TEXTO PARA DISCUSSÃO

No. 657

Transitions in Central Bank Leadership

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July 2017

Abstract

We assemble a novel dataset on transitions in central bank leadership in several countries, and study how monetary policy is conducted around those events. We find that policy is tighter both at the last meetings of departing governors and first meetings of incoming leaders. This finding cannot be fully explained by endogenous transitions, the effects of the zero lower bound, surges in inflation expectations, omitted variables such as fiscal policy and uncertainty nor electoral cycles. We conclude by offering two possible, perhaps complementary, explanations for these results. One based on a simple signalling story, another based on career and reputation concerns.

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1 Introduction

Owing to the importance of monetary policy, a lot of attention is given to central banks as institutions, and to the people in their leadership positions. Recently, this fact came into particular prominence due to the end of Fed Chairman Ben Bernanke's term and the consequent speculations about possible successors. Before it was confirmed that vice-chairwoman Janet Yellen would be the next Fed chair, there were several articles in the media discussing pros and cons of different "candidates".[1] This reflects the importance that is assigned to the identity of a central bank's leader.

This view also finds resonance in the academic literature. Romer and Romer (2004), for example, analyze historical Fed transcripts and past speeches by Fed officials and find support to the idea that a central banker's views about the economy are a key determinant of monetary policy. In terms of theory, Rogoff (1985) flashes out the importance of central bankers, by showing that, in order to address the time inconsistency problem of monetary policy, the government should appoint a central banker who is more conservative than society as a whole.

Despite the importance assigned to central bank leaders, the literature has all but overlooked transitions in central bank leadership.[2,3] In this paper, we study monetary policy around those episodes. To the best of our knowledge, we document a novel empirical fact. Namely, transition periods, which encompass both the first meetings of the incoming governor and the last meetings of the departing one, are associated with a tight monetary policy stance. After failing to find exclusive empirical support for several natural explanations, we propose two possible, perhaps complementary, explanations for this result. Namely, signalling dynamics and career concerns, as we explain below.

Sections 2 and 3 establish the empirical fact. To that end, we assemble a novel dataset containing transitions in central bank leadership in 35 countries since 1984. In particular, our (unbalanced) panel has information on nearly 70 transitions in central bank leadership. After controlling for factors that affect monetary policy decisions through a standard Taylor rule, we can establish how central bank behavior differs in the first monetary policy meetings under a new central banker and in the last meetings of a departing one, relative to the other "usual" meetings.

[1]For a particularly stark opinion piece, see: "Why Janet Yellen, Not Larry Summers, Should Lead the Fed" by Joshph Stiglitz in the New York Times at September 6, 2013.

[2]Notable exceptions include Kuttner and Posen (2010) and Moser and Dreher (2010).

[3]By transitions, we mean the change of the chair of the central bank. Throughout the text, we use the terms leader, chair, governor and central banker interchangeably.

We find that both first and last meetings – i.e. the transition period – are associated with a tight monetary policy stance. In our preferred specification, interest rates exceed the level predicted by a simple Taylor rule that accounts for policy inertia, inflation and activity by 0.076 (0.075) percentage points in the last (first) meetings, on average. To put this in context, note that over 50% of interest changes in our sample are of 0.25 percentage points.

We fail to find exclusive empirical support for some possible straightforward explanations. In particular, results are not driven by the zero lower bound constraint, or a particular specification of the Taylor rule. Also, our results cannot be explained by electoral cycles that might coincide with transitions in central bank leadership, nor by fiscal developments around those times. Moreover, they cannot be explained by unusually high uncertainty or inflation expectations around central bank transitions. Finally, we show that these results are not driven by two immediate endogeneity concerns. Namely, the timing of the transition and the choice of the new governor.

Section 4 then concludes by entertaining two possible explanations for our results. The first is based on signalling dynamics. Assume that the public is uncertain whether a new governor is a Hawk (less tolerant with inflation) or a Dove (more tolerant). A well-known theoretical result (e.g. Barro (1986) and Vickers (1986)) states that an incoming governor, whether Hawk or Dove, has incentives to tighten monetary policy in the first meetings and, thus, face more favorable inflation expectations going forward. In turn, we claim that the departing governor also has incentives to tighten policy in order to make it easier for an incoming Hawk to signal its type and separate from a Dove. As this result is not that intuitive and, to our knowledge, novel, we formalize it in the context of a simple signalling model developed in Appendix D. The model makes explicit how a monetary contraction in the last meeting helps to sustain a separating equilibrium.[4]

The second explanation, based on career and reputation concerns, speaks only to last meetings. By acting as a Hawk, the governor would enhance (or protect) his reputation and career prospects after the end of his mandate. Given the time inconsistency problem of monetary policy (e.g. Kydland and Prescott (1977) and Barro and Gordon (1983b)), by keeping inflation low, a governor that acts as a Hawk might be perceived as someone able to commit, and not vulnerable to short-run pressures. These attributes are arguably valuable

[4]Our model fits within the literature on signalling built on the Barro and Gordon (1983b) classical framework developed to study the time inconsistency problem of monetary policy. Contributions include Backus and Driffill (1985a), Backus and Driffill (1985b), Barro (1986), Vickers (1986), Cukierman and Liviatan (1991), Ball (1995), Walsh (2000), Sibert (2002), and King et al. (2008). For a review of this literature, see Walsh (2010), chapter 7.

for career prospects. In addition, career incentives could be stronger in the last meetings for the following reasons. First, governors may discount less the near future close to the end of their mandates. Second, monetary policy decisions are arguably more publicized during transitions. Finally, potential employers, clients and partners could put more weight on recent events.

In Appendix B we explore some heterogenous effects that might speak to the explanations that we put forward. Altogether, we see our empirical results as suggestive of the presence of both signalling and career incentives in monetary policy. Of course, as it is impossible to exhaust all possibilities, other explanations may be consistent with the body of evidence provided in this paper.

To our knowledge, Hansen and McMahon (2016) is the only paper to offer empirical evidence on signalling in monetary policy. They use data from the Bank of England's Monetary Policy Committee to show that new members tend to be tougher on inflation initially to signal they are not dovish.[5] However, their paper is silent on potentially signalling incentives of departing members. Another related paper is Johnson et al. (2012), who document that, as the end of their mandates approaches, regional Federal Reserve Bank presidents grow hawkish relative to members of the Board of Governors and continuing presidents.[6] In any case, as the compositions of different monetary policy committees overlap, incentives to adopt a more or less hawkish stance during one's mandate should not translate into systematic monetary policy tightening during transitions in main leadership.

Finally, Kuttner and Posen (2010) and Moser and Dreher (2010) build daily datasets to study the impact of governor appointments on financial markets. Kuttner and Posen (2010) consider 61 announcements spanning fifteen industrialised countries over three decades. They find that exchanges rates respond to announcements, but in a statistically significant way only to unanticipated ones. They argue the identity of the new governor, rather than the transition *per se*, explains such response. Moser and Dreher (2010), instead, consider 44 resignations and 21 appointments spanning twenty emerging countries over nearly fifteen years. They find that the announcement of the replacement of a governor negatively affects financial markets. This result is driven by those announcements that happened before the officially scheduled end of tenure. They claim that this result is in line with the credibility problem an incoming governor may face, which is particularly acute in situations in which central bank

[5]Hansen and McMahon (2016) cite other references that contain empirical evidence that is somewhat consistent with signalling – although signalling was not the focus of those papers.

[6]The authors interpret this finding as evidence that consensus building occurs by conforming preferences rather than convincing arguments.

independence is in question. In contrast with these contributions, our results and proposed explanations suggest that transitions *per se* affect incentives to conduct monetary policy.

2 Data and empirical strategy

The aim of the paper is to establish if monetary policy differs at the end or the beginning of the mandate, i.e. during transitions in central bank (CB) leadership, from other periods. To do so, we assemble a novel dataset and design an empirical strategy to estimate the effects of transitions in monetary policy.

2.1 Data

The dataset is a panel composed of 35 countries, where each observation c, m consists of a country c and a monetary policy meeting m. One should note that m does not correspond to the same time period. After all, the m-th meeting we have for, say, the United States FOMC is not at the same date as the m-th meeting of the UK monetary policy committee. In fact, they do not even have the same periodicity: countries vary in the number of meetings held per year – spanning from monthly to quarterly meetings. In addition, countries enter the sample at different years. The US is the first country to enter the sample in 1984, whereas Georgia is the last one in 2008. Tables 21 and 22 in Appendix C.1 list all countries, their number of meetings, governors and transitions in the full sample as well as in the restricted sample used in the baseline estimation.

The panel is unbalanced because we only consider observations for which the instrument target is the interest rate. Moreover, we only consider countries where there is a meeting calendar, or we could track the date of every monetary policy decision. For instance, until the late 1990s many countries simply announced when there was a change in policy. In the absence of a meeting calendar, we cannot track when the monetary committee actively decided to keep interest rates constant. Finally, we drop the financial crisis period – 2008 and 2009 – since this would confound our results on transition effects. Indeed, monetary policy during this period was conducted in an unconventional way, so it would be hard to establish whether monetary policy changed due to the transitions *per se* in comparison to regular policy. In addition, if the model were estimated to also account for the data during the crisis period, it would be fare worse in describing monetary policy during normal times. Since many central banks pursued unconventional monetary policy even after the crisis period, we also consider a specification in which we drop every observation after the year 2007.

