The Dark Side of Conservative Central Banks: A Model of Political Turnover and the Central Bank

Wioletta Dziuda and Carolin Pflueger

May 2022

Dziuda: University of Chicago, Harris School of Public Policy. Email wdziuda@uchicago.edu. Pflueger: University of Chicago, Harris School of Public Policy, NBER, and CEPR. Email cpflueger@uchicago.edu. We thank Fernando Alvarez, Scott Ashworth, Marina Azzimonti (discussant), Francesco Bianchi, Luigi Bocola (discussant), Alex Frankel, Mike Golosov, Gabriel Lopez-Moctezuma, Greg Mankiw, Lubos Pastor, and seminar participants at the University of Chicago, the American Economic Association 2021, and SITE 2021 Political Economic Theory for helpful comments. The paper was previously circulated as "A Model of Politics and the Central Bank".

Abstract

We present a two-period model, where an apolitical central bank affects electoral outcomes. The central bank minimizes a standard quadratic loss function in inflation and unemployment along an expectational Phillips curve, where the elected government's quality acts as a supply shock. In the model, a central bank with a strong price stability mandate shifts the fully rational electoral mean-variance trade-off towards the incumbent of known quality and away from the challenger of unknown quality, thereby allowing lower quality incumbents to be reelected. Intuitively, because the incumbent's quality is less uncertain she benefits more from the reduction in the inflation bias, and suffers less from the increase in unemployment volatility, when the central bank is focused on stabilizing inflation. We test key model predictions using data on elections and central bank laws from developed countries and in a difference-in-differences design around the introduction of the Euro. In line with the model, we show that political leaders are more likely to be reelected if the central bank governor is directly appointed by the executive, and when the central bank has a mandate focused exclusively on price stability.

1 Introduction

In most democracies, elected governments have delegated substantial portions of macroeconomic policy to an independent central bank. Two basic rationales fuel this choice. First, a standard time-inconsistency argument suggests that monetary policy should be conducted by an entity that places a larger weight on taming inflation than society overall (Kydland and Prescott (1977), Barro and Gordon (1983), Rogoff (1985)). Second, a government that controls monetary policy may generate inflation to boost its reelection chances, further leading to excessive inflation (e.g., Nordhaus (1975)). Despite formal central bank independence, however, the central bank's and elected governments' fortunes are interdependent. First, monetary policy reacts to economic conditions created by actions or competence of the elected governments, and the economic outcomes resulting from such reaction may affect reelection chances of the latter.[2] Second, in many democracies, it is an elected government that appoints the head of the central bank, which gives the former an important role in shaping monetary policy.

This interdependence raises a series of important questions. How does the monetary policy affect government's reelection chances? Will the elected government appoint a central banker with the socially optimal focus on taming inflation, or would it instead opt for an overly dovish or hawkish central banker? And finally, what political and economic outcomes result in equilibrium?

To answer these questions, we build a formal model of the interdependence between

[2]For example, Federal Reserve Chair Jerome Powell clarified that the Federal Reserve would respond to trade shocks resulting from the elected government's actions, while others have expressed concerns about how such response may affect the outcome of the presidential election in 2019. See "Challenges for Monetary Policy", a speech by Jerome H. Powell at the Challenges for Monetary Policy symposium, sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, WY, August 23, 2019 and "The central bank should refuse to play along with an economic disaster in the making" by William Dudley, Bloomberg, August 27, 2019.

office-motivated governments and a government-appointed but independent central bank. Overall, we find that elected governments favor more hawkish central bankers than is socially optimal, as hawkish central bankers react to economic conditions in a way that increases the incumbent government's chances for reelection. This leads to political stability at the expense of lower average quality of the elected governments. As a result, unemployment and inflation are higher than what would be predicted by standard models of monetary policy without elections.

We derive those findings within a model that combines a classical model of central banking (Barro and Gordon (1983), Rogoff (1985)) with a simple model of non-partisan political turnover (Ferejohn (1986), Pastor and Veronesi (2012)). There are three groups of agents: a central bank, a government, and voters. The central bank is apolitical in that it follows a mandate to minimize fluctuations in inflation and unemployment, formally captured through a per-period loss function that is quadratic in both inflation and unemployment.[3] We label a central bank with a high weight on inflation fluctuations *inflation-averse*, whereas a central bank with a low weight on inflation fluctuations is *unemployment-averse*. The central bank trades off inflation against unemployment along a standard expectational Phillips curve, where public inflation expectations are formed rationally. On the monetary policy side, our only departure from the standard model is that the supply-type shocks to the inflation-unemployment frontier are not exogenous but instead stem from the quality of the elected government.[4] Lower quality of the government implies higher unemployment in the

[3]We thereby differ from an older literature (Nordhaus (1975), Wooley (1984), Beck (1990), Chappell Jr et al. (1993)), where either the central bank and the executive are amalgamated into one actor or the central bank directly tries to shape election outcomes.

[4]The assumption that the central bank reacts to politically generated and exogenous shocks alike is explicitly supported by Jerome H. Powell's speech referenced in footnote 2 and is in line with recent anecdotes, such as the Federal Reserve's easing of monetary policy in response to trade shocks and to gaps in the political response to Covid-19.

absence of central bank's intervention. The first-period government's quality is drawn exogenously from a prior distribution, and the central bank conducts monetary policy after observing the government's quality. Voters infer the quality of the first-period government (the incumbent) by observing the first-period unemployment, and then decide whether to reelect the incumbent—in which case his quality persists—or replace him with a challenger. After the election, the central bank conducts monetary policy again, and the game ends.

In equilibrium, below-average incumbents are reelected. Voters are willing to tolerate the economic consequences of a below-average incumbent, in exchange for avoiding the unemployment and inflation uncertainty that a challenger of unknown quality would bring. We show that an *inflation-averse central bank lowers the quality threshold* above which incumbents are reelected. This happens for two reasons. First, the anticipated quality of the incumbent acts like a preexisting economic distortion; hence, any central bank's attempt to mitigate the incumbent's low quality leads to inflation bias but no employment gains. The more inflation-averse the central bank is, the lower inflation bias its policy creates, making the reelection of the known incumbent more attractive. Second, the challenger's quality acts like an unexpected supply shock, so the central bank can mitigate its effect on unemployment. An inflation-averse central bank permits larger unemployment fluctuations, making the election of a challenger of uncertain quality riskier and hence less attractive to the voters.

An immediate consequence is that an office-motivated incumbent, that is, an incumbent who seeks to maximize his reelection chances, *prefers a central banker who is as inflation-averse as possible*, or alternatively, a central banker inclined to follow strict inflation targeting. Our model hence provides a new explanation for the political success of price-stability focused central banks. In most modern economies, the central bank is an independent institution, but it is the elected policy makers – in the U.S. the President – who nominate the central

bank's leadership and thereby set the long-term tone for monetary policy, though there is some variation across countries that we exploit in our empirical analysis. The thriving of inflation-targeting central banks and the public's strong confidence in them, as evidenced by low and stable inflation expectations, might therefore appear puzzling. Indeed, historically economists and policy makers were highly doubtful whether the theoretical insights from the academic time-inconsistency debate could ever be implemented politically (see e.g. Lindbeck (1976)'s Ely lecture). We reconcile the otherwise surprising political success of highly inflation-averse central banks by showing that policy makers who care about reelection have incentives to institute and maintain inflation targeting.[5]

Our model, however, uncovers a dark side of the success of inflation-hawkish central banks. The election channel of monetary policy identified in our model implies that overly hawkish monetary policy arises in equilibrium and is economically costly relative to what is implied by the standard time inconsistency models without elections. Since more hawkish monetary policy leads to reelection of lower quality governments, it also leads to higher unemployment. Moreover, this higher unemployment is anticipated when the incumbent is reelected, which raises the inflation bias in the economy. On the positive side, the increased stability of the government means that a more inflation-averse central banker makes unemployment less variable over time. This result is again in contrast to the predictions of Rogoff (1985) but is consistent with empirical findings (Alesina and Summers (1993), Grilli et al. (1991)), namely that independent and inflation averse central banks are associated

[5]Conversely, a challenger has an incentive to advocate for an unemployment-averse central bank. These findings resonate with an anecdote about the Canadian Liberal party shortly after Canada formally adopted inflation targeting. While in opposition the Liberals were fiercely critical of the new Canadian inflation targeting regime, only to change tack and reaffirm price stability as the primary goal of monetary policy in a high-profile joint statement of the newly elected Liberal government and the Bank of Canada in 1993 (Crow (2002), Chapter 10).

with lower, not higher, unemployment volatility.[6]

We provide empirical evidence for the political outcomes predicted by the model using data on political leaders' reelections and Cukierman et al. (1992)'s measures of legal central bank independence and election outcomes for 21 developed countries 1980-1998, before the start of the Euro. While some prior work has found a positive relationship between measures of central bank independence and political stability (Bernhard and Leblang (1999), Gilardi (2007)) this relationship has often been viewed as puzzling, and Dreher et al. (2010) found no empirical relationship outside of political coups. To the best of our knowledge we are the first to provide theoretically-motivated tests of the relationships between different aspects of central bank independence and the probability that a political leader is reelected. In short, we predict in the model and confirm in the data that different aspects of central bank independence have opposite relationships with the reelection probability, thereby explaining the weak empirical relationship between composite measures of central bank independence and reelection probabilities.

Our first empirical result is that the executive's ability to appoint the head of the central bank is positively related with the probability that a political leader is reelected, where we define leaders and the reelection variable following the expanded definition of Brender and Drazen (2008). Because Brender and Drazen (2008) showed that real GDP growth during a political leader's term predicts the probability that she will be reelected, we control for real GDP growth over the political leader's term throughout, though our results are not sensitive to the inclusion of this control. If the central bank governor is appointed by a council of the central bank board or the board of the central bank this tends to increase the "appointment

[6]Formally, Alesina and Summers (1993)'s empirical measure captures central bank independence, noting that without independence it would be impossible to appoint a central banker more inflation averse than the public. Our own empirical analysis in Section **??** is careful to distinguish between the central bank's objective and central bank independence.

independence" component of Cukierman et al. (1992)'s composite measure of central bank independence, whereas if the central bank governor is directly appointed by the executive this would decrease "appointment independence". We therefore find that "appointment independence" is related negatively with a political leader's reelection probability, as predicted by the model.

Our second empirical result is that the political leader's reelection probability increases the stronger the central bank policy objective's emphasis on price stability. As our empirical measure, we use the "objectives independence" component of Cukierman et al. (1992)'s classification of central bank independence. The "objectives independence" corresponds closely to the central bank's weight on inflation stabilization in the model, taking its maximum value of one if "price stability is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government objectives".

In our sample of 21 developed countries, we show that a one-standard-deviation increase in "objectives independence" tends to be associated with a seven percentage point increase in the probability that a leader is reelected. For comparison, a one-standard-deviation increase in real GDP growth over a political leader's term tends to be associated with a ten percentage point increase in reelection probability. The effect of central bank objectives independence is therefore quantitatively important compared to traditional economic drivers of elections. We further confirm the relationship between "objectives independence" and reelection probabilities using a sample of Euro countries before and after the introduction of the Euro, with a sample ending in 2015. We find that the relationship is similarly positive, and even slightly larger, and more statistically significant. Moreover, it holds while controlling for a post-Euro and country-fixed effects, thereby identifying from changes in the reelection probabilities within countries and over time pre- vs. post-Euro. Said differently, governments of

countries where the central bank had a weaker price stability mandate pre-Euro enjoyed a greater increase in their probability of reelection once the Euro was introduced.

