A Model of Politics and the Central Bank

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Abstract

We present a two-period model examining how the central bank and the elected government jointly shape elections and economic outcomes. An apolitical central bank minimizes a quadratic loss function in inflation and unemployment along an expectational Phillips curve, which is shifted by the government's quality. Fully rational voters optimally choose between the incumbent, whose quality they infer from unemployment, and a challenger of unknown quality. We find that governments prefer more inflation-averse central banks than the social planner, rationalizing the political success of inflation-targeting in practice. Inflation-targeting, however, has negative economic consequences by allowing lower quality incumbents to be reelected.

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, 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, 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. 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.[2]

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 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 recently 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 next presidential election. 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 inflation-targeting regimes. 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. 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 inflation targeting 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 targeting. The election channel of monetary policy identified in our model implies that an 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 with lower, not higher, unemployment volatility.[6]

[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).

[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

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), Brender and Drazen (2008), and Bernhard and Leblang (1999) 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 public.

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

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

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

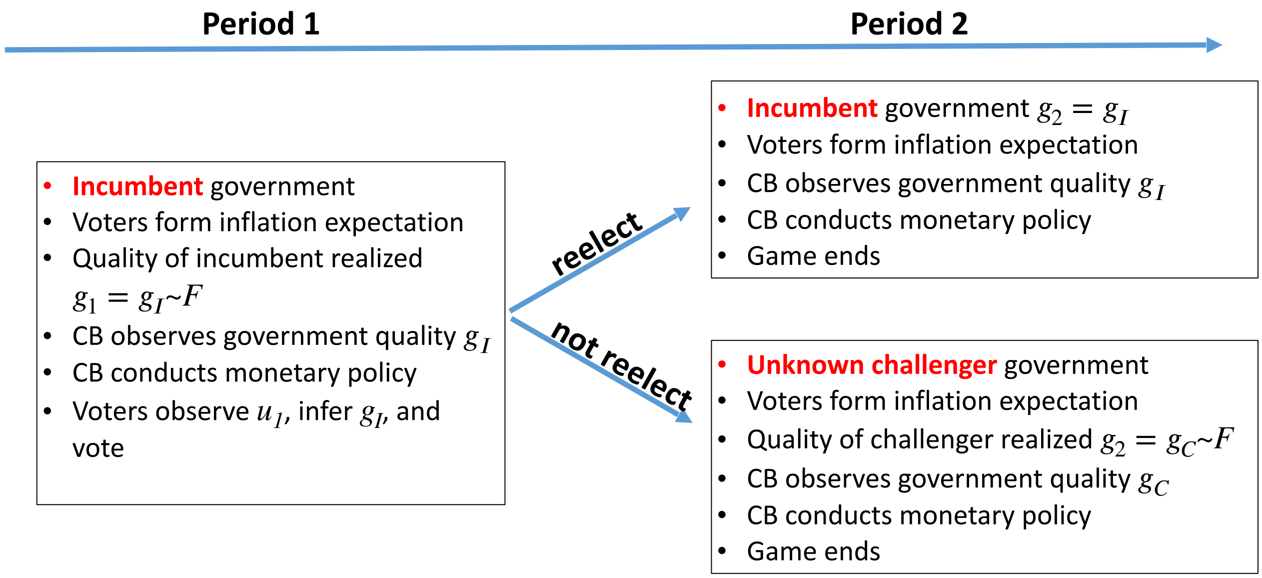
Period 1 starts with the incumbent government in power. The incumbent's quality is denoted by g_I, so $g_1 = g_I$. We assume that the quality of the incumbent is drawn from a distribution F, with corresponding probability density f. The distribution is assumed to have mean 0, variance σ_g^2, and the 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 $\mathbb{E}(g_2 \mid I_2) = g_I$. 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, $\mathbb{E}(g_2 \mid I_2) = \mathbb{E}(g_C) = 0$, 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]

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

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

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

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.

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[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 $\mathbb{E}\left(\mathcal{L}_1 + \mathcal{L}_2\right)$ in our model with elections, and $\tilde{\theta}^{Rogoff}$ as the $\tilde{\theta}$ that minimizes $\mathbb{E}\left(\mathcal{L}_1 + \mathcal{L}_2\right)$ 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**