In the sample used in our baseline estimation, the average number of meetings per country is 115.2 and the median is 105. Regarding the number of transitions between governors, there are 71 meetings in which governors are participating for the first time, whereas 70 for the last time. The main variables used in our panel regressions are:[7]

- Policy interest rate decisions (in %): $i_{c,m}$;
- Inflation (YoY): $\pi_{c,m}$;
- Economic activity : $y_{c,m}$ (mostly unemployment when available, output growth otherwise);
- Dummy for the first meetings of a CB governor: $FM_{c,m}$;
- Dummy for the last meetings of a CB governor: $LM_{c,m}$.

The data come from four main sources: the OECD database, *Bloomberg* terminals, *Datastream - Thomson Reuters* terminals and individual central banks' websites. Since specific meeting dates are typically irregular, policy rate decisions and governors' transitions were obtained at each central bank's website. The macroeconomic series were mainly obtained from the OECD database and data terminals. However, there are countries whose time series are too short or not available at terminals. For these countries, we complement the macroeconomic series with data from central banks' websites and national data bureaus.

We match the macroeconomic series with each central bank meeting of a given country c according to the following algorithm. First, we identify the calendar month of each meeting m. For instance, a meeting on the 17th of April counts as April. Then we match with the inflation and unemployment referring to that calendar month. However, some countries do not report unemployment monthly. In these cases we check the availability of quarterly data for unemployment. If not available, then we use quarterly data for GDP growth. We use the quarterly value for the three months of the corresponding quarter, as if it was a monthly variable. For instance, if the rate of unemployment was 7 percent for the second quarter of a given year, we input 7 percent in the cells referring to April, May and June. Then we proceed as before matching the quarterly rate to the meeting in the corresponding month.

Data on first and last meetings of governors are found in each central bank website. Normally, there is a webpage reporting the list of former governors with the initial and

[7]For data other than interest rates that were not originally seasonally adjusted, we use ARIMA X12 procedure to adjust for seasonality.

final dates of their mandates. If, for some governor in a given country, this information is ambiguous on the webpage, we checked the minutes of the relevant meetings in order to locate when the transition took place. In some transitions, the final meeting of a governor is not the one exactly before the first meeting of his successor, i.e. $LM_{c,m}$ does not necessarily lag $FM_{c,m}$. Sometimes a governor's term ends before the appointment of his successor. In between the mandates, there may appear an acting governor for a couple meetings. In Appendix C.2 we discuss in detail how these transitions are coded, but in any case our results vary little with reasonable code changes.

Finally, it is important to assuage a possible concern regarding our dataset. That is, the possibility that most transitions in our baseline estimation are clustered around a couple of years. Figure 1 shows that the transitions are scattered, with most of them happening after the late 1990s. In fact, most countries enter the full sample after the 1990s as shown in Figure 2.

Figure 1: Transitions per biennium

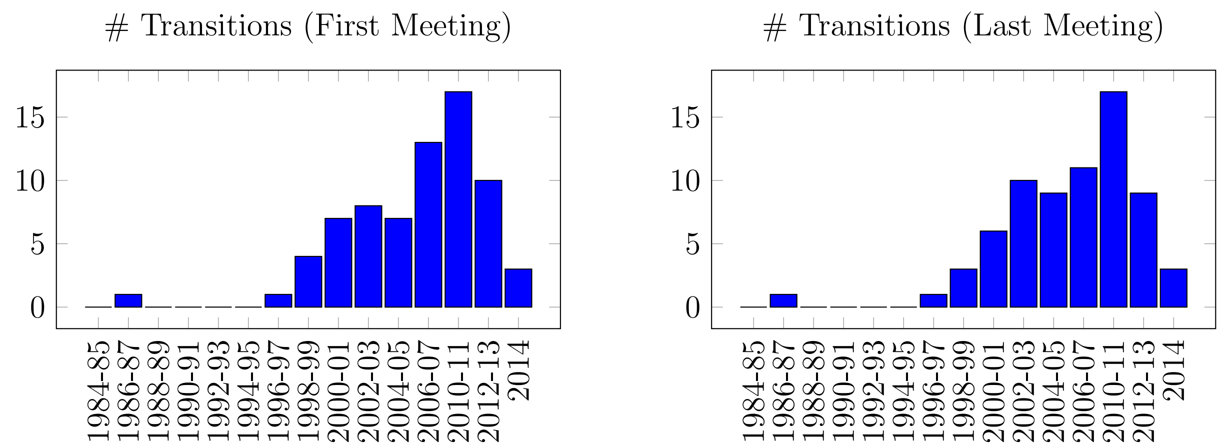
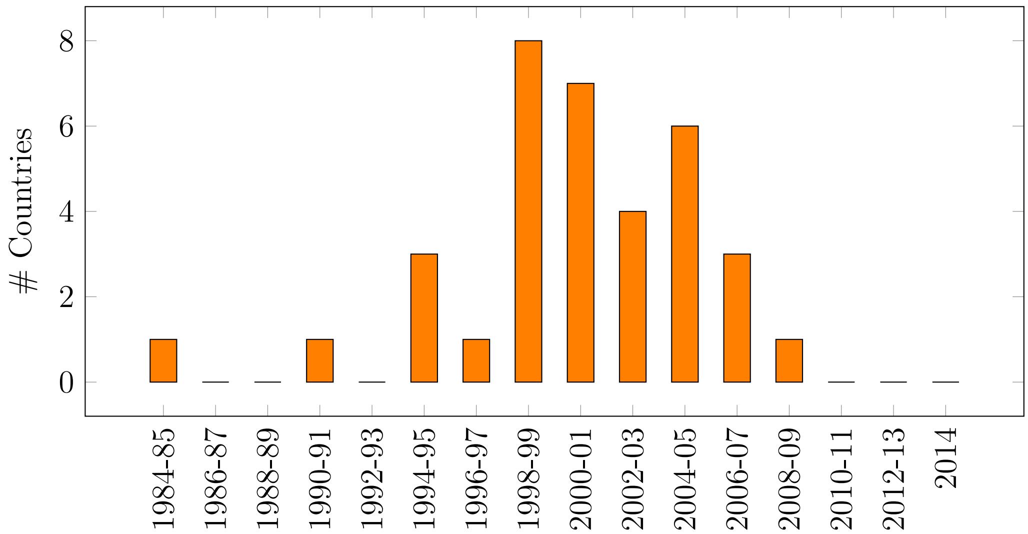


Figure 2: Countries entering the sample per biennium



2.2 Empirical strategy

Recall that $FM_{c,m}$ ($LM_{c,m}$) is a dummy which takes value one when m is among the first (last) meetings of a given CB governor in country c. In order to estimate the effects of transitions in monetary policy, we add $FM_{c,m}$ and $LM_{c,m}$ to a simple Taylor rule in which inflation $\pi_{c,m}$, economic activity $y_{c,m}$ (either unemployment or GDP growth as explained above) and lagged interest rate $i_{c,m-1}$ are accounted for. In particular, we pool all observations and allow the coefficients on each of these variables to vary across countries. Moreover, we allow the intercept to vary across countries c and years $t = 1984, ..., 2014$. Hence, we estimate the following Taylor rule:

$$i_{c,m} = \rho_c i_{c,m-1} + \alpha_{\pi,c}\pi_{c,m} + \alpha_{y,c}y_{c,m} + \beta_F FM_{c,m} + \beta_L LM_{c,m} + \delta_{c,t} + e_{c,m}. \quad (1)$$

Our coefficients of interest are β_F and β_L. The idea is that, once changes in monetary policy warranted by macroeconomic factors are accounted for, β_F and β_L capture the effect of transitions on the interest rate $i_{c,m}$.

By combining fixed effects and lagged dependent variable, least square estimators of β_F and β_L are not consistent. Due to the nature of our dataset, which includes heterogenous countries in many aspects, we must include fixed effects. In addition, many empirical and theoretical papers suggest that lagged interest rate should be included in the Taylor rule.[8] We follow Judson and Owen (1999) recommendation, based on a Monte Carlo study, to use regular fixed effect estimations when the panel is unbalanced and the time dimension is relatively large, as in our case. The intuition for their result is that the bias of including a lagged dependent variable in a fixed effects regression goes to zero as the time dimension becomes arbitrarily large. Alternatively, we could use GMM-style estimators, such as those discussed in Arellano and Bond (1991). Aside the controversial debate on the validity of the chosen instruments, these estimators are designed for datasets with larger cross-section dimension relative to time dimension, which is not our case.

Of course, some other endogeneity concerns may arise. Omitted variables, such as transitions in government, may correlate with interest rates and transitions in CB leadership. Similarly, reverse causation could also be a problem as changes in interest rates may trigger transitions. In addition, the Taylor rule might describe inadequately how monetary policy is conducted is some countries or situations. Throughout the paper, we address these and other issues by considering several subsamples, specifications and extensions for the Taylor rule. The fact that governors tighten monetary policy during transitions is remarkably robust.

Importantly, to estimate transition effects, the bulk of variation in monetary policy due to macroeconomic factors must be accounted for. Notice, for instance, that we do not control for inflation expectations, a relevant variable that informs monetary policy. The reason is data availability. In order to get a meaningful number of transitions, we consider several countries for which inflation expectations are not publicly available. It is reassuring, however, that despite this omission as well as the simplicity of the functional form above, the R^2 of our baseline specification is 99.6%. In particular, the smoothing term improves a lot the fit of the regression - R^2 would be 92.6% otherwise.