Our paper adds to a recent and growing literature on macroeconomics, political economy, and the role of the central bank (Dovis and Kirpalani (2019), Bianchi et al. (2019), Halac and Yared (2019)). We also add to the recent literature on political and economic uncertainty (Pastor and Veronesi (2012), Pastor and Veronesi (2013), Fernández-Villaverde et al. (2015), Baker et al. (2014), Baker et al. (2016)), and to the broader literature studying the interaction of monetary and fiscal policy (Lucas Jr and Stokey (1983), Calvo (1978), Lustig et al. (2008)).

The paper provides a complementary perspective to the literature on political business cycles (Nordhaus (1975), Persson et al. (2000), Lohmann (1998), Cukierman and Meltzer (1986), Rogoff (1990), Rogoff and Sibert (1988)). In these papers a policy and office motivated politician controls monetary policy, which leads to opportunistic business cycles: a politician generates inflation before elections to boost output in order to signal that he is the high competence type. In contrast, we take the institutional independence of the central bank seriously, assuming that the politician can affect monetary policy (if at all) only via the appointment of the central banker. We do not obtain political business cycles, and to the contrary, we show that incumbents prefer inflation fighting central bankers. Our contrasting model prediction is consistent with the empirical evidence of Brender and Drazen (2005), and Brender and Drazen (2008) who find that deficit spending in election years does not increase reelection chances, but low inflation and central bank independence do.

On the political economy side, our research contributes to literatures studying the interaction between the executive and other branches of government. The executive's interaction with the legislature (e.g. Alesina and Rosenthal (1996), Alesina and Rosenthal (2000)), with the bureaucracy (Fiorina and Noll (1978), Acemoglu and Verdier (2000)), and with state-

owned enterprises (Shleifer and Vishny (1994)) have been subject of large literatures. The complementary question of how monetary policy is shaped by the strategic interaction of different decision makers within the central bank has recently received growing attention (Vissing-Jorgensen (2019), Vissing-Jorgensen and Morse (2020)). However, despite the significant and growing relevance of the central bank as a separate institution for macroeconomic policy, little is known about its interaction with political elections.

2 Model

This section describes our baseline two-period model. We integrate a simple model of a time-inconsistent central bank (Kydland and Prescott (1977), Barro and Gordon (1983),Rogoff (1985)) with the literature on political selection (Ferejohn (1986), Ashworth (2005), Ashworth and de Mesquita (2016), Ashworth (2012),Ashworth and de Mesquita (2008), Ashworth and De Mesquita (2014), Besley (2006), Fearon (1999), Barro (1973), Persson et al. (2000)).

The model has three types of agents: a central bank, a government, and voters. The first-period government's quality is drawn exogenously from a prior distribution, and the central bank conducts monetary policy after observing the government's quality. Voters then learn about the quality of the first-period government (the incumbent) by observing unemployment, and decide whether to reelect the incumbent for a second term or replace him with a challenger. After the election, the central bank conducts monetary policy again, and the game ends. Figure 1 illustrates the timeline of the model.

2.1 Monetary Policy

We start from the classical Barro and Gordon (1983) monetary policy problem.[7] Social welfare each period is represented by a loss function, that is quadratic in both unemployment and inflation:

$$\mathcal{L}_t = \frac{(u_t - u^*)^2}{2} + \theta \frac{{\pi_t}^2}{2}, \tag{1}$$

where u_t and π_t represent realized unemployment and inflation, and the parameter θ captures how voters trade off fluctuations in inflation against fluctuations in unemployment. The socially optimal level of inflation is normalized to zero, and u^* is the socially optimal unemployment level. We assume that $u^* < 0$, which with the assumptions that follow implies that the socially optimal unemployment is below what would obtain without central bank's intervention. This is in line with the literature and is meant to represent pre-existing economic distortions present irrespective of the elected government. A quadratic objective function of the form (1) can be microfounded as a log-quadratic expansion of the consumer welfare function in New Keynesian models (Woodford (2003)).

The central bank sets policy to minimize its own loss function. The central bank's loss function takes the same form as the social loss function, but the central bank's weight on inflation deviations, $\tilde{\theta}$, may be different from the social weight, θ:

$$\tilde{\mathcal{L}}_t = \frac{(u_t - u^*)^2}{2} + \tilde{\theta} \frac{\pi_t^2}{2}, \tag{2}$$

We call $\tilde{\theta}$ the central bank's *inflation-aversion*. If $\tilde{\theta}$ is large, we say that the central bank is *inflation-averse* and if $\tilde{\theta}$ is low, we say that the central bank is *unemployment-averse*. The central bank's inflation-aversion is common knowledge and is the same in both periods.

[7] See Drazen (2000) for a textbook exposition.

Each period, the central bank's problem is to choose inflation π_t and unemployment u_t to minimize

$$\min_{\pi_t, u_t} \tilde{\mathcal{L}}_t$$

subject to a standard expectational Phillips curve

$$u_t = -(\pi_t - \pi_t^e) - g_t, \tag{3}$$

and the voters' inflation expectations π_t^e being rational. The Phillips curve (3) is like in Barro and Gordon (1983), where g_t would represent an exogenous unemployment shock. However, we do not take g_t to be exogenous. Instead, we assume that it represents the quality of the current government like in Persson et al. (2000) and Lohmann (1998). That is the quality of the elected government is the sole source of unemployment shocks in our model.[8]

Inflation expectations π_t^e are formed after period t government is elected. The central bank chooses period t inflation and unemployment knowing inflation expectations π_t^e and after learning the government quality g_t. Note that we assume that the central bank minimizes its loss function period by period, instead of minimizing the sum of its losses for periods 1 and 2, to reflect an apolitical mandate of the central bank to tend to inflation and unemployment fluctuations.

[8]In a previous version of this paper, we assumed that there are two types of shocks, one coming from government's quality and one exogenous. None of the central findings were affected. We abstract from government's quality entering as a demand shock, because those can be perfectly undone by monetary policy, whereas supply shocks present the central bank with a meaningful trade-off between inflation and unemployment. Government quality can therefore be thought of as policy-induced distortions to product and labor markets, such restrictions to wages, prices, labor mobility, or international and domestic competition.

2.2 Elections

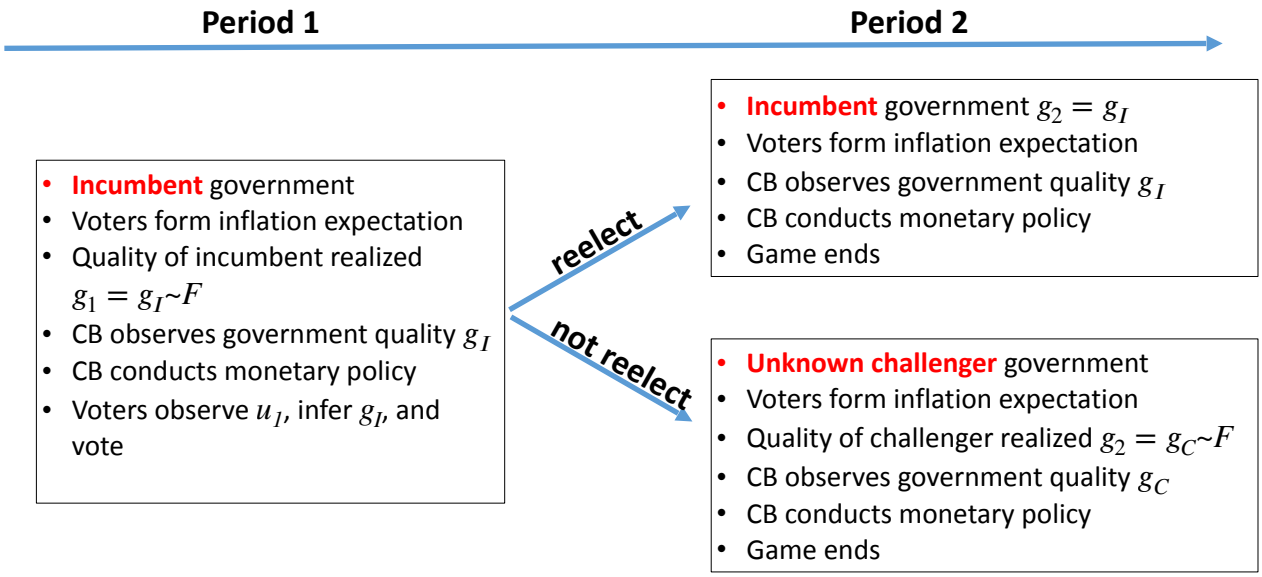
Period 1 starts with the incumbent government in power. The incumbent's quality is denoted by g_I, so $g_1 = g_I$. We assume that the quality of the incumbent is drawn from a distribution F, with corresponding probability density f. The distribution is assumed to have mean 0, variance σ_g^2, and the upper bound $-u^*$.[9] The upper bound on the quality of the government assures that no government fully eliminates all distortions in the economy, and that unemployment is always higher than what is socially optimal. We assume that g_I is not directly observed by the voters. Instead, at the time of the election voters observe only period 1 unemployment u_1. As the reader will see, whether voters observe inflation π_1 is irrelevant in the model.

The voters' problem at the end of period 1 is to choose whether to reelect the incumbent, in which case its quality persists so $g_2 = g_I$, or to elect a challenger of unknown quality, in which case $g_2 = g_C$, where g_C is drawn from F. The quality of the incumbent and the challenger, g_I and g_C, are assumed to be uncorrelated.

The voters' period utility function is the negative of the loss function (1). They reelect the incumbent if and only if their expected utility from doing so is at least as large as the expected utility from electing the unknown challenger. When voting, voters recognize that in the second period the central bank will observe g_2 and choose inflation and unemployment to minimize its own loss function (2). After the loss in the second period is realized, the game ends.

[9] We normalize F to have zero mean, as a shift in the distribution for g_t is isomorphic to a change in the socially optimal level of unemployment u^*.

Figure 1: **Model Timeline**



2.3 Discussion of the assumptions

Many actions of the government affect unemployment, and some of these actions may reflect an innate quality of the government. For example incompetent governments may issue regulations that stifle competition or economic activity. They may fail to prepare for a pandemic or fail to mitigate the effects of a natural disaster. Such actions are captured in our model by g_t.

Voters in our model are rational and informed in that they understand the objective function of the central bank and rationally anticipate its policy making. In practice, voters' inflation expectation may be influenced also by non-rational components, e.g., the history of past inflation. Any non-rational component in inflation expectations will mute the effects identified in our model, but as long as there is a rational component the mechanisms

presented here will be present.

3 Equilibrium

This section derives the equilibrium.

3.1 Within-Period Equilibrium

The within-period problem of the central bank is completely standard (for a detailed derivation see Appendix A.1). In period t, equilibrium inflation and unemployment are given by

$$\pi_t = -\frac{1}{\tilde{\theta}}u^* - \frac{1}{\tilde{\theta}}\mathbb{E}\left(g_t \,|I_t\right) - \frac{1}{1+\tilde{\theta}}\left(g_t - \left(\mathbb{E}\left(g_t \,|I_t\right)\right)\right) \tag{4}$$

$$u_t = -\mathbb{E}\left(g_t \,|I_t\right) - \frac{\tilde{\theta}}{1+\tilde{\theta}}\left(g_t - \mathbb{E}\left(g_t \,|I_t\right)\right), \tag{5}$$

where I_t denotes information that voters have at the beginning of period t once the election outcome is known. So $I_1 = \emptyset$ and $I_2 = \{u_1\}$.

