 p<0.0001 ***	0.0062 p=0.0103 *	0.0084 p=0.0015 **	0.0086 p<0.0001 ***
United Kingdom	0.0163 p<0.0001 ***	0.0085 p=0.0012 **	0.0096 p=0.0006 ***	0.0093 p<0.0001 ***
United States	0.0109 p=0.0006 ***	0.0065 p=0.0106 *	0.0068 p=0.0200 *	0.0079 p<0.0001 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table A6 (Part 1 of 2): Estimated Effect of Dif on the Real Central Bank Policy Rate When Outliers Are Recursively Dropped From the Dataset - For Different Regressions				
Country Excluded	Equation 1		Equation 2	
	Fixed Effect	Two-Way FE	Fixed Effect	Two-Way FE
1	0.0117 p<0.0001 ***	0.0062 p=0.0103 *	0.0085 p=0.0011 **	0.0084 p<0.0001 ***
2	0.0117 p<0.0001 ***	0.0063 p=0.0117 *	0.0088 p=0.0007 ***	0.0081 p<0.0001 ***
3	0.0120 p<0.0001 ***	0.0062 p=0.0113 *	0.0086 p=0.0008 ***	0.0077 p<0.0001 ***
4	0.0120 p<0.0001 ***	0.0062 p=0.0117 *	0.0081 p=0.0014 **	0.0078 p<0.0001 ***
5	0.0126 p<0.0001 ***	0.0061 p=0.0129 *	0.0085 p=0.0007 ***	0.0077 p<0.0001 ***
6	0.0124 p<0.0001 ***	0.0060 p=0.0138 *	0.0079 p=0.0016 **	0.0077 p<0.0001 ***
7	0.0124 p<0.0001 ***	0.0061 p=0.0129 *	0.0073 p=0.0032 **	0.0077 p<0.0001 ***
8	0.0124 p<0.0001 ***	0.0061 p=0.0135 *	0.0074 p=0.0026 **	0.0076 p<0.0001 ***
9	0.0124 p<0.0001 ***	0.00607 p=0.0137 *	0.0070 p=0.0039 **	0.0076 p<0.0001 ***
10	0.0122 p<0.0001 ***	0.0062 p=0.0119 *	0.0067 p=0.0058	0.0077 p<0.0001 ***
11	0.0120 p<0.0001 ***	0.0063 p=0.0107 *	0.0067 p=0.0055 **	0.0077 p<0.0001 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				

Table A6 (Part 2 of 2): Estimated Effect of Dif on the Real Central Bank Policy Rate When Outliers Are Recursively Dropped From the Dataset - For Different Regressions				
Country Excluded	Equation 1		Equation 2	
	Fixed Effect	Two-Way FE	Fixed Effect	Two-Way FE
12	0.0118 p<0.0001 ***	0.0062 p=0.0117 *	0.0067 p=0.0052 **	0.0077 p<0.0001 ***
13	0.0116 p<0.0001 ***	0.0063 p=0.0110 *	0.0063 p=0.0082 **	0.0078 p<0.0001 ***
14	0.0116 p<0.0001 ***	0.0063 p=0.0113 *	0.0063 p=0.0077 **	0.0078 p<0.0001 ***
15	0.0116 p<0.0001 ***	0.0063 p=0.0108 *	0.0066 p=0.0052 **	0.0078 p<0.0001 ***
16	0.0113 p<0.0001 ***	0.0065 p=0.0095 **	0.0063 p=0.0069 **	0.0079 p<0.0001 ***
17	0.0114 p<0.0001 ***	0.0065 p=0.0096 **	0.0058 p=0.0120 *	0.0079 p<0.0001 ***
18	0.0114 p<0.0001 ***	0.0065 p=0.0096 **	0.0059 0.0101 *	0.0079 p<0.0001 ***
19	0.0109 p<0.0001 ***	0.0065 p=0.0092 **	0.0056 p=0.0147 *	0.0079 p<0.0001 ***
20	0.0104 p<0.0001 ***	0.0065 p=0.0098 **	0.0055 p=0.0160 *	0.0079 p<0.0001 ***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 1				