3 Results

Transition incentives faced by departing and incoming governors do not necessarily have to be limited to only the first and last meetings. For instance, a departing governor could influence his successor by changing policy at the penultimate meeting and not making any change at the very last meeting. Similarly, an incoming governor may have signalling incentives to tight policy not only in the first, but also in the second meeting. Hence, we report results

[8] An incomplete list includes Cukierman (1991), Clarida et al. (2000), Sack (2000), Orphanides (2003), Woodford (2003), Riboni and Ruge-Murcia (2010) and Coibion and Gorodnichenko (2012). Our results become much stronger if the lagged policy rate is excluded from the Taylor rule.

from regression (1) for different specifications, in which the variable $FM_{c,m}$ ($LM_{c,m}$) may include the first (last) n meetings. If $n = 2$, for instance, the specification consider the first (last) two meetings.

Before reporting the results, one word on inference: throughout the main text we report robust standard errors as usual. Nonetheless, in Appendix A.1.1 we discuss and report how our baseline results remain essentially the same when we use Driscoll and Kraay (1998) standard errors, which are tailored to macroeconomic panel data. In that appendix, we also discuss why the most common approach in the microeconometric literature, which in our case means to report standard errors robust to clustering at the country level, is not suitable.

3.1 Baseline

Table 1 reports the results from regression (1) for specifications with n (the number of meetings) varying from one to four. Notice that the number of transitions used to estimate the effects of interest when $n = 1$, i.e. 68 first and last meetings, are slightly smaller than we document as some covariates included in the Taylor are missing for some dates.[9]

Table 1: Main Regression: $i_{c,m}$ is the dependent variable

# Meetings	1	2	3	4
FM (β_F)	0.050*	0.075***	0.061**	0.034
	[0.077]	[0.001]	[0.045]	[0.175]
LM (β_L)	0.087*	0.076**	0.086***	0.087***
	[0.098]	[0.023]	[0.001]	[0.001]
# Obs	3916	3916	3916	3916
# First Meet	68	138	206	274
# Last Meet	68	134	198	256

P-value between [ ], calculated with robust standard errors.

[9]In a few cases, the first meeting of a country in the sample coincides with the first meeting of a governor. Hence, as the lagged interest rate would be missing for this observation, this transition only counts to estimate the coefficients of interest when $n > 1$.

Table 1 shows that both the first and last few meetings are associated with higher interest rates than those prescribed by the Taylor rule in comparison to regular meetings. These results are statistically significant and robust across specifications. Moreover, they are economically relevant: take column 2, it means that interest rates are on average 0.075 and 0.076 percentage point higher in the first and last meetings, respectively, than in other meetings. As reference for this magnitude, we note that over 50% of interest changes in our of sample are of 0.25 percentage points. In a few words, monetary policy is tight around transitions.

Besides being an important aspect of empirical Taylor rules, the interest rate smoothing addresses a concern that the new central banker might not be tightening policy. Assume that the departing banker increases interest rates above the level prescribed by the Taylor rule, generating a positive residual. Even if the new governor did not change policy, it is likely that macroeconomic conditions would have changed little from one meeting to the other so that the residual of the Taylor rule would remain positive. However, smoothing prevents this from happening. As the smoothing coefficient is quite high (almost always above 0.9), most of the interest rate hike engendered by the departing banker is absorbed by the Taylor rule. Consequently, a positive coefficient of similar magnitude means that there was indeed a further tightening during the first few meetings.

In Appendix A, we report results considering different specifications for the Taylor rule. We discuss how results would change were two lags included in Appendix A.1.2. In addition, as current inflation and activity might not be readily observed, in Appendix A.1.3 we also consider a specification with lagged values of inflation and activity instead. Results are robust, which mitigate concerns regarding misspecification of the estimated Taylor rule.

In the following section, we show that the transition effects we estimate diminish as meetings distance themselves from actual changes in leadership. Then, in the remainder of the empirical section, we dismiss possible rationalizations for the results above, such as interest rates at the zero lower bound, surges in inflation expectations, government expenditures and economic uncertainty around transitions, and simultaneity of transitions in central bank and government leaderships. Then, after arguing that results are not driven by the endogeneity of the transition timing or governor's choice, we propose two explanations. One based on signalling dynamics, another on career concerns.

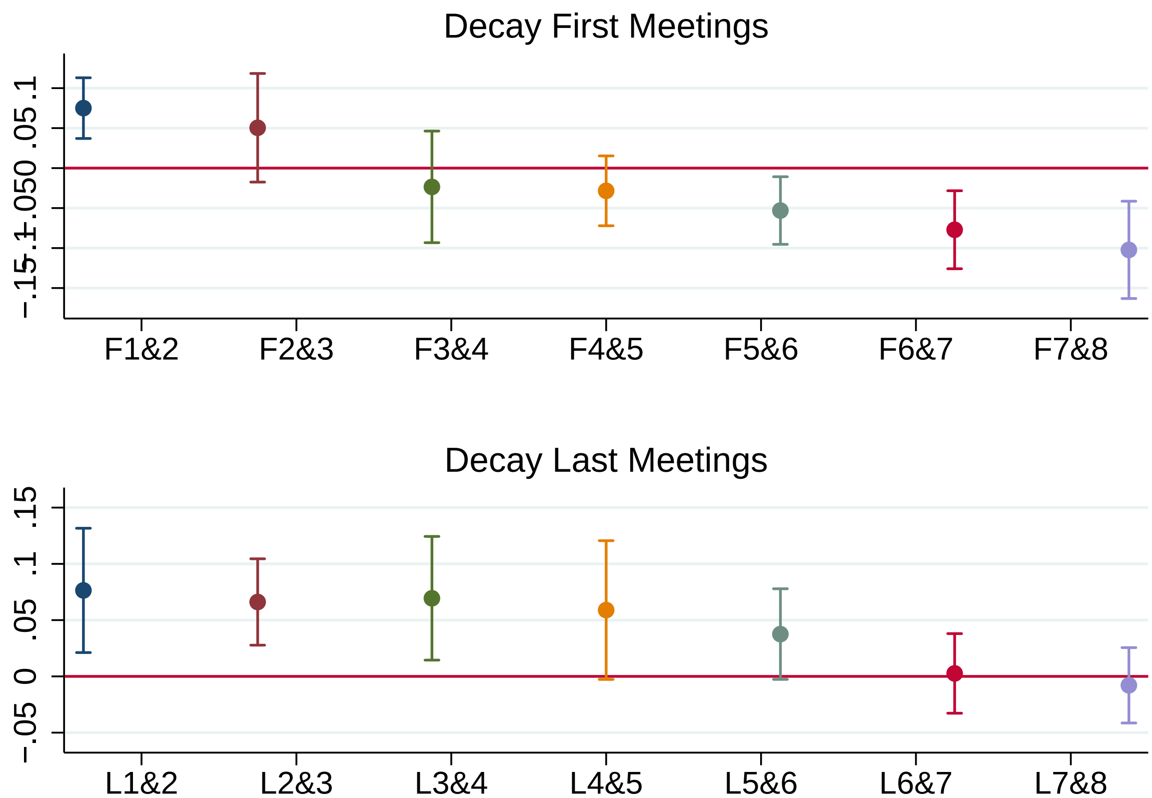
3.2 Decaying effect

We argued above that a departing (incoming) governor does not have to act precisely at the last (first) meeting; he could tighten monetary policy a bit before (later) and achieve his objectives in the same way. In particular, we considered above different specifications that encompass transitions happening up to four meetings before, and after, the change in leadership.

This argument loses strength as meetings grow more distant from the actual governor's change. After all, policy should return to normal. The goal of this section is to show that as the meetings distance themselves from actual change, the transition effects diminish. In particular, we drop $FM_{c,m}$ and $LM_{c,m}$ from the specification in (1), but add other two dummy variables across seven different specifications. The j-th specification includes one dummy variable that accounts for the j-th and $(j+1)$-th first meetings and another one that accounts for the last j-th and $(j+1)$-th meetings. For example, in the first specification, there are two dummies variables accounting for the first and last two meetings, respectively. Similarly, the second specification considers one dummy variable that accounts for the second and third meetings, as well as another dummy to account for the the penultimate and anti-penultimate meetings. The same logic applies for the subsequent specifications.

Figure 3 plots the coefficients for the dummy variables in these seven specifications. The upper (bottom) part of the graph plots the value of the coefficients associated with the first (last) meetings.

Figure 3: Decay: Rolling Transition (2 meetings)