In $t = 1$, voters have only their prior about the first period government's quality, so $\mathbb{E}\left(g_1 \,|I_1\right) = 0$, and hence equations (4) and (5) become

$$\pi_1 = -\frac{1}{\tilde{\theta}}u^* - \frac{1}{1+\tilde{\theta}}g_I, \tag{6}$$

$$u_1 = -\frac{\tilde{\theta}}{1+\tilde{\theta}}g_I. \tag{7}$$

Period 2 inflation and unemployment are different depending on whether the incumbent or the challenger wins the election. Note that if the incumbent is reelected, voters can use

(7) to infer its quality from u_1, so $\mathbb{E}(g_2 | I_2) = g_I$. Hence conditional on the incumbent being reelected, period 2 inflation and unemployment are given by

$$\pi_2 = -\frac{1}{\tilde{\theta}} u^* - \frac{1}{\tilde{\theta}} g_I, \tag{8}$$

$$u_2 = -g_I. \tag{9}$$

By contrast, if the challenger is elected, $\mathbb{E}(g_2 | I_2) = \mathbb{E}(g_C) = 0$, so period 2 inflation and unemployment are given by

$$\pi_2 = -\frac{1}{\tilde{\theta}} u^* - \frac{1}{1+\tilde{\theta}} g_C, \tag{10}$$

$$u_2 = -\frac{\tilde{\theta}}{1+\tilde{\theta}} g_C. \tag{11}$$

Since $\frac{1}{\tilde{\theta}} > \frac{1}{1+\tilde{\theta}}$ and $1 > \frac{\tilde{\theta}}{1+\tilde{\theta}}$, equations (8) through (11) show that period 2 inflation and unemployment are more sensitive to the incumbent's quality g_I than to the challenger's quality g_C, meaning that a low-quality incumbent raises both inflation and unemployment more than a low-quality challenger. This is because conditional on the incumbent being reelected, the period 2 government quality is known and acts like a preexisting friction, whereas the challenger's quality is only realized after the formation of period 2 inflation expectations. Conditional on the incumbent being reelected, the central bank's policy therefore results in *inflation bias* equal to $-\frac{1}{\tilde{\theta}} u^* - \frac{1}{\tilde{\theta}} g_I$, but leaves unemployment unchanged. If the challenger is elected instead, the central bank can trade off unemployment arising from g_C against unexpected inflation. In the extreme case of a central bank that cares only about unemployment (i.e. $\tilde{\theta} = 0$) the central bank completely mitigates the impact of g_C on unemployment, while a central bank that cares only about inflation (i.e. $\tilde{\theta} = \infty$) completely mitigates the impact

of g_C on inflation.

Although the intuition that monetary policy is most powerful if it can surprise the public is well-known, our model newly links this insight to voters' incentives to reelect the government. By generating unexpected inflation, the central bank can mitigate unemployment induced by an unexpectedly bad challenger government, and a more unemployment-averse bank will do that to a larger extent. However, when a low quality government is reelected, voters fully anticipate the central bank's inflation response, which in turn renders the central bank powerless against unemployment. Inflation ensues, and the inflation bias is worse the more weight the central bank puts on smoothing unemployment.

3.2 Political Turnover

In this section, we show that political turnover takes a threshold form, whereby voters replace the incumbent if and only if her perceived quality exceeds a threshold. While it is standard to find that equilibrium political turnover takes a threshold form (e.g. Pastor and Veronesi (2012), Pastor and Veronesi (2013), and Kelly et al. (2016)), our model differs in that voters trade off an objective along two dimensions – unemployment and inflation. This innovation will allow us to characterize how the reelection threshold varies with the central bank in the next section.

Voters reelect the incumbent if and only if the expected social loss from doing so is no larger than if the challenger is elected, that is, if and only if

$$\mathbb{E}\left(\mathcal{L}_2 \,|u_1, \text{incumbent}\right) \leq \mathbb{E}\left(\mathcal{L}_2 \,|u_1, \text{challenger}\right).$$

Using (1) and the within-period equilibrium (4) and (5), we obtain[10]

$$\mathbb{E}\left(\mathcal{L}_t \left| I_t \right.\right) = \frac{\tilde{\theta}^2 + \theta}{2\left(1+\tilde{\theta}\right)^2}\mathbb{V}\left(g_t \left| I_t \right.\right) + \frac{\tilde{\theta}^2 + \theta}{2\tilde{\theta}^2}\left(\mathbb{E}\left(g_t \left| I_t \right.\right) + u^*\right)^2. \tag{12}$$

Voters' inference about the incumbent's quality is a central input into their election decision. From equation (7), voters learn g_I fully after observing period 1 unemployment u_1.[11] Using this and the fact that the challenger's quality has zero mean and variance σ_g^2, (12) implies that voters reelect the incumbent if and only if:

$$\left(g_I + u^*\right)^2 - \left(u^*\right)^2 \leq \left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2 \sigma_g^2. \tag{13}$$

Since $g_I < -u^*$ by assumption, we obtain from (13) that the incumbent is reelected iff $g_I > \underline{g}$, where

$$\underline{g} = -u^* - \sqrt{\left(u^*\right)^2 + \left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2 \sigma_g^2} < 0. \tag{14}$$

This leads to Proposition 1.

Proposition 1 ***(Political Turnover):*** *There exists $\underline{g} < 0$ such that the incumbent is reelected if and only if $g_I \geq \underline{g}$.*

The intuition for Proposition 1. is as follows. Voters like high quality and dislike uncertainty. Hence, they may elect the candidate with lower variance even if she is of below average quality. As the saying goes, "better the devil you know than the devil you don't".

[10] See Appendix A.1 for a derivation of equation (12).

[11] Since voters perfectly infer incumbent's quality from unemployment alone, it is inconsequential whether they observe inflation as well. Observing inflation would also be inconsequential in an extended model in which unemployment in (3) were also affected by an exogenous Phillips curve shock $-\varepsilon_t$. In that case, voters would perfectly infer $g_I + \varepsilon_1$ independent of $\tilde{\theta}$, irrespective of whether inflation is observed.

Because in our model voters learn about the incumbent but not about the challenger, this translates into incumbency advantage in the sense that voters optimally choose to reelect below average incumbents.[12]

4 The Central Bank and Elections

This section presents our main results. We analyze how elections are affected by the inflation aversion of the central bank (Theorem 1), whether the government would choose to appoint a conservative central banker (Corollary 1), and how the central banker appointed by the government compares to the one a social planner would choose (Proposition 2). Finally, we study the central bank's incentives to alter monetary policy to affect election outcomes (Proposition **??**).

4.1 Political Outcomes

Differentiating the reelection threshold (14) with respect to $\tilde{\theta}$ gives the following result.

Theorem 1 *The incumbent government's reelection probability increases with central bank inflation aversion:* $\frac{d\Pr\left(g_I \geq \underline{g}\right)}{d\tilde{\theta}} > 0$.

Theorem 1 presents our first main result. It says that the incumbent's reelection chances increase as the central bank becomes more inflation averse. The intuition for this somewhat surprising finding is as follows. The central bank affects electoral considerations in two ways. First, a more inflation-averse central bank generates less inflation bias in response to a low

[12] We can also show that the social inflation aversion θ drops out of the optimal reelection threshold. This means that despite $\tilde{\theta} \neq \theta$, the central bank and the voters agree on which quality incumbents should be reelected, and hence the central bank has no incentive to try to change voters' perception of the incumbent's quality.

quality incumbent. Second, a more inflation averse central bank is expected to mitigate less future unemployment shocks, which penalizes the candidate of more uncertain quality. Both of these effects favor the incumbent.

Theorem 1 has a surprising implication for the type of central bank preferred by an office-motivated incumbent and an office-motivated challenger.

Corollary 1 *The following holds:*

1. *an office-motivated incumbent prefers a central bank that focuses solely on inflation, i.e.,* $\tilde{\theta} = \infty$*;*

2. *an office-motivated challenger prefers a central bank that focuses solely on unemployment, i.e.,* $\tilde{\theta} = 0$*.*

Note that since the incumbent does not care about inflation and unemployment per se, its preference for an inflation-averse central bank in Corollary 1 does not result from a simple desire to improve economic welfare by resolving the well-known time-inconsistency problem of monetary policy. Instead, the incumbent appoints an inflation-averse central banker in order to improve economic outcomes only conditional on being reelected, but to worsen them conditional on losing the election. The assumption that incumbents are purely office-motivated simplifies Corollary 1, but is not crucial for the qualitative result. As long as governments are partly motivated by reelection, the incumbent would prefer a more inflation-averse central bank than the challenger.[13]

[13]The preferences of the incumbent over various central banks are driven solely by what is expected to happen in the second period. Hence what is relevant for our result is that the incumbent can choose $\tilde{\theta}$ for the second period. This is relevant in practice, as oftentimes the tenure of the central banker extends beyond the tenure of the incumbent. In the U.S., for example, both tenures are four years, but the incumbent typically gets to appoint the chair of the Federal Reserve only well into her term, so she expects the same chair to be responsible for monetary policy at least at the beginning of the next term.

The result that the incumbent in our model prefers an inflation-averse central bank might be surprising, as it contrasts with the common narrative that incumbents prefer the central bank to generate unexpected inflation and help with reelection, as suggested in Nordhaus (1975). The difference arises from the fact that in our model inflation is not set directly by politicians, but instead by a central bank whose objective function is known.

Even if in practice some uncertainty about the central banker's type is inevitable, we believe that the assumption that the public knows $\tilde{\theta}$ is a useful and reasonable baseline. For example, appointed heads of central banks tend to have a long history of comments on monetary policy revealing their philosophy, and their training and pedigree is well known.[14]

Corollary 1 is in line with the sweeping adoption of inflation targeting since the 1990s, and the public's confidence in the persistence of low inflation. It also provides a natural explanation for why political candidates may attack the central bank's inflation focus while campaigning for office, only to change course once in power.

One might wonder why some governments nonetheless appear to pressure their central banks openly to lower unemployment and raise inflation.[15] One way to rationalize this behavior within our framework is if the incumbent government's goal is not to covertly pressure the central bank, but instead to publicly announce that she is facing an inflation-averse central bank, thereby improving her reelection chances.

[14]Moreover, in our model, if given a choice, the incumbent government would strictly benefit from the transparency over the preferences of the central banker. The lack of transparency would push it to appoint a dovish central banker, but rational voters would anticipate this, which would wipe out any electoral advantage that the government hopes to create by having dovish monetary policy, but instead result in unnecessary inflation bias like in the political business cycle literature.

[15]For example, President Trump very openly and frequently criticized the Fed Chairman Jerome Powell for not doing enough to stimulate the economy.

4.2 Social Planner

We now compare the socially optimal central bank inflation aversion in our model to the central bank inflation aversion preferred by the incumbent government, and to the socially optimal central bank inflation aversion in Rogoff (1985)'s benchmark model with no political selection. We define $\tilde{\theta}^*$ as the $\tilde{\theta}$ that minimizes the ex ante expected social loss $\mathbb{E}(\mathcal{L}_1 + \mathcal{L}_2)$ in our model with elections, and $\tilde{\theta}^{Rogoff}$ as the $\tilde{\theta}$ that minimizes $\mathbb{E}(\mathcal{L}_1 + \mathcal{L}_2)$ if g_1 and g_2 are drawn independently from F.

Proposition 2 ***(Social Planner)*** *The incumbent government prefers a central bank that is more inflation-averse than is socially optimal either in our model with elections or in the Rogoff (1985) benchmark without elections:*

$$\theta < \tilde{\theta}^{Rogoff} < \tilde{\theta}^* < \infty.$$

Sketch of Proof: In the Rogoff case, where shocks across periods are assumed to be uncorrelated, standard arguments show that $\frac{d\mathbb{E}(\mathcal{L}_1+\mathcal{L}_2)}{d\tilde{\theta}} < 0$ when $\tilde{\theta} = \theta$, proving that $\theta < \tilde{\theta}^{Rogoff}$. For the case with political turnover, the derivative $\frac{d\mathbb{E}(\mathcal{L}_1+\mathcal{L}_2)}{d\tilde{\theta}}$ can be shown to be negative at $\tilde{\theta} = \tilde{\theta}^{Rogoff}$, proving that $\tilde{\theta}^{Rogoff} < \tilde{\theta}^*$. Noting that $\frac{d\mathbb{E}(\mathcal{L}_1+\mathcal{L}_2)}{d\tilde{\theta}}$ becomes positive as $\tilde{\theta} \to \infty$ shows that the optimal inflation weights are finite. The detailed proof is available in the Appendix.