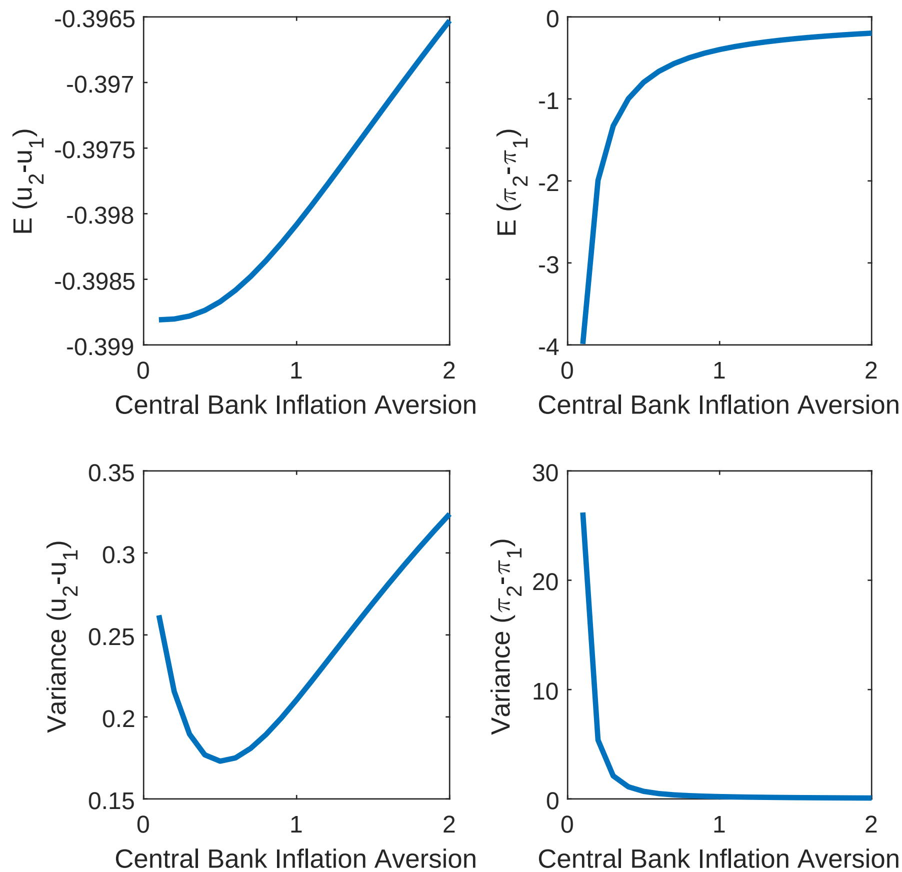

Figure 3: This figure shows the difference between period 2 and period 1 unemployment (left panels) and inflation (right panels) as a function of the central bank inflation weight $\tilde{\theta}$ for $\sigma_g = 1$ and $u^* = -2$. The upper panels show the average (Theorem 3.c), and the lower panels 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 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.

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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

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

which delivers (12). For $t=2$, $\mathbb{V}\left(g_2\,|I_2\right)=0$ and $\mathbb{E}\left(g_2\,|I_2\right)=g_I$ if the incumbent is reelected and $\mathbb{V}\left(g_2\,|I_2\right)=\sigma_g^2$ and $\mathbb{E}\left(g_2\,|I_2\right)=0$ 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

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

■

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

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

■

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

$$\mathbb{E}\left[\pi_2 - \pi_1\right] = \int\int_{g_I \geq \underline{g}} \left[-\frac{1}{\tilde{\theta}} g_I + \frac{1}{1+\tilde{\theta}} g_I\right] f\left(g_I\right) dg_I f\left(g_C\right) dg_C \qquad \text{(A.6)}$$

$$+ \int\int_{g_I < \underline{g}} \left[-\frac{1}{1+\tilde{\theta}} g_C + \frac{1}{1+\tilde{\theta}} g_I\right] f\left(g_I\right) dg_I f\left(g_C\right) dg_C$$

$$= -\frac{1}{\tilde{\theta}} \int_{g_I \geq \underline{g}} g_I f\left(g_I\right) dg_I < 0.$$

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:

$$\mathbb{E}\left[u_2 - u_1\right] = \int\int_{g_I \geq \underline{g}} \left(\frac{\tilde{\theta}}{1+\tilde{\theta}} g_I - g_I\right) f\left(g_I\right) dg_I f\left(g_C\right) dg_C \qquad \text{(A.7)}$$

$$+ \int\int_{g_I < \underline{g}} \left(\frac{\tilde{\theta}}{1+\tilde{\theta}} g_I - \frac{\tilde{\theta}}{1+\tilde{\theta}} g_C\right) f\left(g_I\right) dg_I f\left(g_C\right) dg_C$$

$$= -\int_{g_I \geq \underline{g}} g_I f\left(g_I\right) dg_I < 0,$$

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

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

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

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

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

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

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

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