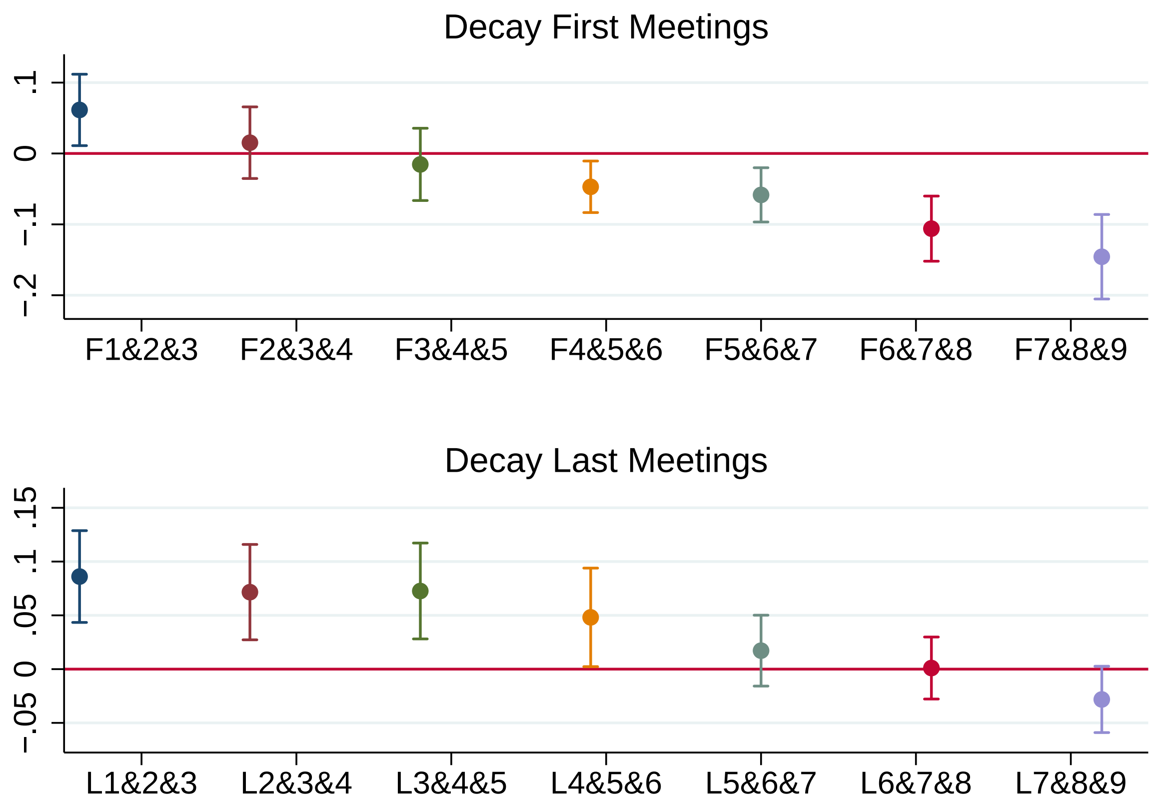


Notice that coefficients associated with last meetings fall as they grow distant from the actual leadership change. In particular, the coefficient becomes statistically indistinguishable from zero around the 5th meeting. Similarly, coefficients associated with the first meetings fall and become zero around the 3rd meeting. In addition, they become statistically negative before returning to zero.

We attribute this latter pattern to the lagged policy rate included in the Taylor rule. Assume that, due to some reason inherent to the first meetings, governors set the interest rate above the level prescribed by the Taylor rule. This reason, for example, could be signalling incentives. Due to the lagged term, the Taylor rule will prescribe a higher level of interest rate in the following meetings, although the reason to set a tighter policy stance is not present anymore. Hence, if governors understand this, they set the interest rate below the level prescribed by the Taylor rule. In other words, residuals of the Taylor rule become negative for a while until the excess tightening absorbed by the lagged term after the first meetings dissipates.

We find very similar results when we report the graph for a rolling window of three meetings instead, as shown by Figure 4.

Figure 4: Decay: Rolling Transition (3 meetings)



This decaying effect enhances the evidence discussed so far on the positive association between leadership transitions and tighter monetary policy. The next sections, after ruling out straightforward confounding factors that may explain our estimated transitions effects, aim to establish a causation direction that goes from transitions to tighter monetary policy.

3.3 Ruling out possible explanations

The previous sections document that monetary policy tightens around transitions. In this section we rule out straightforward explanations for these findings. First, we show that results are not driven by the zero lower bound. In this case, the Taylor rule is not appropriate to describe monetary policy.

Then, we show that our results still hold when we account for straightforward confounding factors. Namely, inflation expectations, fiscal policy, economic uncertainty and political transitions. These variables are potential confounding factors as they may correlate positively with both transitions in central bank leadership and hikes in interest rates.

In the remainder of the empirical section, we report results assuming that transitions last for $n = 2$ or $n = 3$ meetings, for brevity. In this way we are not limited to a too short time interval nor we are allowing the transition to last too long. Results for $n = 1$ and $n = 4$ are available upon request.

3.3.1 Zero lower bound

One possible concern is that the zero lower bound on nominal interest rates could bias our results. When economies are at the zero lower bound, Taylor rules usually predict negative rates. If, perhaps due to the inherent difficulty of conducting monetary policy at the zero lower bound, more transitions occur in these economies, the residuals around these transitions would tend to be positive. Hence, the coefficients associated with both FM and LM would be positively biased. In order to address this concern, we change the sample we use to estimate our main regression in three ways. Table 2 reports the results.

Table 2: Zero Lower Bound

	$RS, i > 0.5$	$RS, i > 0.5$	$t < 2008$	$t < 2008$	$FS, i > 0.5$	$FS, i > 0.5$
# Meet	2	3	2	3	2	3
FM (β_F)	0.070***	0.056*	0.078*	0.070*	0.039	0.037
	[0.004]	[0.084]	[0.062]	[0.075]	[0.231]	[0.260]
LM (β_L)	0.074**	0.085***	0.084	0.119***	0.064*	0.082***
	[0.035]	[0.002]	[0.135]	[0.005]	[0.059]	[0.002]
# Obs	3648	3648	2538	2538	4281	4281
# FM	127	189	79	118	147	220
# LM	128	186	77	114	150	222

P-value between [ ], calculated with robust standard errors.

First, we consider the restricted sample used in the baseline estimation, in which we drop the crisis years (2008 and 2009). In addition, we drop every observation for which the interest rate is equal to or lower then 0.5 percent (columns $RS, i > 0.5$). In this specification, the number of transitions drops to 67 meetings in which governors are participating either for the first or last time. Results change little in this case.

Second, we also report results considering the more drastic approach of dropping every observation after the year 2007 (columns $t < 2008$), when many central banks pursued unconventional monetary policy. As Figure 1 indicates, this drastic approach severely reduces the number of transitions used to estimate the coefficients of interested to 41 (both first and last meetings). Hence, some loss of precision is expected, although the magnitudes of the estimated coefficients are similar to those of our baseline results.

Finally, by including the crisis years (2008 and 2009), we consider the full sample but drop every observation for which the interest rate is equal to or lower then 0.5% (columns $FS, i > 0.5$). In this case, the number of transitions increases to 76 (78) regarding the first (last) meetings. During the crisis period, monetary policy was unusual even for economies that were not at the zero lower bound. Hence, once the crisis years are included in the sample, the estimated Taylor rule naturally becomes a worse description of monetary policy during normal times. It is reassuring that coefficients associated with the first meetings remain positive, although smaller in magnitude and statistically insignificant. Importantly, coefficients associated with the last meetings change little.

We conclude that most results change little after the sample is adjusted to deal with the zero lower bound, or unconventional monetary policy in general. In particular, the novel empirical fact that departing governors tend to tighten monetary policy is remarkably robust.

3.3.2 Surges in inflation expectations

In countries where changes in central bank leadership bring fear of bad policy, one might observe surges in inflation expectations around transitions. To the extent that governors react to inflation expectations, interest rate in these countries should also rise around transitions. We address this concern by restricting the sample for two groups of countries that are arguably less likely to face surges in inflation expectations. Namely, inflation targeters and richer countries.

Consider inflation targeters. Johnson (2002), Gürkaynak et al. (2010), among others, have documented that inflation expectations are better anchored in the presence of an explicit target for inflation. Therefore, surges in inflation expectations are less likely to occur in these countries. If these surges are driving our results, one might expect much weaker transition effects after the adoption of an inflation targeting regime.

We follow Hammond (2012) and Schmidt-Hebbel and Carrasco (2016) to code countries that adopted an inflation targeting regime. In particular, we restrict the sample to countries and years for which an inflation-targeting framework was operative.[10]

The number of transitions drops to 48 regarding both the first and last meetings, so some loss of precision is expected. Results are presented in the first two columns in Table 3. Coefficients are always positive and significant. Importantly, their magnitudes are similar to those obtained in the baseline estimations.

[10]These countries are Albania (adopted in 2009), Australia (1993), Brazil (1999), Chile (1999), Colombia (1999), Czech Republic (1997), Georgia (2009), Ghana (2007), Guatemala (2005), Hungary (2001), India (2015), Indonesia (2005), Israel (1997), Japan (2013), Mexico (2001), New Zealand (1989), Norway (2001), Peru (2002), Philippines (2002), Poland (1999), Serbia (2009), South Africa (2000), South Korea (1998), Sweden (1995), Thailand (2000), Turkey (2006) and United Kingdom (1992). As some countries countries adopted inflating targeting in the middle of the calendar-year, we check robustness by also excluding meetings occurred in the year following the adoption. Most results change little.

Table 3: Inflation Targeters and Richer Countries

	Targeters	Targeters	Richer	Richer
# Meetings	2	3	2	3
FM (β_F)	0.060**	0.067*	0.056**	0.058*
	[0.029]	[0.073]	[0.026]	[0.099]
LM (β_L)	0.073*	0.074**	0.061*	0.066**
	[0.076]	[0.015]	[0.099]	[0.017]
# Obs	2783	2783	3357	3357
# FM	96	144	104	156
# LM	96	143	104	154

P-value between [ ], calculated with robust standard errors.

In a similar vein, we also report results excluding those nine countries in our sample that are at the lower-middle-income group according to the World Bank's classification.[11] The idea is that, if surges in inflation expectations around transitions are driving our results, this argument should be stronger in countries with weaker institutions. Hence, one should expect much weaker transition effects in richer countries. After these exclusions, the number of transitions drops to 53 (52) regarding the first (last) meetings. Results are reported in the last two columns Table 3. Again, coefficients are always positive, statistically and economically significant.

Of course, to the extent that transitions among richer countries or inflation targeters differ from poorer countries or non-targeters for reasons other than surges in inflation expectations, the evidence provided above is only suggestive. Appendix B.1 provides further suggestive evidence that inflation expectations do not drive our results. It shows that transition effects are still positive, statistically significant and economically relevant, even for countries with relatively stronger institutions (more independent and transparent central banks as well as better regulatory quality). If inflation expectations are better anchored in countries with stronger institutions, this evidence suggests that, although inflation expectations might play a role, they cannot fully explain the estimated transition effects.