The intuition for Proposition 2 is as follows. The optimal central bank in Rogoff (1985) and in our model weighs the desire to mitigate the inflation bias against greater unemployment fluctuations, implying that welfare-maximizing central bank has inflation aversion that is greater than voters' but nonetheless finite. The government instead focuses only on its reelection chances and those are the highest when unemployment volatility in case of

challenger being elected is the highest.[16]

Our results therefore help explain the continued political success of strict inflation targeting and especially the support it receives from the executive branch. But they also reveal a darker side, in that overly hawkish central banks arise in equilibrium, not due to a desire to increase economic welfare but due to incumbent governments' desire to get reelected. For example, New Zealand's experience has been interpreted as overly strict inflation targeting policies imposed by politicians (Mishkin and Posen (1998)).

5 Economic Outcomes

So far, we have seen that the central bank's inflation focus can increase the likelihood that a low quality government gets reelected. In this section, we characterize the economic costs generated through this elections channel of monetary policy. Because period 1 is unaffected by elections, we isolate the elections channel by comparing economic outcomes in period 2 relative to period 1. We first characterize the average effect of elections on inflation and unemployment (Theorem 2) and then, more importantly, how the appointment of an inflation-averse central banker changes period 2 unemployment and inflation (Theorem 3).

Theorem 2 ***(Economic Outcomes due to Political Selection)***

a. *On average, inflation and unemployment are lower in the second period:*
$\mathbb{E}(\pi_2 - \pi_1) < 0$ *and* $\mathbb{E}(u_2 - u_1) < 0$.

b. *Conditional on the incumbent being reelected,* $\pi_2 - \pi_1 > 0$ *and* $u_2 - u_1 > 0$ *if* $g_I < 0$, *and* $\pi_2 - \pi_1 < 0$ *and* $u_2 - u_1 < 0$ *if* $g_I > 0$.

[16] We obtain $\tilde{\theta}^{Rogoff} < \tilde{\theta}^*$ because in our model the cost of higher unemployment volatility appears only in the states of the world where the incumbent loses reelection, whereas in Rogoff (1985) it applies in all states of the world.

Theorem 2.a states that on average political selection is beneficial, lowering period 2 unemployment and inflation relative to period 1. Voters vote the incumbent out of office if his quality is too low, thereby benefiting both inflation and employment. Theorem 2.a follows from the expressions for the within period equilibria (6), (7), (8), (9), (10), and (11), taking expectations conditional on $g_2 = g_I$ and conditional on f$g_s = g_C$, and applying iterated expectations.

Theorem 2.b, however, captures an interesting heterogeneity when we restrict attention to the performance of reelected incumbents. When the incumbent is reelected, his quality remains unchanged. However, because voters learn about the incumbent's quality, monetary policy is less able to mitigate the effects of government's quality in period 2. As a result, above average governments (i.e. $g_I > 0$) perform better and below average governments (i.e. $g_I < 0$) perform worse in their second terms.

We now characterize how the central bank's impact on elections changes the economic costs and benefits of appointing and inflation-averse central banker.

Theorem 3 ***(Economic Outcomes and Central Bank)***

a. *An inflation-averse central bank lowers average inflation but raises average unemployment:* $\frac{\mathbb{E}(u_2+u_1)}{d\tilde{\theta}} > 0$*, and if* $\max_g f(g)$ *is not too large then* $\frac{\mathbb{E}(\pi_2+\pi_1)}{d\tilde{\theta}} < 0$*;*

b. *An inflation-averse central bank raises average second-period inflation and unemployment relative to period* 1*:* $\frac{d\mathbb{E}(\pi_2-\pi_1)}{d\tilde{\theta}} > 0$ *and* $\frac{d\mathbb{E}(u_2-u_1)}{d\tilde{\theta}} > 0$*.*

c. *Inflation and unemployment variability decline with the central bank's inflation weight* $\tilde{\theta}$ *when* $\tilde{\theta}$ *is small:* $\frac{d\mathbb{V}(\pi_2-\pi_1)}{d\tilde{\theta}} < 0$ *and* $\frac{d\mathbb{V}(u_2-u_1)}{d\tilde{\theta}} < 0$*.*

Sketch of proof: We take the within period equilibria (6), (7), (8), (9), (10), and (11) to find

expressions for $\mathbb{E}(u_2 + u_1)$, $\mathbb{E}(\pi_2 - \pi_1)$, $\mathbb{E}(\pi_2 - \pi_1)$, $\mathbb{E}(u_2 - u_1)$, $\mathbb{V}(\pi_2 - \pi_1)$, $\mathbb{V}(u_2 - u_1)$, and take comparative statics with respect to $\tilde{\theta}$.

Theorem 3.a shows that, in contrast to standard models of time-inconsistency, appointing an inflation-averse central banker is costly for average unemployment, as an inflation-averse central bank increases the reelection chances of low quality incumbents. Similarly to the standard model without political selection, having a more inflation-averse central banker lowers average inflation.[17]

Theorem 3.b isolates the effects due to the elections channel by comparing inflation and unemployment in period 2 to period 1. It shows that by adversely affecting elections, an inflation-averse central bank has a smaller benefit for average inflation and a larger cost for average unemployment. Said differently, *an inflation-averse central bank mitigates the beneficial effects of political selection on unemployment and inflation.* The upper panels of Figure 2 visualize the effect of the elections channel on average unemployment and inflation against central bank inflation-aversion.

Theorem 3.c shows that political selection can potentially rationalize the otherwise puzzling relationship between central bank inflation aversion and unemployment variability in the data. In standard models without political selection, an inflation-averse central bank unambiguously increases real economic volatility. However, the empirical relationship between economic volatility and central bank mandates appears ambiguous (Alesina and Summers (1993), Grilli et al. (1991)). Theorem 3.c states that this can be explained by political selection. A more inflation-averse central bank increases the probability that the incumbent is

[17]The decrease in average inflation is driven by the standard forces present in the time-inconsistency literature, though the proof shows that this standard effect is weakened by the fact that a more inflation-averse central bank leads to election of lower quality, and hence more inflationary, incumbents. The condition on $\max_g f(g)$ needed for this result assures that a small change in central bank's inflation aversion does not lead to a disproportionately large change in the mass of incumbents that get reelected.

Figure 2: **Economic outcomes against central bank inflation aversion**

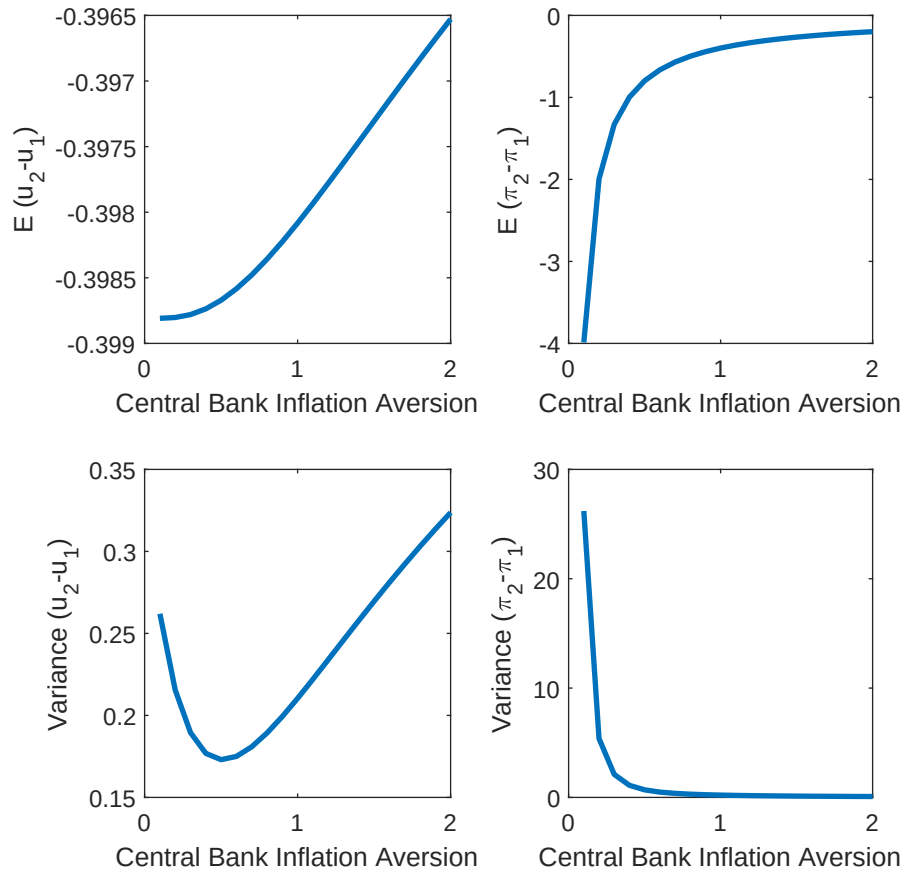


Figure 3: This figure shows the difference between period 2 and period 1 unemployment (left panels) and inflation (right panels) as a function of the central bank inflation weight $\tilde{\theta}$ for $\sigma_g = 1$ and $u^* = -2$. The upper panels show the average (Theorem 3.c), and the lower panels show the variance (Theorem.3.d). To generate those plots we assume that F is a normal distribution, even though technically this distribution does not satisfy our assumptions that g has an upper bound. However, for the chosen parameter values the probability that $g > -u^*$ is very small.

reelected, thereby reducing unemployment volatility. The lower left panel of Figure 2 illustrates the u-shaped relationship between central bank inflation aversion and the volatility of unemployment in our model for a particular distribution F.

6 Empirical Analysis

So far, we have seen within our model that a central bank with a stronger price-stability mandate should increase the probability that a political incumbent is reelected. Further, if given the opportunity, the executive will appoint a central banker who is more inflation-averse than is socially optimal, thereby increasing the incumbent's chances of being reelected.

In this section we test these key model predictions for political outcomes using elections data and data on central bank legal frameworks in 21 developed countries, as well as exploiting variation in Eurozone countries pre- vs. post-Euro. Prior work has found that political stability may be positively correlated with central bank independence (Dreher et al. (2010)), though it did not distinguish between different aspects of central bank independence. Gilardi (2007) interpreted this finding as a puzzle, especially since they found the opposite empirical relationship between political stability and the independence of other regulatory agencies. Our model resolves this puzzle because it is specific to the management of an expectational Phillips curve, and provides us with new testable predictions for different empirical aspects of central bank independence.

We use cross-sectional and panel data from 21 developed countries to test the following two predictions. In particular, we predict that if the executive can appoint the central bank governor, her reelection chances will increase. This generates the first prediction in the data that if the central bank governor appointment process is insulated from the executive ("ap-

pointment independence") this should be negatively correlated with reelection chances for the executive. This aspect of central bank independence is captured by the first component of Cukierman et al. (1992)'s measure of central bank independence, which takes a higher lower numerical value if the central bank governor is appointed directly by the executive and a higher value if the governor is appointment by parliament, and an even higher value if the appointment is chosen by a committee within the central bank.

Second, we predict that a higher weight on inflation stabilization within the central bank's objective function (a higher θ^*) will lead to higher reelection probabilities. This aspect of central bank independence is measured by the third, "objectives independence", component of Cukierman et al. (1992)'s measure of central bank independence. This component assigns the highest value if price stability "is the major or only objective in the charter, and the central bank has the final word in case of conflict with other government objectives", and lower values if for example the central bank charter mentions several objectives. It is therefore an ideal measure to test the predictions of our Theorem 1.

We start with a simple cross-sectional analysis, using the original Cukierman et al. (1992) central bank independence measures that were constructed for the period 1980-1989 and election outcomes for developed countries 1980-1998, before the start of the Euro. This time period is ideal to study cross-sectional differences in central bank independence and reelection probabilities. Because many central banks converged to a model of strong central bank independence after the late 1990s, and in particular many countries joined the Euro, we analyze the pre- vs. post-Euro variation separately. Our empirical analysis builds on Brender and Drazen (2008) for developed countries. The observation unit is $Reelect_{i,t}$, which corresponds to a national election in country i and year t, and takes a value of one if the political leader gets reelected and zero if not. We use Brender and Drazen (2008)'s expanded

definition and their data for the pre-1998 period. Our pre-1998 sample of countries consists of Australia, Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, the United Kingdom, Greece, Ireland, Italy, Japan, Luxemburg, the Netherlands, Norway, New Zealand, Sweden, and the United States. We split the countries into a Euro sample, which includes the original members of the Euro plus Denmark, which while not being an official member of the Euro is effectively pegged to the Euro. The advantage of considering a Euro sample is that definitions are more comparable within Europe, and also that this allows us to conduct a pre- vs. post-Euro analysis. This gives us a total of 95 elections 1980-1998 in all developed countries and 51 elections over this sample period for the Euro sample. Because Brender and Drazen (2008) find that real GDP growth predicts a leader's probability of reelection we control for this measure of macroeconomic outcomes throughout.[18]

Table 1 shows our main empirical result, namely that appointment independence is negatively related with a leader's probability of being reelected, but objectives independence is positively correlated with the probability that an incumbent gets reelected, exactly as predicted by the model. These relationships are visually depicted in Figure 4, where each

[18]The "expanded" definition adds cases in which a leader was substituted by another candidate from his party under the following specific circumstances: (1) the leader died in the year before the elections; or (2) the leader could not run for reelection due to legal term limits. In these cases the substitute leader (in the first case) or the candidate from the leader's party (in the second case) is treated as the incumbent. Additionally, in the expanded sample, leaders who quit their job within a year before the election are treated as having lost reelection. Because Brender and Drazen (2008)'s data ends in 2003, we hand-collect additional data to update the reelection data until 2015 for our Euro sample. Because their original data did not include Switzerland, we hand-collected elections data for Switzerland for the entire sample period. For this, we collect reelection data manually from the International Institute for Democracy and Electoral Assistance (IDEA) data set "Voter Turnout Since 1945", the International Foundation for Election Systems ELECTION GUIDE data set, Zárate's Political Collections (ZPC) and the Worldstatesmen online encyclopedia, following the data definitions in Brender and Drazen (2008). We follow their variable construction for real per capita GDP growth, using average annual growth rate of real GDP per capita between the current and the previous election year. We use real GDP per capital in constant 2010 USD from the world development indicators (WDI) data base. Our measure of real GDP growth is slightly different from theirs because we use a 2010 base year, whereas they use a 1995 base year.

country corresponds to one observation and we plot the average probability of the incumbent being reelected on the y-axis against aspects of central bank independence on the x-axis.[19] We run regressions of the form

$$Reelect_{i,t} = b_0 + b_1 CBI_{i,t} + GDP_{i,t} + \varepsilon_{i,t}, \tag{15}$$

where $CBI_{i,t}$ is either the aggregate central bank independence measure or one of its four separate components, and $GDP_{i,t}$ measures real per capital GDP growth over an incumbent's term.

[19] We show the analogous figures for the Euro sample in Appendix Figure A1.

Table 1: The Effect of Central Bank Independence on Probability of Reelection 1980-1998

	Dependent Variable: $Reelect_{i,t}$									
CBI Measure	Combined		Appointment		Instrument		Objectives		Fiscal	
Central Bank Laws	0.70	0.39	-0.87***	-0.48*	0.69*	0.25	0.52***	0.26**	0.70	0.31
	(1.36)	(1.15)	(-3.20)	(-1.77)	(2.09)	(0.94)	(4.05)	(2.57)	(1.69)	(1.15)
GDP Growth	5.66	8.49*	7.32	7.74*	8.04	8.35*	4.54	7.28	6.75	8.89*
	(0.92)	(2.00)	(1.33)	(1.85)	(1.33)	(1.92)	(0.71)	(1.62)	(1.11)	(2.06)
Const.	0.07	0.17	0.74***	0.59***	0.09	0.26**	0.04	0.23**	0.08	0.20
	(0.34)	(1.15)	(5.29)	(4.22)	(0.56)	(2.43)	(0.36)	(2.58)	(0.44)	(1.53)
Countries	Euro	Dev	Euro	Dev	Euro	Dev	Euro	Dev	Euro	Dev
N	51	95	51	95	51	95	51	95	51	95
R-sq	0.06	0.06	0.11	0.07	0.13	0.06	0.10	0.07	0.09	0.06

Note: This table reports regressions of the form $Reelect_{i,t} = b_0 + b_1 CBI_{i,t} + GDP_{i,t} + \varepsilon_{i,t}$. The observation is at the country-election level and $Reelect_{i,t}$ takes a value of one if the incumbent was reelected and zero otherwise. $CBI_{i,t}$ is a measure of central bank independence. We follow Brender and Drazen (2008)'s expanded definition, where a substitute leader is considered to have won reelection if the previous leader was prevented from being reelected due to term limits or death in office. $CBI_{i,t}$ is the central bank independence measure of Cukierman et al. (1992) obtained via Crowe and Meade (2008) for the period 1980-1989. Appointment independence, instrument independence, objectives independence, and financing independence are the four aspects used to compute $CBI_{i,t}$. $GDP_{i,t}$ is real annualized GDP growth in percent over the leader's term, as in Brender and Drazen (2008). The Euro sample consists of all original Euro members plus Denmark. The developed countries sample "Dev" additionally includes Australia, Canada, Switzerland, the United Kingdom, Japan, New Zealand, Sweden, and the United States. Elections are from 1980 through 1998, though countries may start later depending on data availability. Standard errors clustered by year in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

We start with the aggregate measure of central bank independence, which we see not to be significantly correlated with the probability of being reelected either for the Euro sample or all developed countries.[20] This non-relation could be interpreted as a puzzle without the additional guidance from our model. The subsequent columns put each component of the aggregate central bank independence measure on the right-hand-side of the regression separately. The next two columns show that indeed appointment independence enters negatively and significantly for both the Euro and all developed countries samples. The increase in R-squared from 0.06 to 0.11 for the Euro sample is substantial compared to the combined central bank independence measure in the first column, showing that appointment independence can explain meaningful variation in reelection probabilities. We also see that objectives independence is significantly positively related to the political leader's reelection probability in both the Euro and developed country samples. The magnitude is substantial. A one standard deviation increase in central bank objectives independence in the Euro sample equals 0.27, so a one-standard deviation increase in objectives independence tends to be associated with an increase in the probability of being reelected of 14 percentage points. For completeness, we also show the empirical relationships between the reelection probability and the remaining two aspects of central bank independence. We find that instrument independence also enters positively, though not always significantly, and fiscal independence appears bears no statistically significant relationship with the probability of an incumbent being reelected.[21] Overall, these empirical results therefore confirm our key predictions, and explain why combined measures of central bank independence may reflect opposing forces

[20] A logit model estimation is shown in Appendix Table A2.

[21] These two other measures capture whether the central bank can set the policy rate without consultation with the executive ("instrument independence") and whether it is prohibited from lending to the government ("fiscal independence"). While our model does not make predictions about these, instrument independence is a crucial ingredient of our model and a necessary precondition for objectives independence, so we might expect it to be positively related to the reelection probability, similarly to objectives independence.

and therefore appear unrelated to political stability.

We next exploit the introduction of the Euro for a difference-in-differences type design. The Euro was introduced in 199 and unified monetary policy across a large number of European countries in 1999. This change allow us to speak to causality by using a differences-in-differences design, exploiting the change in central bank independence in each country over time. Even though of course the European Central Bank cannot respond to national shocks like a national central bank would, within a slightly broader interpretation of our model, one could interpret changes in objectives independence pre- vs. post-1999 as an exogenous change in the monetary policy inflation weight (θ^*) in the model. We would therefore expect that countries that experienced a greater increase in objectives independence pre- vs. post-Euro to also experience a greater increase in the incumbent's probability of being reelected. However, since the model predicts a relationship between appointment independence and the reelection probability if and only if the executive can appoint the central banker, this relationship might be expected to be weaker post-1999 when all Euro country governments lost their ability to appoint the central bank governor.

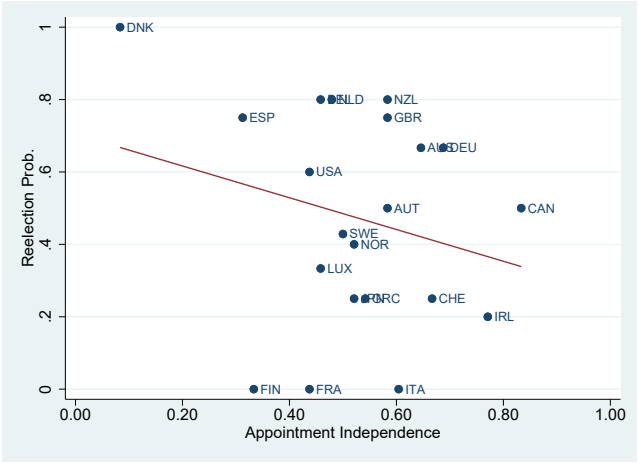
Table 2: The Effect of Central Bank Independence on Reelection Probabilities around Euro Introduction

	Dependent Variable: $Reelect_{i,t}$									
CBI Measure	Combined		Appointment		Instrument		Objectives		Fiscal	
Central Bank Laws	0.35	0.51*	-0.40	-0.18	0.67**	0.55**	0.38**	0.38**	0.38	0.45*
	(1.16)	(1.74)	(-1.59)	(-0.28)	(2.14)	(2.05)	(2.62)	(2.16)	(1.45)	(2.00)
GDP Growth	8.20***	8.41***	8.50***	8.32***	8.96***	8.59***	7.99***	8.41***	8.38***	8.46***
	(3.68)	(3.56)	(3.80)	(3.54)	(4.00)	(3.51)	(3.51)	(3.59)	(3.80)	(3.56)
Const.	0.15	0.10	0.49***	0.40	0.07	0.16	0.05	0.06	0.15	0.15
	(1.15)	(0.37)	(3.53)	(0.99)	(0.65)	(0.71)	(0.53)	(0.23)	(1.38)	(0.65)
Country FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Post-1999 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Euro	Euro	Euro	Euro	Euro	Euro	Euro	Euro	Euro	Euro
N	105	105	105	105	105	105	105	105	105	105
R-sq	0.10	0.29	0.11	0.28	0.15	0.30	0.12	0.29	0.11	0.30

Note: This table reports regressions of the form $Reelect_{i,t} = b_0 + b_1 CBI_{i,t} + GDP_{i,t} + c_i + I_{t\geq 1999} + \varepsilon_{i,t}$. Here $I_{t\geq 1999}$ is a dummy taking a value of one if $t \geq 1999$ and zero otherwise. The sample consists of all original Euro countries plus Denmark 1980-2015. The central bank independence measures 1999-2015 are from 2003 update by Crowe and Meade (2008). All other measures are as in Table 1. Standard errors clustered by year in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

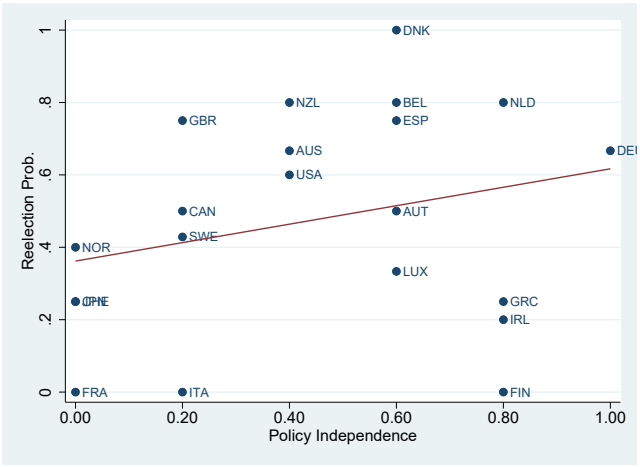
Figure 4: Probability of Reelection vs. Aspects of Central Bank Laws

Panel A: Appointment Independence



Central bank board appoints ← → Executive appoints

Panel B: Objectives Independence



Several conflicting objectives ← → Single price stability objective

Note: This figure plots the average probability of reelection for all developed countries on the y-axis against aspects of central bank independence on the x-axis. Reelection probabilities are averages for the period 1980-1998. The deveoped country sample is defined as in Table 1.