[11]Namely, Ghana, Guatemala, Kenya, India, Indonesia, Nigeria, Pakistan, Philippines and Tunisia. Our sample does not contain countries at the low-income group.

Finally, our results would be less interesting if they were driven solely by countries with weak institutions or by non inflation targeters. After all, Taylor rules might inadequately describe monetary policy in these countries. Results in this section show this is not the case.

3.3.3 Fiscal policy

In this section we address the concern that our results might be driven by fiscal policy. This could be the case if transitions were more likely to occur in times of fiscal build ups. Hence, by controlling for the ratio of government expenditures to GDP in the Taylor rule, we assume that monetary policy may also react to fiscal developments. Importantly, we allow the coefficient on this variable to vary across countries.

In addition, to the extent that fiscal build ups hinge on electoral cycles or changes in government, by controlling for fiscal policy in the Taylor rule, results in this section indirectly address the concern that our results might be driven by political transitions. We further explore the potential role of political transitions below.

The ratio of government to GDP is a quarterly measure, which is available for most countries in our sample. The data come from the OECD dataset, IMF database and national data bureaus.[12] We use the quarterly value for the three months of the corresponding quarter.[13] In addition, there are one-hundred missing observations that reduce the number of transitions to 67 regarding both first and last meetings. This sample selection arguably favors countries with better fiscal institutions and policies. We do not see this as a problem as our results would be of less interest if they did not apply to such countries.

Table 4 reports the results. In addition, to make results comparable, we also report a version of our baseline specification in which we restrict the sample to be exactly the same as in the specification that accounts for fiscal developments. If anything, transition effects become stronger and more precisely estimated once fiscal policy is accounted for.

[12] For series that were not originally seasonally adjusted, we use the CENSUS X-13 procedure to adjust for seasonality.

[13] Ghana, Kenya, Nigeria, Pakistan and Tunisia only report annual data. In this case, we repeat this value for all the meetings in the corresponding year.

Table 4: Fiscal Policy

	Fiscal	Fiscal	W/o Fiscal	W/o Fiscal
# Meetings	2	3	2	3
FM (β_F)	0.089**	0.073**	0.079***	0.064**
	[0.000]	[0.018]	[0.001]	[0.048]
LM (β_L)	0.092***	0.103***	0.082**	0.092***
	[0.008]	[0.000]	[0.019]	[0.001]
# Obs	3816	3816	3816	3816
# First Meet	132	197	132	197
# Last Meet	129	191	129	191

P-value between [ ], calculated with robust standard errors.

3.3.4 Uncertainty

In this section we address the concern that our results could be driven by uncertainty. The idea is that transitions in central bank leadership may increase uncertainty. Conversely, uncertainty can also trigger transitions in central bank leadership. In common theoretical frameworks, the central bank would ease policy to calm markets. Nonetheless, it is easy to conceive cases involving emerging market economies, for instance, in which uncertainty increases capital flights, forcing the central bank to increase interest rates. This could explain monetary contractions around transitions.

In order to address this concern, we control for two measures of uncertainty in the Taylor rule: the standard deviation of log returns of the main stock market index of each country ($sdStock_{c,m}$) and the standard deviation of log returns of the nominal exchange rate ($sdExchange_{c,m}$), both obtained from *Bloomberg* terminals. The motivation is straightforward: uncertain periods should be reflected in volatile stock and exchange markets. Finally, we allow the coefficients of these variables to vary across countries.

Due to data availability the number of transitions drops a bit from one specification to another.[14] We do not see this sample selection as a problem to the extent that we are

[14] To be precise, there are 64 first and 64 last meetings if both measures of uncertainty are considered; 68 and 68 (67 and 66) if only *sdExchange* (*sdStock*) is considered.

selecting countries with better institutions, where our results would be of more interest.

The first two columns in Table 5 report the transition coefficients by adding each uncertainty measure at a time. The third column adds both measures, whereas the fourth column reports a version of the baseline specification in which we restrict the sample to be exactly the same as in the third column. Coefficients are quite similar across specifications. Hence, our results do not appear to be driven by uncertainty.

Table 5: Uncertainty

Variable	*sdExchange*	*sdStock*	both	none
# Meetings	2	2	2	2
FM (β_F)	0.075***	0.083***	0.085***	0.091***
	[0.008]	[0.001]	[0.005]	[0.000]
LM (β_L)	0.089***	0.082**	0.092***	0.087**
	[0.007]	[0.019]	[0.007]	[0.016]
# Obs	3724	3581	3416	3416
# First Meet	132	129	123	123
# Last Meet	130	126	122	122
# Meetings	3	3	3	3
FM (β_F)	0.061**	0.067**	0.065**	0.072**
	[0.032]	[0.033]	[0.034]	[0.034]
LM (β_L)	0.093***	0.087***	0.090***	0.093***
	[0.000]	[0.001]	[0.001]	[0.001]
# Obs	3724	3581	3416	3416
# First Meet	197	192	183	183
# Last Meet	192	186	180	180

P-value between [ ], calculated with robust standard errors.

To the extent that uncertainty may stem from electoral cycles, results in this section indirectly address the concern that our results might be driven by political transitions. The following section further addresses this concern.

3.3.5 Political transitions

In this section we directly address the concern that transitions in central bank leadership may interact with transitions in government leadership. In particular, monetary policy could be responding to some sort of political cycle.

Notice that the usual argument that monetary policy accommodates before political transitions would bias the estimated coefficient for departing governors downwards. In addition, most central banks in the sample are subject to fixed mandates. The goal of such mandates is precisely to make monetary policy less susceptible to governments' influence. In fact, terms are often designed not to coincide with political cycles.

Nonetheless, we run specifications accounting for variables that capture political transitions. Based on an extensive research on general elections in each country, we create four dummies:

1. $Elec_{c,m}$: The meeting c,m took place in a election year when a candidate other than the incumbent won the election.

2. $Reelec_{c,m}$: The meeting c,m took place in a election year when the incumbent won the election.

3. $BegMandElec_{c,m}$: The meeting c,m took place in the year when a new head of government took office after a election.

4. $BegMandReelec_{c,m}$: The meeting c,m took place in the year when the incumbent head of government took office after a reelection.

Before presenting the results, we clarify a few points regarding the coding of political transitions. First, the specific position of the head of government varies across countries. In presidential systems, it is naturally the president, who usually takes office in the year following the election. In parliamentary systems, the head of government is the prime minister (even if the country has a president) who is elected following a general election. In most cases, the prime minister takes office immediately after the election so that $Elec_{c,m}$ and $BegMandElec_{c,m}$ coincide for most parliamentary systems. Second, it is also important to note that the dummies refer to calendar year and not the twelve-month window before or after an election. For example, if a presidential election in a given country took place in September 2014, all country's meetings in 2014 have either $Elec_{c,m}$ or $Reelec_{c,m}$ equal to one. Finally, we note that, for convenience, reelection years are those when an incumbent succeeded. If a president tried to get himself reelected but lost, the year in question counts as $Elec_{c,m} = 1$ and $Reelec_{c,m} = 0$.

Results are reported in Table 6. Each column refers to a specification that includes a single political transition (PT) variable at a time, as well as its interaction with FM and LM. Since we are interest in first and last meetings effects that do not coincide with political transitions, the coefficients of interest are still those associated with FM and LM, rather than $FM \times PT$ and $LM \times PT$. Importantly, out of the 71 (70) transitions regarding the first (last) meetings, 11 (13), 5 (7), 16 (14) and 5 (4) occurred in years for which $Elec = 1$, $Reelec = 1$, $BegMandElec = 1$ and $BegMandReelec = 1$, respectively. Hence, given the reduced number of transitions, coefficients associated with the interaction terms should be read with caution. Aside being less precisely estimated, they are sensitive to potential outliers, which hinders interpretation.

Table 6: Political Transitons

PT Variable	$Elec$	$Reelec$	$BegMandElec$	$BegMandReelec$
# Meetings	2	2	2	2
FM	0.079***	0.076***	0.044*	0.062***
	[0.003]	[0.001]	[0.074]	[0.006]
FM × PT	−0.008	−0.012	0.137**	0.191
	[0.886]	[0.924]	[0.033]	[0.195]
LM	0.030	0.079**	0.073*	0.074**
	[0.184]	[0.035]	[0.070]	[0.038]
LM × PT	0.235*	−0.028	0.016	0.036
	[0.082]	[0.693]	[0.802]	[0.672]
PT	0.068***	0.015	−0.002	-0.010
	[0.001]	[0.547]	[0.926]	[0.697]
# Obs	3916	3916	3916	3916
# FM	138	138	138	138
# FM × PT	22	10	32	9
# LM	134	134	134	134
# LM × PT	26	14	28	8
# Meetings	3	3	3	3
FM	0.077**	0.062**	0.047	0.055*
	[0.032]	[0.047]	[0.201]	[0.065]
FM × PT	−0.080	0.003	0.064	0.106
	[0.194]	[0.978]	[0.328]	[0.536]
LM	0.049**	0.092***	0.075**	0.087***
	[0.013]	[0.001]	[0.014]	[0.002]
LM × PT	0.182*	−0.062	0.056	−0.019
	[0.066]	[0.326]	[0.300]	[0.810]
PT	0.070***	0.016	−0.003	-0.007
	[0.001]	[0.512]	[0.884]	[0.775]
# Obs	3916	3916	3916	3916
# FM	200	200	200	200
# FM × PT	33	13	48	13
# LM	194	194	194	194
# LM × PT	39	20	41	12

P-value between [ ], calculated with robust standard errors.