Table 2 confirms our these predictions in the pre- and post-Euro sample period. All regressions include a post-1999 dummy to control for possible joint time trends in the probability of reelection. We show all regressions with and without country fixed effects, thereby exploiting only variation within each country over time, and controlling for the possibility that some countries may have persistently higher political turnover for reasons unrelated to central bank independence. We see that objectives independence continues to enter significantly with a large coefficient with and without country fixed effects. Instrument independence, which is a precondition for objectives independence, now also enters positively and significantly. Fiscal independence also enters positively, though less significantly than the other aspects of central bank independence. As expected, appointment independence no longer enters significantly, but the point estimate is still negative. Overall, we therefore find strong support from elections data in developed countries for our model's predictions that if the executive is less able to appoint the central bank governor this decreases her reelection chances, but a strong focus of the central bank's charter on price stability increases the incumbent's reelection chances. Because both of these aspects are typically interpreted as aspects of central bank independence, aggregate indicators of central bank independence may bear only a weak relationship with political turnover.

7 Conclusion

The interaction of the central bank and politics is clearly a first-order question in a world of high and increasing political uncertainty. We present a fully rational framework of this interaction, building on the classic framework of Barro and Gordon (1983) and Rogoff (1985) on the monetary policy side, and a simple model of non-partisan political turnover (Ferejohn

(1986)) on the political economy side.

Our framework shows that governments may have strong, and socially excessive, political incentives to institute an inflation-targeting central bank, and that an inflation-targeting central bank may have so far underappreciated consequences for the macroeconomy by affecting the political fortunes of the elected government.

We believe that our rational baseline model opens up future research avenues to understand how the central bank as an institution interacts with its political environment, and ultimately outcomes for employment, growth, inflation, and political stability. While our model is intentionally stylized and does not incorporate fiscal policy as an inflation determinant (e.g. Cochrane (2001), Sims (2011), Bianchi and Ilut (2017)), one could build on it to understand politician incentives to delegate price stability to an independent central bank in the presence of government indebtedness and concerns about debt service costs. It would also be relevant to ask how voters learn about government quality when macroeconomic outcomes are partially mediated by the central bank, potentially by modeling voter uncertainty about the central bank's weight on inflation stabilization.

References

Acemoglu, D., and Verdier, T. (2000), "The choice between market failures and corruption," *American Economic Review*, 90(1), 194–211.

Alesina, A., and Rosenthal, H. (1996), "A theory of divided government," *Econometrica: Journal of the Econometric Society*, pp. 1311–1341.

Alesina, A., and Rosenthal, H. (2000), "Polarized platforms and moderate policies with checks and balances," *Journal of Public Economics*, 75(1), 1–20.

Alesina, A., and Summers, L. H. (1993), "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence," *Journal of Money, Credit and Banking*, pp. 151–162.

Ashworth, S. (2005), "Reputational Dynamics and Political Careers," *Journal of Law, Economics and Organization*, 21(2), 441–466.

Ashworth, S. (2012), "Electoral Accountability: Recent Theoretical and Empirical Work," *Annual Review of Political Science*, 15, 183–201.

Ashworth, S., and de Mesquita, E. B. (2008), "Electoral Selection, Strategic Challenger Entry, and the Incumbency Advantage," *Journal of Politics*, 70(4), 1006–1026.

Ashworth, S., and De Mesquita, E. B. (2014), "Is voter competence good for voters? Information, rationality, and democratic performance," *American Political Science Review*, pp. 565–587.

Ashworth, S., and de Mesquita, E. B. (2016), "Delivering the goods: legislative particularism in different electoral and institutional settings," *Journal of Politics*, 68(1), 169–179.

Baker, S. R., Bloom, N., Canes-Wrone, B., Davis, S. J., and Rodden, J. (2014), "Why has US policy uncertainty risen since 1960?," *American Economic Review*, 104(5), 56–60.

Baker, S. R., Bloom, N., and Davis, S. J. (2016), "Measuring economic policy uncertainty," *Quarterly Journal of Economics*, 131(4), 1593–1636.

Barro, R. (1973), "The control of politicians: an economic model," *Public Choice*, 4, 19–42.

Barro, R. J., and Gordon, D. B. (1983), "Rules, Discretion and Reputation in a Model of Monetary Policy," *Journal of Monetary Economics*, 12(1), 101–121.

Beck, N. (1990), "Political monetary cycles," in *The Political Economy of American Monetary Policy*, ed. T. Mayer, Cambridge, UK: Cambridge University Press, pp. 115–30.

Bernhard, W., and Leblang, D. (1999), "Democratic institutions and exchange-rate commitments," *International Organization*, pp. 71–97.

Besley, T. (2006), *Principled Agents? The Political Economy of Good Government*, Oxford, UK: Oxford University Press.

Bianchi, F., and Ilut, C. (2017), "Monetary/fiscal policy mix and agents' beliefs," *Review of economic Dynamics*, 26, 113–139.

Bianchi, F., Kung, H., and Kind, T. (2019), Threats to Central Bank Independence: High-Frequency Identification with Twitter,. NBER Working Paper wp26308.

Brender, A., and Drazen, A. (2005), "Political budget cycles in new versus established democracies," *Journal of Monetary Economics*, 52(7), 1271–1295.

Brender, A., and Drazen, A. (2008), "How do budget deficits and economic growth affect reelection prospects? Evidence from a large panel of countries," *American Economic Review*, 98(5), 2203–20.

Calvo, G. A. (1978), "On the Time Consistency of Optimal Policy in a Monetary Economy," *Econometrica: Journal of the Econometric Society*, pp. 1411–1428.

Chappell Jr, H. W., Havrilesky, T. M., and McGregor, R. R. (1993), "Partisan monetary policies: Presidential influence through the power of appointment," *Quarterly Journal of Economics*, 108(1), 185–218.

Cochrane, J. H. (2001), "Long-Term Debt and Optimal Policy in the Fiscal Theory of the Price Level," *Econometrica*, 69(1), 69–116.

Crow, J. (2002), *Making Money*, Etobicoke, Ontario, Canada: Wiley.

Crowe, C., and Meade, E. E. (2008), "Central bank independence and transparency: Evolution and effectiveness," *European Journal of Political Economy*, 24(4), 763–777.

Cukierman, A., and Meltzer, A. H. (1986), "A positive theory of discretionary policy, the cost of democratic government and the benefits of a constitution," *Economic Inquiry*, 24(3), 367–388.

Cukierman, A., Web, S. B., and Neyapti, B. (1992), "Measuring the independence of central banks and its effect on policy outcomes," *The world bank economic review*, 6(3), 353–398.

Dovis, A., and Kirpalani, R. (2019), Rules without commitment: Reputation and incentives,. NBER Working paper, wp26451.

Drazen, A. (2000), *Political Economy in Macroeconomics*, Princeton, NJ: Princeton University Press.

Dreher, A., Sturm, J.-E., and De Haan, J. (2010), "When is a central bank governor replaced? Evidence based on a new data set," *Journal of Macroeconomics*, 32(3), 766–781.

Fearon, J. D. (1999), "Electoral Accountability and Incumbency," in *Models of Strategic Choice in Politics*, ed. P. C. Ordeshook, Ann Arbor, MI: University of Michigan Press, pp. 121–150.

Ferejohn, J. (1986), "Incumbent performance and electoral control," *Public choice*, pp. 5–25.

Fernández-Villaverde, J., Guerrón-Quintana, P., Kuester, K., and Rubio-Ramírez, J. (2015), "Fiscal volatility shocks and economic activity," *American Economic Review*, 105(11), 3352–84.

Fiorina, M. P., and Noll, R. G. (1978), "Voters, legislators and bureaucracy: Institutional design in the public sector," *American Economic Review*, 68(2), 256–260.

Gilardi, F. (2007), "The same, but different: Central banks, regulatory agencies, and the politics of delegation to independent authorities," *Comparative European Politics*, 5(3), 303–327.

Grilli, V., Masciandaro, D., and Tabellini, G. (1991), "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries," *Economic Policy*, 6(13), 341–392.

Halac, M., and Yared, P. (2019), Inflation Targeting under Political Pressure,. Working paper, Yale University and Columbia University.

Kelly, B., Pástor, L., and Veronesi, P. (2016), "The price of political uncertainty: Theory and evidence from the option market," *The Journal of Finance*, 71(5), 2417–2480.

Kydland, F. E., and Prescott, E. C. (1977), "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *The Journal of Political Economy*, pp. 473–491.

Lindbeck, A. (1976), "Stabilization policy in open economies with endogenous politicians," *American Economic Review*, 66(2), 1–19.

Lohmann, S. (1998), "Rationalizing the political business cycle: A workhorse model," *Economics & Politics*, 10(1), 1–17.

Lucas Jr, R. E., and Stokey, N. L. (1983), "Optimal Fiscal and Monetary Policy in an Economy without Capital," *Journal of Monetary Economics*, 12(1), 55–93.

Lustig, H., Sleet, C., and Yeltekin, Ş. (2008), "Fiscal hedging with nominal assets," *Journal of Monetary Economics*, 55(4), 710–727.

Mishkin, F. S., and Posen, A. S. (1998), Inflation targeting: Lessons from four countries,, Technical report, National Bureau of Economic Research.

Nordhaus, W. D. (1975), "The Political Business Cycle," *Review of Economic Studies*, 42(2), 169–190.

Pastor, L., and Veronesi, P. (2012), "Uncertainty About Government Policy and Stock Prices," *Journal of Finance*, 67(4), 1219–1264.

Pastor, L., and Veronesi, P. (2013), "Political Uncertainty and Risk Premia," *Journal of Financial Economics*, 110(3), 520–545.

Persson, T., Roland, G., and Tabellini, G. (2000), "Comparative politics and public finance," *Journal of Political Economy*, 108(6), 1121–1161.

Rogoff, K. (1985), "The Optimal Degree of Commitment to an Intermediate Monetary Target," *The Quarterly Journal of Economics*, pp. 1169–1189.

Rogoff, K. (1990), "Equilibrium Political Budget Cycles," *American Economic Review*, pp. 21–36.

Rogoff, K., and Sibert, A. (1988), "Elections and macroeconomic policy cycles," *Review of Economic Studies*, 55(1), 1–16.

Shleifer, A., and Vishny, R. W. (1994), "Politicians and firms," *Quarterly Journal of Economics*, 109(4), 995–1025.

Sims, C. A. (2011), "Stepping on a rake: The role of fiscal policy in the inflation of the 1970s," *European Economic Review*, 55(1), 48–56.

Vissing-Jorgensen, A. (2019), "Central Banking with Many Voices: The Communications Arms Race," in *Conference Proceedings, 23rd Annual Conference of the Central Bank of Chile*, Central Bank of Chile:.

Vissing-Jorgensen, A., and Morse, A. (2020), Information Transmission from the Federal Reserve to the Stock Market: Evidence from Governors' Calendars,. Working Paper, Berkeley University.

Woodford, M. (2003), *Interest and Prices*, Princeton, NJ: Princeton University Press.