Notice that transition effects change little once political transitions are accounted for, except for two cases. Namely, last and first meeting effects are weaker for transitions in central bank leadership that occurred in years without political transitions, according to the definition underlining $Elec$ and $BegMandElec$, respectively. Indeed, transition effects become less economically relevant, and statistically insignificant in some cases. We also find that political transitions coded in accordance to the definition of $Elec$ are associated with higher interest rates. Hence, in principle, political transitions could be part of the explanation behind hikes in interest rates during transitions in central bank leadership.

In order to further investigate the role of political transitions, we control for variables that are confounding factors. As argued above, political transitions could be times of fiscal build ups and uncertainty, which may themselves be associated with transitions in central bank leadership and tight monetary policy. Hence, Table 7 presents results controlling for our fiscal policy variable as well as both uncertainty measures. As some sample selection may arise due to data availability, in Appendix A.2 we report an analogous table without these variables but restricting the sample to be exactly the same as in Table 7.

Table 7: Political Transitons (Controlling for Fiscal Policy and Uncertainty Measures)

PT Variable	*Elec*	*Reelec*	*BegMandElec*	*BegMandReelec*
# Meetings	2	2	2	2
FM	0.099***	0.094***	0.062**	0.079***
	[0.003]	[0.003]	[0.045]	[0.009]
FM × PT	−0.020	0.014	0.146*	0.222*
	[0.763]	[0.882]	[0.073]	[0.091]
LM	0.065**	0.095**	0.097**	0.091**
	[0.013]	[0.012]	[0.018]	[0.012]
LM × PT	0.148	0.042	0.007	0.151
	[0.220]	[0.592]	[0.918]	[0.156]
PT	0.057***	-0.032	−0.021	−0.057*
	[0.001]	[0.289]	[0.292]	[0.051]
# Obs	3367	3367	3367	3367
# FM	119	119	119	119
# FM × PT	20	10	28	9
# LM	119	119	119	119
# LM × PT	26	14	26	8
# Meetings	3	3	3	3
FM	0.094***	0.074**	0.060*	0.066**
	[0.007]	[0.019]	[0.079]	[0.025]
FM × PT	−0.094	0.040	0.080	0.155
	[0.141]	[0.629]	[0.277]	[0.404]
LM	0.072***	0.099***	0.083***	0.095***
	[0.001]	[0.001]	[0.009]	[0.001]
LM × PT	0.105	0.001	0.069	0.073
	[0.263]	[0.987]	[0.209]	[0.472]
PT	0.060***	-0.031	−0.024	−0.054*
	[0.001]	[0.298]	[0.241]	[0.060]
# Obs	3367	3367	3367	3367
# FM	177	177	177	177
# FM × PT	30	13	42	13
# LM	176	176	176	176
# LM × PT	39	20	38	12

P-value between [ ], calculated with robust standard errors.

Once we control for these confounding factors, all coefficients associated with either FM or LM are positive, economically relevant and statistically significant. We conclude that although political transitions might play a role, they cannot fully explain monetary policy tightening during transitions. Importantly, these results are not driven solely by sample selection once we control for extra variables with missing observations, as Table 13 in Appendix A.2 highlights.

3.4 Endogeneity concerns

After ruling out possible explanations (i.e. zero lower bound, inflation expectations, fiscal policy, uncertainty and political transitions) for our results, we address two other endogeneity concerns. First, the choice of the new governor is endogenous. For example, if most transitions in the sample happened at times of high inflation, appointments of hawkish governors might have been more likely. Second, transitions *per se* might be endogenous. They could be more likely to occur, for instance, at times when the interest rate is above the level prescribed by the Taylor rule.

In what follows, we also present specifications that control for both fiscal policy and uncertainty measures (as well as their counterpart with the same sample but without these controls to make results comparable). We control for fiscal policy because, as Section 3.3.3 highlights, accounting for monetary and fiscal policies interactions seems to be important. We also control for uncertainty measures because endogenous transitions are more likely to occur in times of uncertainty.

Based on the arguments explored in Section 3.3.2, in Appendix A.3 we reproduce the results reported in this section considering two subsample of countries, inflation targeters and richer countries. Despite the expected loss of precision, results are fairly robust.

3.4.1 Governor's choice

The choice of the new governor is clearly endogenous. For example, hawkish governors may have been more likely to be appointed if most transitions in the sample were somehow associated with high inflation. If this is the case, due to their preferences, governors would increase interest rates above those levels prescribed by the estimated Taylor rule.

In this section we argue that though this criticism may play a role, it cannot account for the full effect. To address this issue, we add governor's fixed effects. In this case, β_F captures the difference between first meetings and other meetings held by the same governor. A positive β_F implies that, on average, the same governor is more hawkish during his first meetings than throughout the rest of his tenure. A similar interpretation applies to β_L.

Table 8 shows that results survive the inclusion of governor's fixed effects. As we add over one hundred governor dummies, of course, estimations lose some precision. Nevertheless, the coefficients less precisely estimated are those associated with the last meetings, which are less threatened by the criticism of endogenous governors' appointments. After all, the departing governor was chosen well before the transition. As the aforementioned criticism concerns the coefficients associated with first meetings, it is reassuring that they remain positive, statistically significant and economically relevant. Consequently, different governors' preferences cannot explain our results. Conclusions do not change much after adjusting the sample, to make results comparable, and controlling for uncertainty measures and fiscal policy (last four columns).

Table 8: Governor Fixed Effects

Fisc/Unc	no	no	no	no	yes	yes
Sample	baseline	baseline	adjusted	adjusted		
# Meet	2	3	2	3	2	3
FM (β_F)	0.099***	0.083**	0.119***	0.098**	0.126***	0.108***
	[0.001]	[0.021]	[0.001]	[0.019]	[0.001]	[0.005]
LM (β_L)	0.037	0.053*	0.042	0.054*	0.054	0.053*
	[0.305]	[0.063]	[0.275]	[0.077]	[0.112]	[0.065]
# Obs	3916	3916	3367	3367	3367	3367
# FM	138	206	119	177	119	177
# LM	134	198	119	176	119	176

P-value between [ ], calculated with robust standard errors.

3.4.2 Transition timing

One can argue that transitions are associated with tighter monetary policy stance because they are endogenous. For example, a central banker setting a tight policy to disinflate the economy might get fired by a government worried about its costs in terms of activity.

In this section we explore transitions' timing in order to address this criticism. In most countries, mandates are fixed and, thus, central bankers' tenure are determined in advance. Even in countries where mandates are not fixed, such as Brazil, central bankers are usually appointed in the beginning of a new government.[15] Hence, the timing of most of the transitions catalogued in this paper was known in advance and, thus, should not have been caused by other factors that could also cause an increase in the interest rate.

[15]Recall that we show in Section 3.3.5 that our results are not driven by political transitions.

However, in some cases, transitions occurred because governors unexpectedly resigned or were dismissed, perhaps at times of high interest rates. In order to address this concern, after extensive research documented in Appendix C.3, we create a dummy variable that takes value one in cases of unexpected transitions, call it $UN_{c,m}$. We catalogue twenty one cases of unexpected transitions.

Table 9 reports results once we add to the Taylor rule a proper interaction of FM and LM with UN. Consequently, in this specification, coefficients β_F and β_L, associated with FM and LM, respectively, capture the effects of transitions known in advance that, by construction, cannot be triggered by high interest rates. In addition, as unexpected transitions could be surrounded by uncertainty or fiscal build ups, we also provide a specification in which we control for fiscal policy and both uncertainty measures (as well as its counterpart with the sample adjusted for the missing observations but without these extra variables to make results comparable).

Table 9: Unexpected Transitions

Fisc/Unc Sample	no baseline	no baseline	no adjusted	no adjusted	yes	yes
# Meet	2	3	2	3	2	3
FM	0.060**	0.044	0.075**	0.055	0.087**	0.062*
	[0.029]	[0.253]	[0.020]	[0.229]	[0.016]	[0.091]
FMxUN	0.058	0.065	0.061	0.068	0.033	0.057
	[0.237]	[0.225]	[0.274]	[0.266]	[0.565]	[0.319]
LM	0.050	0.060*	0.064	0.070*	0.087*	0.081**
	[0.259]	[0.067]	[0.207]	[0.064]	[0.064]	[0.022]
LMxUN	0.083	0.083*	0.071	0.077	0.034	0.052
	[0.181]	[0.086]	[0.271]	[0.126]	[0.567]	[0.273]
# Obs	3916	3916	3367	3367	3367	3367
# FM	138	206	119	177	119	177
# FMxU	38	57	34	51	34	51
# LM	134	198	119	176	119	176
# LMxU	45	65	42	61	42	61

P-value between [ ], calculated with robust standard errors.

Without controlling for fiscal policy and uncertainty measures (first four columns of Table 9), effects associated with transitions known in advance remain positive with an economically relevant magnitude, and in some cases statistically significant. However, the sum of the coefficients associated with FM and $FM \times UN$ (or LM and $LM \times UN$) captures the effects of unexpected transitions, which seem to be part of the variation that explains our baseline results.

A close inspection of the stories behind such unexpected transitions, documented in Appendix C.3, reveals that some of them occurred in situations of high uncertainty or fiscal fragility, which might warrant a hike in interest rates. Once we account for such factors, in the last two columns of Table 9, the magnitudes and significance levels of the coefficients associated with the interaction terms reduce substantially. In this case, β_F and β_L, which capture effects of transitions known in advance, remain economically and statistically significant.

Although part of the transition effects seems to be associated with unexpected transitions, altogether, the empirical evidence reported in Tables 1 to 9 suggests that there is a causation direction that goes from transitions to tighter monetary policy. It is not simply the case that results stem from transitions being more likely to occur during periods associated with monetary policy tightening. In other words, there is something going on during transitions that leads to tight policy. In the next section, we explore two possible explanations. Namely, career concerns and signalling dynamics.

4 Discussion

We document a novel fact. Namely, transition periods in central bank leadership are associated with tighter monetary policy. We argue that this result is unlikely to stem from straightforward explanations. The literature has substantiated both theoretically (e.g. Vickers (1986)) and empirically (e.g. Hansen and McMahon (2016)) the intuitive claim that governors, whether Hawks or Doves, have incentives to tighten monetary policy in the first meetings in order to signal that they are Hawks and, thus, face lower inflation expectations going forward. We take these established results as a reasonable explanation for the monetary policy contractions we document in the first meetings. Hence, this section focuses on two possible explanations for the novel fact that departing governors also tend to be more hawkish in the last meetings. In Appendix B we report heterogeneous effects that are consistent with the proposed explanations.

The first explanation regards career concerns. Our claim is that, by acting as a Hawk, the departing governor aims to enhance (or protect) his reputation and career prospects after the end of his mandate. Notice that this claim rests on two implicit assumptions. First, acting as a Hawk, rather than a Dove, is something positive for reputation and career prospects. Second, acting as a Hawk in the last, rather than previous, meetings is more effective to accomplish these goals.

We argue that, due to the time inconsistency problem of monetary policy (e.g. Kydland and Prescott (1977), Barro and Gordon (1983b)), a governor that acts as a Hawk could be perceived by the public as someone able to commit, and not vulnerable to short-run pressures. Besides contributing positively to governors' reputation that goes beyond their mandates, these attributes are arguably valuable for career prospects. In contrast, a similar time inconsistency problem implies that acting as a Dove could be optimal when the interest rate is at the zero lower bound (e.g. Krugman (1998), Eggertsson and Woodford (2003)). In this case, ability to commit and not being vulnerable to short-run pressures amount to keeping the interest rate at zero for some time, even if the Taylor rule prescribes a positive rate. Nonetheless, we exclude the financial crisis period from the sample, and show in Section 3.3.1 that our results are not driven by the zero lower bound. Hence, for most countries and years in our sample, a governor able to commit and not vulnerable to short-run pressure should act as a Hawk, which could help him build reputation and improve career prospects.

Naturally, acting as a Hawk in the last, rather than previous, meetings should be more effective to enhance career prospects. First, governors should discount considerably less the period after the end of their mandates in the last meetings. Second, monetary policy decisions are arguably more publicized in the media during transitions. Finally, perhaps due to memory, potential employers, partners and clients could put more weight on recent events.

The second explanation is based on signalling dynamics. Assume that the public is uncertain whether a new governor is a Hawk or a Dove.[16] As explained above, in the first meetings, new governors, whether Doves or Hawks, may want to signal they are Hawks in order to face lower inflation expectations going forward. If the departing one wants to help a Hawk successor to signal his type, contracting monetary policy would make it harder for a Dove to pretend he is a Hawk. After all, Doves should find even more costly to tighten monetary policy further after an interest rate increase. As this result is not that intuitive and, to our knowledge, novel, we formalize it in the context of a simple signalling model developed in Appendix D. The model makes explicit how a monetary contraction in the last meeting helps to sustain a separating equilibrium.

In order to make this interpretation reasonable, on top of uncertainty regarding the incoming governor's type, we need one additional assumption. Namely, the incumbent central banker has preferences that somehow make him willing to help the public learn his successor type, Dove or Hawk. Of course, as this assumption involves preferences, it is hard to either substantiate or dismiss empirically.

Nonetheless, one reasonable example in which the outgoing governor wishes to foster separation of types is as follows. If the incumbent governor cares not only about inflation during his mandate, but also beyond it, facilitating revelation of a Hawk central banker is consistent with lower levels of inflation in the future. For this particular example, two more assumptions are needed. First, the departing central banker knows more about his successor than economic agents do, thus his actions can be informative about the type of the new central banker.[17] Second, the departing

[16] There are plenty of anecdotal evidence that substantiate the idea that the public has great uncertainty about new central bankers. In fact, "So, Mr. Carney, Hawk or Dove" at the WSJ and "ECB: Clearing the way for an Italian hawk?" at the BBC demonstrate such uncertainty. Moreover, central bankers are aware of this special uncertainty, as illustrated by this quote by Willis J. Winn, former Cleveland Fed President, at Volcker's first meeting: "I think any action we take – because we are certainly in the spotlight today – will be looked at very eagerly and there are psychological reactions coming from what we do."

[17] Indeed, in many cases the departing governor's prestige might give him some say in the choice of his successor. Even if this is not the case, both central bankers are likely to meet in informal talks before and during the transition period.

central banker has stronger beliefs that the incoming governor is a Hawk than the public does.[18]

Appendix B reports results in which we explore some heterogeneities across countries and meetings, arguably consistent with the explanations described above. We summarize our findings below.

Independence, transparency and regulatory quality. We show that transition effects are weaker the more independent or transparent the CB, or the better the regulatory quality of the country. Under the assumption that signalling incentives are weakened where institutions are strong, this evidence is consistent with our signalling story. This assumption could be justified on the grounds that strong institutions tend to select better governors. But if better governors do not need to protect reputation or enhance career prospects, the direction of these heterogenous effects is also consistent with the explanation based on career concerns.

Governor's strength. As the paper focuses on leadership transitions, wherever the governor is stronger, in the sense that he is more able to impose his will over the committee, transition effects due to either signalling dynamics or career concerns are expected to be larger. Indeed, we document stronger effects, although significant only for the last meetings.

Governor was previously part of the committee. If the incoming governor was part of the committee, the public should be better informed about his type, so we expect weaker transition effects due to signalling dynamics. In contrast, except for one case, we document positive effects if the governor was a member of the committee, although coefficients are statistically insignificant.

Governor has a PhD degree. If the governor has a PhD degree, we expect stronger transition effects as governors with a PhD should better understand signalling incentives, as well as be more career oriented – after all they are less likely to have been nominated due to political patronage and thus be more concerned about their career after the end of their mandate. In fact, transition effects are stronger, although statically significant only in a single case (first two meetings).

Governor worked in the public sector before. We find weaker and precisely estimated last meeting effects for governors that worked in the public sector before. To the extent that the

[18]In order to be consistent with our estimated transition effects, this assumption means that our sample has on average more incoming Hawks than Doves (relative to the public's beliefs). We believe this is realistic. The bulk of transitions had happened by the beginning of the 2000s, when inflation targeting regimes and, thus, the explicit notion that inflation is the main objective of monetary policy, had been adopted in many countries. In contrast, policy prescriptions at the zero lower bound involve credible commitments to inflate the economy in the future, which creates a favorable atmosphere for dovish central bankers. But notice that we exclude the financial crisis from the sample and the zero lower bound is immaterial to our results.

public sector is less meritocratic and more prone to patronage, acting as a Hawk should reveal information that is more valuable for career progression in the private sector.

Of course, this evidence is only suggestive. Beside the small number of transitions that implies a further loss of precision once we explore these heterogeneities, one may come up with a different rationale consistent with these findings. If anything, altogether, these heterogeneities are in congruence with the explanations proposed.

To conclude, we document the novel fact that departing governors opt for a tight monetary policy stance. We rule out straightforward explanations. Although other possibilities may remain, we provide two possible explanations for this fact that are hard to disentangle. Namely, career concerns and signalling dynamics. Finally, in the appendix, we provide empirical and theoretical reasonings consistent with both explanations.

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Appendix

A Additional empirical results

A.1 Robustness of baseline specification

In what follows we present robustness checks on our baseline results. In particular, we use Driscoll and Kraay (1998) approach to compute the standard errors, and then consider alternative specifications for the Taylor rule.

A.1.1 Driscoll-Kraay standard errors

The results in the empirical analysis report the usual robust standard errors. However, the features of the data are such that there could be reason to worry about serial correlation in the error term. There are different ways of addressing this issue within a panel. In our case, the most common approach in the microeconometric literature means to report standard errors robust to clustering at the country level. A more suitable approach is to use Driscoll and Kraay (1998) errors.

The advantage of Driscoll-Kraay errors is that they are robust to general forms of temporal dependence as the time dimension becomes large. In other words, its asymptotic properties rely on large time dimension holding the cross-section dimension fixed, which is a closer description of our panel data. In fact, our data comprise a small number of countries but long time periods for a given country. In contrast, clustered errors are consistent as the number of clusters goes to infinity, which is not a suitable approximation in our case. Moreover, the required number of clusters (with respect to the accuracy of the asymptotic approximation) is even greater when different units have different time lengths as in our case in which some countries span decades while others span only a few years. Consequently, we should favor techniques that are motivated by large time dimension relative to cross-section dimension asymptotics as in Driscoll and Kraay (1998).

Table 10 reports results analogous to those in Table 1 but with Driscoll-Kraay standard errors instead (p-values in brackets). Results are still significant. Although p-values increase a bit, they are fairly small considering the large set of errors dependence Driscoll-Kray method corrects for. In addition, for completeness, we also report standard errors robust to clustering at the country level (p-values in parentheses), although we do not find this option suitable for our panel data, as explained above. It is reassuring that even in this extreme case, although p-values increase more, coefficients are still significant (or marginally significant) in most of the cases.