Wooley, J. T. (1984), *Monetary Politics: The Federal Reserve and the Politics of Monetary Policy*, Cambridge, UK and New York: Cambridge University Press.

Online Appendix: A Model of Politics and the Central Bank

Wioletta Dziuda and Carolin Pflueger

A Detailed Derivations

A.1 Proofs for Section 3

Derivation of Equations (6), (7), (8), (9), (10), and (11).

Plugging the Philips curve into the central bank's objective function and minimizing it with respect to π_t delivers:

$$\pi_t = \frac{1}{1+\tilde{\theta}} \left(\pi_t^e - g_t - u^*\right). \tag{A.1}$$

Imposing that voters' expectations are rational in (A.1) gives

$$\pi_t^e = -\frac{1}{\tilde{\theta}} \left(\mathbb{E}\left(g_t \,|I_t\right) + u^*\right). \tag{A.2}$$

Using (A.2) in (A.1) we obtain

$$\pi_t - \pi_t^e = -\frac{1}{1+\tilde{\theta}} \left(g_t - \mathbb{E}\left(g_t \,|I_t\right)\right). \tag{A.3}$$

Substituting (A.3) into the Phillips Curve (3) delivers equilibrium unemployment (7). Plugging (A.2) into (A.1), we obtain (6). ■

Proof of Proposition 1. Taking the expectation of (2), we obtain

$$\mathbb{E}\left(\mathcal{L}_t \,|I_t\right) = \frac{1}{2}\left(\mathbb{V}\left(u_t \,|I_t\right) + \left(\mathbb{E}\left(u_t \,|I_t\right) - u^*\right)^2\right) + \frac{\theta}{2}\left(\mathbb{V}\left(\pi_t \,|I_t\right) + \left(\mathbb{E}\left(\pi_t \,|I_t\right)\right)^2\right),$$

and using (7) and (6) in the above, we obtain

$$\begin{aligned}\mathbb{E}\left(\mathcal{L}_t\left|I_t\right.\right) &= \frac{1}{2}\left(\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\mathbb{V}\left(g_t\left|I_t\right.\right)+\left(\mathbb{E}\left(g_t\left|I_t\right.\right)+u^*\right)^2\right)\\ &+ \frac{\theta}{2}\left(\left(\frac{1}{1+\tilde{\theta}}\right)^2\mathbb{V}\left(g_t\left|I_t\right.\right)+\left(\frac{1}{\tilde{\theta}}\right)^2\left(\mathbb{E}\left(g_t\left|I_t\right.\right)+u^*\right)^2\right)=\\ &= \frac{\tilde{\theta}^2+\theta}{2\left(1+\tilde{\theta}\right)^2}\mathbb{V}\left(g_t\left|I_t\right.\right)+\frac{\tilde{\theta}^2+\theta}{2\tilde{\theta}^2}\left(\mathbb{E}\left(g_t\left|I_t\right.\right)+u^*\right)^2,\end{aligned}$$

which delivers (12). For $t=2$, $\mathbb{V}\left(g_2\left|I_2\right.\right)=0$ and $\mathbb{E}\left(g_2\left|I_2\right.\right)=g_I$ if the incumbent is reelected and $\mathbb{V}\left(g_2\left|I_2\right.\right)=\sigma_g^2$ and $\mathbb{E}\left(g_2\left|I_2\right.\right)=0$ if the challenger wins. Comparing then voters' expected loss if the incumbent is reelected and if the challenger wins, we obtain (13). Since $g_I<-u^*$ by assumption, we obtain from (13) that the incumbent is reelected iff $g_I>\underline{g}$, where

$$\underline{g}=-u^*-\sqrt{\left(u^*\right)^2+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\sigma_g^2}<0. \tag{A.4}$$

■

Proof of Theorem 1. Differentiating (A.4) with respect to $\tilde{\theta}$, one obtains

$$\frac{d\underline{g}}{d\tilde{\theta}}=-\frac{\frac{1}{\left(1+\tilde{\theta}\right)^2}\sigma_g^2}{\sqrt{\left(u^*\right)^2+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\sigma_g^2}}<0. \tag{A.5}$$

■

Proof of Theorem 2.

Using (6), (7), (8), (9), (10), and (11) we obtain second-period inflation and unemployment as functions of g_I and g_C

$$\pi_2\left(g_I,g_C\right)=\begin{cases}-\frac{1}{\tilde{\theta}}u^*-\frac{1}{\tilde{\theta}}g_I \text{ if } g_I\geq\underline{g}\\ -\frac{1}{\tilde{\theta}}u^*-\frac{1}{1+\tilde{\theta}}g_C \text{ if } g_I<\underline{g}\end{cases}$$

$$u_2\left(g_I,g_C\right)=\begin{cases}-g_I \text{ if } g_I\geq\underline{g}\\ -\frac{\tilde{\theta}}{1+\tilde{\theta}}g_C \text{ if } g_I<\underline{g}\end{cases}$$

Subtracting period 1 inflation and unemployment shows that ex ante, before the realization

of g_I and g_C, we have

$$\begin{aligned}\mathbb{E}\left[\pi_2-\pi_1\right] &= \int\int_{g_I\geq \underline{g}}\left[-\frac{1}{\tilde{\theta}}g_I+\frac{1}{1+\tilde{\theta}}g_I\right]f\left(g_I\right)dg_I f\left(g_C\right)dg_C \\ &\quad +\int\int_{g_I<\underline{g}}\left[-\frac{1}{1+\tilde{\theta}}g_C+\frac{1}{1+\tilde{\theta}}g_I\right]f\left(g_I\right)dg_I f\left(g_C\right)dg_C \\ &= -\frac{1}{\tilde{\theta}}\int_{g_I\geq \underline{g}} g_I f\left(g_I\right)dg_I<0.\end{aligned} \tag{A.6}$$

This last inequality follows because g_I is assumed to have mean zero, and we have already shown that $\underline{g}<0$.

For the average change in unemployment between periods 2 and 1:

$$\begin{aligned}\mathbb{E}\left[u_2-u_1\right] &= \int\int_{g_I\geq \underline{g}}\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}g_I-g_I\right)f\left(g_I\right)dg_I f\left(g_C\right)dg_C \\ &\quad +\int\int_{g_I<\underline{g}}\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}g_I-\frac{\tilde{\theta}}{1+\tilde{\theta}}g_C\right)f\left(g_I\right)dg_I f\left(g_C\right)dg_C \\ &= -\int_{g_I\geq \underline{g}} g_I f\left(g_I\right)dg_I<0,\end{aligned} \tag{A.7}$$

which proves part a. Part b is straightforward and proved in the main text following the theorem. ■

Proof of Theorem 3.

Differentiating the (A.6) and (A.7), we obtain

$$\frac{d\mathbb{E}\left[\pi_2-\pi_1\right]}{d\tilde{\theta}}=\frac{1}{\tilde{\theta}^2}\int_{g_I\geq \underline{g}} g_I f\left(g_I\right)dg_I+\frac{1}{\tilde{\theta}}\underline{g}f\left(\underline{g}\right)\frac{d\underline{g}}{d\tilde{\theta}}>0,$$

$$\frac{d\mathbb{E}\left[u_2-u_1\right]}{d\tilde{\theta}}=\underline{g}f\left(\underline{g}\right)\frac{d\underline{g}}{d\tilde{\theta}}>0,$$

proving Theorem 3.b. To prove Theorem 3.a note that

$$\mathbb{E}\left[u_1+u_2\right]=\mathbb{E}\left[2u_1+u_2-u_1\right]=\mathbb{E}\left[u_2-u_1\right],$$

and we have already shown that the last expression increases with $\tilde{\theta}$. Now use (6) and (7)

and (A.6) to obtain that

$$\mathbb{E}\left[\pi_1+\pi_2\right]=\mathbb{E}\left[2\pi_1+\pi_2-\pi_1\right]=-\frac{2}{\tilde{\theta}}u^*+\mathbb{E}\left[\pi_2-\pi_1\right]=-\frac{2}{\tilde{\theta}}u^*-\frac{1}{\tilde{\theta}}\int_{g_I\geq\underline{g}}g_I f\left(g_I\right)dg_I. \quad \text{(A.8)}$$

Using (A.8), we have

$$\frac{d\mathbb{E}\left[\pi_1+\pi_2\right]}{d\tilde{\theta}}=\frac{2}{\tilde{\theta}^2}u^*+\frac{1}{\tilde{\theta}^2}\int_{g_I\geq\underline{g}}g_I f\left(g_I\right)dg_I+\frac{1}{\tilde{\theta}}\underline{g}f\left(\underline{g}\right)\frac{d\underline{g}}{d\tilde{\theta}}.$$

Since $g_I<-u^*$, we have $\frac{d\mathbb{E}[\pi_1+\pi_2]}{d\tilde{\theta}}<\frac{1}{\tilde{\theta}^2}u^*+\frac{1}{\tilde{\theta}}\underline{g}f\left(\underline{g}\right)\frac{dg}{d\tilde{\theta}}$. From (A.5), we have

$$\frac{d\mathbb{E}\left[\pi_1+\pi_2\right]}{d\tilde{\theta}}<\frac{1}{\tilde{\theta}}\left(\frac{1}{\tilde{\theta}}u^*-\frac{\frac{1}{\left(1+\tilde{\theta}\right)^2}\sigma_g^2}{\sqrt{\left(u^*\right)^2+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\sigma_g^2}}\underline{g}f\left(\underline{g}\right)\right).$$

and the last expression is negative if and only if $f\left(\cdot\right)$ is sufficiently small.

To prove Theorem 3.c, note that

$$\begin{aligned}E\left[\left(u_2-u_1\right)^2\right] &= \left(\frac{1}{1+\tilde{\theta}}\right)^2\int_{g_I\geq\underline{g}}\left(g_I\right)^2 f\left(g_I\right)dg_I+\\ &\quad+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\int\int_{g_I<\underline{g}}\left(g_C^2+g_I^2\right)f\left(g_C\right)dg_C f\left(g_C\right)dg_C,\end{aligned}$$

which can be rewritten as

$$\begin{aligned}E\left[\left(u_2-u_1\right)^2\right] &= \left(\frac{1}{1+\tilde{\theta}}\right)^2\int_{g_I\geq\underline{g}}\left(g_I\right)^2 f\left(g_I\right)dg_I\\ &\quad+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\int_{g_I<\underline{g}}\left(\left(g_I\right)^2+\sigma_g^2\right)f\left(g_I\right)dg_I.\end{aligned}$$

Using this and (A.7), we obtain

$$\begin{aligned}\mathbb{V}(u_2-u_1) &= \left(\frac{1}{1+\tilde{\theta}}\right)^2\int_{g_I\geq\underline{g}}(g_I)^2 f(g_I)dg_I \\ &\quad+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\int_{g_I<\underline{g}}\left((g_I)^2+\sigma_g^2\right)f(g_I)dg_I \\ &\quad-\left(\int_{g_I\geq\underline{g}}g_I f(g_I)dg_I\right)^2\end{aligned}$$

$$\begin{aligned}\frac{d\mathbb{V}(u_2-u_1)}{d\tilde{\theta}} &= -2\frac{1}{\left(1+\tilde{\theta}\right)^3}\int_{g_I\geq\underline{g}}(g_I)^2 f(g_I)dg_I \\ &\quad+2\left(\frac{\tilde{\theta}}{\left(1+\tilde{\theta}\right)^3}\right)\int_{g_I<\underline{g}}\left((g_I)^2+\sigma_g^2\right)f(g_I)dg_I \\ &\quad+\left(2\left(\int_{g_I\geq\underline{g}}g_I f(g_I)dg_I\right)\underline{g}+\left(\frac{\tilde{\theta}}{1+\tilde{\theta}}\right)^2\left(\left(\underline{g}\right)^2+\sigma_g^2\right)-\left(\frac{1}{1+\tilde{\theta}}\right)^2\left(\underline{g}\right)^2\right)f(\underline{g})\frac{d\underline{g}}{d\tilde{\theta}}\end{aligned}$$

Evaluated at $\tilde{\theta}=0$, and hence $\underline{g}=0$, we obtain

$$\frac{d\mathbb{V}(u_2-u_1)}{d\tilde{\theta}}=-2\int_{g_I\geq 0}(g_I)^2 f(g_I)dg_I<0.$$

To prove the corresponding result for inflation, note that

$$\begin{aligned}\pi_2\left(g_I,g_C\right)-\pi_1 &= \begin{cases}-\frac{1}{\tilde{\theta}}g_I+\frac{1}{1+\tilde{\theta}}g_I \text{ if } g_I\geq\underline{g}\\ -\frac{1}{1+\tilde{\theta}}g_C+\frac{1}{1+\tilde{\theta}}g_I \text{ if } g_I<\underline{g}\end{cases} \\ &= \frac{1}{\tilde{\theta}}\left(u_2-u_1\right).\end{aligned}$$

The proof for $\frac{d\mathbb{V}(\pi_2-\pi_1)}{d\tilde{\theta}}<0$ then uses the fact that that

$$\frac{d\mathbb{V}(\pi_2-\pi_1)}{d\tilde{\theta}}=-\frac{2}{\tilde{\theta}^3}\mathbb{V}(u_2-u_1)+\frac{1}{\tilde{\theta}^2}\frac{d\mathbb{V}(u_2-u_1)}{d\tilde{\theta}},$$

which implies that $\frac{d\mathbb{V}(\pi_2-\pi_1)}{d\tilde{\theta}}<0$ for $\tilde{\theta}$ close to 0. ■

Proof of Proposition 2. We start with the Rogoff case, where shocks across period are assumed to be uncorrelated. From equation (12), the expected period 1 and 2 loss functions are equal and given by

$$\mathbb{E}\left(\mathcal{L}_t\right) = \frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\left(1+\tilde{\theta}\right)^2}\sigma_g^2 + \frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}(u^*)^2. \tag{A.9}$$

The optimal θ^{Rogoff} is given by the first-order condition for $\mathbb{E}\left(\mathcal{L}_1+\mathcal{L}_2\right)$ with respect to $\tilde{\theta}$, where

$$\frac{d\mathbb{E}\left(\mathcal{L}_1+\mathcal{L}_2\right)}{d\tilde{\theta}} = 2\left(\frac{\tilde{\theta}-\theta}{(1+\tilde{\theta})^3}\sigma_g^2 - \frac{\theta}{\tilde{\theta}^3}(u^*)^2\right). \tag{A.10}$$

When $\tilde{\theta}=\theta$, this derivative is clearly negative. As $\tilde{\theta}\to-\infty$, the positive terms in (A.10) dominate. Together, this shows that $\theta < \tilde{\theta}^{Rogoff} < \infty$.

Now we turn to the case with political turnover. The first period loss function as well as the loss function conditional on the challenger being elected is the same as in (A.9). Conditional on the incumbent being reelected, (12) gives

$$\mathbb{E}\left(\mathcal{L}_2\,|\text{incumbent}\right) = \frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}\left(g_I+u^*\right)^2.$$

Hence

$$\mathbb{E}\left(\mathcal{L}_1+\mathcal{L}_2\right) = \left(1+F\left(\underline{g}\right)\right)\left(\frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\left(1+\tilde{\theta}\right)^2}\sigma_g^2 + \frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}(u^*)^2\right) + \int_{\underline{g}}^{\infty}\frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}\left(g_I+u^*\right)^2 f(g_I)dg_I.$$

Using the Leibniz rule to differentiate integrals, we obtain

$$\begin{aligned}\frac{d\mathbb{E}\left(\mathcal{L}_1+\mathcal{L}_2\right)}{d\tilde{\theta}} &= \left(1+F\left(\underline{g}\right)\right)\left(\frac{\tilde{\theta}-\theta}{(1+\tilde{\theta})^3}\sigma_g^2 - \frac{\theta}{\tilde{\theta}^3}(u^*)^2\right) + \left(\frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\left(1+\tilde{\theta}\right)^2}\sigma_g^2 + \frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}(u^*)^2\right) f\left(\underline{g}\right)\frac{d\underline{g}}{d\tilde{\theta}} \\ &\quad -\frac{1}{2}\frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}\left(\underline{g}+u^*\right)^2 f(\underline{g})\frac{d\underline{g}}{d\tilde{\theta}} - \int_{\underline{g}}^{\infty}\frac{\theta}{\tilde{\theta}^3}\left(g_I+u^*\right)^2 f(g_I)dg_I.\end{aligned}$$

Using the fact that at $g_I=\underline{g}$, the expected loss from the challenger and the incumbent is

the same, that is, $\frac{\tilde{\theta}^2+\theta}{\left(1+\tilde{\theta}\right)^2}\sigma_g^2 + \frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}(u^*)^2 = \frac{\tilde{\theta}^2+\theta}{\tilde{\theta}^2}\left(\underline{g}+u^*\right)^2$, we obtain

$$\frac{d\mathbb{E}\left(\mathcal{L}_1+\mathcal{L}_2\right)}{d\tilde{\theta}} = \left(1+F\left(\underline{g}\right)\right)\left(\frac{\tilde{\theta}-\theta}{(1+\tilde{\theta})^3}\sigma_g^2 - \frac{\theta}{\tilde{\theta}^3}(u^*)^2\right) - \int_{\underline{g}}^{\infty}\frac{\theta}{\tilde{\theta}^3}\left(g_I+u^*\right)^2 f(g_I)dg_I. \quad \text{(A.11)}$$

For $\tilde{\theta}$ close to 0 this entire expression is clearly negative, and by definition, the first expression is 0 at $\tilde{\theta} = \tilde{\theta}^{Rogoff}$. As $\tilde{\theta} \to \infty$ the positive terms dominate in (A.11), giving $\tilde{\theta}^{Rogoff} < \tilde{\theta}^* < \infty$. ■

B Empirical Robustness

This Section reports robustness for our empirical results. Table **??** reports summary statistics for our 1980-1998 sample of developed countries.

Table A1: Summary Statistics 1980-1998 Developed Countries

	N	Mean	Std	Min	Max
$Reelect_{i,t}$	95	.4947368	.5026247	0	1
$CBI_{i,t}$	95	.3676574	.1548495	.1366319	.6785715
"Appointment Independence"	95	.5346491	.1550891	.0833333	.8333333
"Instrument Independence"	95	.2326316	.2326728	0	.6666667
"Objectives Independence"	95	.44	.3095639	0	1
"Fiscal Independence"	95	.3433626	.2124984	.0777778	.8541667

Table A2 reports an estimation of a logit model for our main empirical result in Table **??**. We see that appointment independence continues to enter negatively and significantly, and objectives independence enters positively and signifificantly. Our results are therefore not sensitive to whether we estimate them via OLS or in a logit specification. Table A3 shows analogous OLS regressions without the GDP growth control. We see that controlling for GDP growth increases the precision of our estimates, as one would expect if voters learn from realized unemployment, but results are similar in magnitude if slightly noisier for the developed country sample when we do not control for GDP growth. Finally, Figure A1 visually shows the robust negative relationship between appointment independence and reelection probabilities and the positive relationship between objectives independence and reelection probabilities for our sample of Euro countries.

Table A2: Logit Model of Probability of Reelection onto Central Bank Independence 1980-1998

	Dependent Variable: $Reelect_{i,t}$									
CBI Measure	Combined		Appointment		Instrument		Objectives		Fiscal	
Central Bank Laws	2.93	1.68	-3.88***	-2.07	3.07*	1.03	2.41***	1.12***	2.96	1.31
	(1.34)	(1.17)	(-2.61)	(-1.61)	(1.84)	(0.94)	(3.40)	(2.60)	(1.63)	(1.16)
GDP Growth	23.83	37.15*	32.78	33.77	35.88	36.03*	19.62	32.79	28.83	38.58*
	(0.89)	(1.74)	(1.21)	(1.61)	(1.31)	(1.68)	(0.69)	(1.44)	(1.08)	(1.79)
Const.	-1.80**	-1.41**	1.10*	0.38	-1.84**	-1.01*	-2.11***	-1.19**	-1.80**	-1.27**
	(-1.96)	(-2.05)	(1.68)	(0.62)	(-2.22)	(-1.95)	(-3.56)	(-2.53)	(-2.19)	(-2.08)
N	51	95	51	95	51	95	51	95	51	95
Pseudo R-sq	0.05	0.04	0.09	0.05	0.10	0.04	0.08	0.05	0.07	0.05
AIC	73.20	131.82	70.49	131.07	69.42	132.01	71.13	130.64	71.71	131.64

Note: This table reports estimations from a logit model of $Reelect_{i,t}$ onto a constant $CBI_{i,t}$ and $GDP_{i,t}$. The sample and all variable definitions are as described in Table 1. Standard errors clustered by year in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

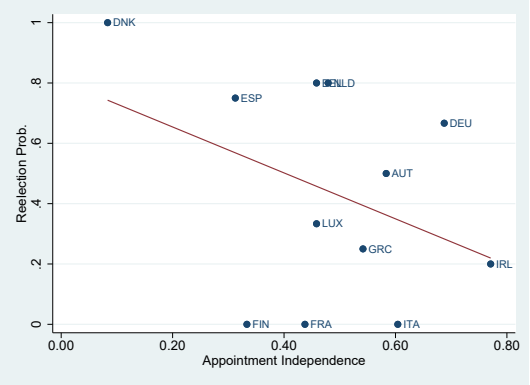
Table A3: Probability of Reelection onto Central Bank Independence 1980-1998 - No GDP Control

	Dependent Variable: $Reelect_{i,t}$									
CBI Measure	Combined		Appointment		Instrument		Objectives		Fiscal	
Central Bank Laws	0.66	0.24	-0.74***	-0.46	0.58	0.16	0.53***	0.28**	0.61	0.16
	(1.18)	(0.64)	(-2.99)	(-1.59)	(1.49)	(0.55)	(4.16)	(2.67)	(1.31)	(0.56)
Const.	0.21	0.41**	0.84***	0.74***	0.30*	0.46***	0.13	0.37***	0.26	0.44***
	(0.88)	(2.71)	(6.95)	(4.68)	(2.08)	(5.51)	(1.44)	(5.79)	(1.37)	(4.15)
N	51	95	51	95	51	95	51	95	51	95
R-sq	0.04	0.01	0.07	0.02	0.08	0.01	0.08	0.03	0.06	0.00

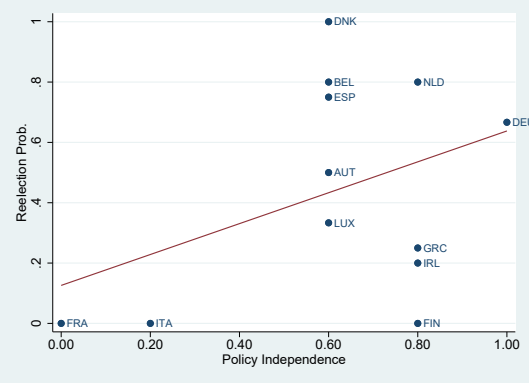
Note: This table reports regressions analogous to Table 1, but does not include the GDP growth control. Standard errors clustered by year in parentheses. * p <0.10, ** p <0.05, *** p <0.01.

Figure A1: Probability of Reelection vs. Central Bank Laws - Euro Sample

Panel A: Appointment Independence



Panel B: Objectives Independence



Note: This figure plots the average probability of reelection for Euro countries on the y-axis against aspects of central bank independence on the x-axis. Reelection probabilities are averages for the period 1980-1998. The Euro sample is defined as in Table 1