Table 10: Driscoll-Kraay errors: $i_{c,t}$ is the dependent variable

# Meetings	1	2	3	4
FM (β_F)	0.050*	0.075**	0.061**	0.034
	[0.089]	[0.012]	[0.036]	[0.175]
	(0.126)	(0.039)	(0.111)	(0.234)
LM (β_L)	0.087*	0.076*	0.086**	0.087**
	[0.091]	[0.076]	[0.015]	[0.026]
	(0.098)	(0.082)	(0.029)	(0.064)
# Obs	3916	3916	3916	3916
# First Meet	68	138	206	274
# Last Meet	68	134	198	256

P-value between [ ], calculated with Driscoll-Kraay standard errors.

P-value between ( ), calculated with standard errors robust to clustering at country level.

A.1.2 Alternative Taylor rule: Two lags of the interest rate

In this paper, the Taylor rule with lagged interest rate follows the standard specification in the literature. This lag captures the fact that interest rates are very persistent due to many factors that lead central banks to avoid abrupt policy changes.[19] However, Coibion and Gorodnichenko (2012) point out the empirical need to include two lags in the Taylor rule. Table 11 reports results analogous to those in Table 1 but considering two lags of the interest rate instead. Notice that the extra lag reduces a bit the number of observations as well as the number of transitions used to estimate the effects of interest.

[19]See, among others, Cukierman (1991), Woodford (2003) and Riboni and Ruge-Murcia (2010).

Table 11: Taylor rule with two lags of $i_{c,m}$ as regressors

# Meetings	1	2	3	4
FM (β_F)	0.033	0.060**	0.050	0.030
	[0.289]	[0.016]	[0.108]	[0.261]
LM (β_L)	0.061	0.055*	0.057**	0.063**
	[0.170]	[0.059]	[0.015]	[0.011]
# Obs	3883	3883	3883	3883
# First Meet	67	135	203	271
# Last Meet	67	132	194	251

P-value between [ ], calculated with robust standard errors.

Results survive, although they are somewhat weakened. As we add an extra lag to absorb part of the variability in the data, this is expected. Notice, however, that the novel fact that departing governors tend to tighten monetary policy remains fairly robust.

A.1.3 Alternative Taylor rule: Lagged values of inflation and activity

In this section we assess how the baseline results would change if we consider lagged values of inflation and activity, $\pi_{c,m-1}$ and $y_{c,m-1}$, in the Taylor rule instead of current values, $\pi_{c,m}$ and $y_{c,m}$. This exercise captures the idea that current inflation and activity might not be available information for central bankers when monetary policy is decided. Of course this an extreme consideration as central bankers have a fairly good idea of the current state of the economy. As expected, results reported in Table 12 are very similar to the baseline results displayed in Table 1.

Table 12: π_{m-1} and y_{m-1} in the Taylor rule instead of π_m and y_m

# Meetings	1	2	3	4
FM (β_F)	0.038	0.065***	0.062**	0.042*
	[0.297]	[0.001]	[0.042]	[0.100]
LM (β_L)	0.087	0.084**	0.094***	0.096***
	[0.120]	[0.018]	[0.001]	[0.001]
# Obs	3936	3936	3936	3936
# First Meet	67	137	206	275
# Last Meet	68	134	198	256

P-value between [ ], calculated with robust standard errors.

A.2 Political transitions

Recall that Table 7, in which we report results controlling for fiscal policy and uncertainty, shows that political transitions cannot fully explain first and last meeting effects. In this section we show that these results are not driven solely by sample selection once we control for these extra variables that contain missing observations. Indeed, Table 13 restricts the sample to be exactly the same as in Table 7. Although transition effects are stronger once we restrict the sample, Table 13 conveys the same message as Table 6, in which we report results without controlling for fiscal policy and uncertainty measures. Namely, last and first meeting effects tend to be weaker for transitions in central bank leadership that occurred in years without political transitions, according to the definition underlining $Elec$ and $BegMandElec$, respectively.

Table 13: Political Transitons (Same Sample as in Table 7)

PT Variable	*Elec*	*Reelec*	*BegMandElec*	*BegMandReelec*
# Meetings	2	2	2	2
FM	0.094***	0.094***	0.057**	0.078***
	[0.002]	[0.000]	[0.045]	[0.003]
FM × PT	−0.015	−0.031	0.152**	0.176
	[0.820]	[0.808]	[0.039]	[0.230]
LM	0.041	0.090**	0.085*	0.085**
	[0.110]	[0.028]	[0.054]	[0.031]
LM × PT	0.202	−0.032	0.013	0.046
	[0.132]	[0.665]	[0.849]	[0.601]
PT	0.067***	0.019	−0.019	−0.014
	[0.000]	[0.469]	[0.319]	[0.582]
# Obs	3367	3367	3367	3367
# FM	119	119	119	119
# FM × PT	20	10	28	9
# LM	119	119	119	119
# LM × PT	26	14	26	8
# Meetings	3	3	3	3
FM	0.090**	0.074**	0.060	0.066*
	[0.032]	[0.041]	[0.162]	[0.058]
FM × PT	−0.093	−0.008	0.063	0.099
	[0.175]	[0.940]	[0.406]	[0.571]
LM	0.059***	0.101***	0.083**	0.096***
	[0.007]	[0.001]	[0.013]	[0.002]
LM × PT	0.150	−0.063	0.061	−0.007
	[0.133]	[0.334]	[0.290]	[0.928]
PT	0.069***	0.021	−0.021	−0.011
	[0.000]	[0.438]	[0.299]	[0.658]
# Obs	3367	3367	3367	3367
# FM	177	177	177	177
# FM × PT	30	13	42	13
# LM	176	176	176	176
# LM × PT	39	20	38	12

P-value between [ ], calculated with robust standard errors.

A.3 Endogeneity concerns

In what follows, we reproduce the estimations reported in Section 3.4 considering a more homogenous subsample, for which Taylor rules are a better description on how monetary policy is conducted. Namely, inflation targeters and richer countries as in Section 3.3.2, in which we explain how we code these subgroups of countries.

A.3.1 Governor's fixed effects: inflation targerters and richer countries

Tables 14 and 15 show results including governor's fixed effects, fiscal policy and uncertainty measures for inflation targerters and richer countries, respectively. The first two columns do not include fiscal policy and uncertainty measures, whereas the last two do. Intermediate columns adjust the sample to make results with and without fiscal policy and uncertainty measures comparable.

Table 14: Governor Fixed Effects: Inflation Targeters

Fisc/Unc Sample	no baseline	no baseline	no adjusted	no adjusted	yes	yes
# Meet	2	3	2	3	2	3
FM (β_F)	0.079**	0.091**	0.085**	0.101**	0.097**	0.114***
	[0.023]	[0.038]	[0.030]	[0.041]	[0.042]	[0.008]
LM (β_L)	0.064	0.070**	0.060	0.063*	0.052	0.048
	[0.148]	[0.044]	[0.192]	[0.079]	[0.206]	[0.149]
# Obs	2783	2783	2457	2457	2457	2457
# FM	96	144	85	127	85	127
# LM	96	143	88	131	88	131

P-value between [ ], calculated with robust standard errors.

Table 15: Governor Fixed Effects: Richer Countries

Fisc/Unc Sample	no baseline	no baseline	no adjusted	no adjusted	yes	yes
# Meet	2	3	2	3	2	3
FM (β_F)	0.075**	0.082**	0.097***	0.100**	0.107**	0.112**
	[0.021]	[0.043]	[0.007]	[0.026]	[0.010]	[0.005]
LM (β_L)	0.027	0.035	0.043	0.049	0.048	0.052
	[0.510]	[0.274]	[0.323]	[0.147]	[0.221]	[0.108]
# Obs	3357	3357	2919	2919	2919	2919
# FM	104	156	94	141	94	141
# LM	104	156	96	142	96	142

P-value between [ ], calculated with robust standard errors.

Recall that we add over one hundred governor dummies, so some loss of precision is expected. Results are fairly robust once compared to those in Section 3.4.1. Of course, given the reduced number of transitions, some loss of precision is expected. Importantly, the coefficients less precisely estimated are those associated with the last meetings, which are less threatened by the criticism of endogenous governors' appointments.

A.3.2 Transition timing: inflation targerters and richer countries

Tables 16 and 17 report results exploring unexpected transitions, analogous to those in Section 3.4.2, for the subsample of inflation targerters and richer countries, respectively. Again, the first two columns do not include fiscal policy and uncertainty measures. Intermediate columns consider the adjusted sample, comparable with the specification that includes fiscal policy and uncertainty measures, reported in the last two columns.

Table 16: Unexpected Transitions: Inflation Targeters

Fisc/Unc Sample	no base	no base	no adjusted	no adjusted	yes	yes
# Meet	2	3	2	3	2	3
FM	0.043	0.058	0.048	0.070	0.069	0.083**
	[0.174]	[0.218]	[0.195]	[0.199]	[0.119]	[0.038]
FMxUN	0.067	0.037	0.075	0.030	0.040	0.025
	[0.298]	[0.590]	[0.265]	[0.687]	[0.573]	[0.712]
LM	0.051	0.051	0.058	0.056	0.083	0.074*
	[0.328]	[0.178]	[0.328]	[0.193]	[0.144]	[0.082]
LMxUN	0.075	0.080	0.055	0.060	0.027	0.046
	[0.355]	[0.195]	[0.485]	[0.313]	[0.718]	[0.426]
# Obs	33	2783	2457	2457	2457	2457
# FM	96	144	85	127	85	127
# FMxU	25	38	25	38	25	38
# LM	96	143	88	131	88	131
# LMxU	28	41	28	41	28	41

P-value between [ ], calculated with robust standard errors.

Table 17: Unexpected Transitions: Richer Countries

Fisc/Unc	no	no	no	no	yes	yes
Sample	base	base	adjusted	adjusted		
# Meet	2	3	2	3	2	3
FM	0.039	0.042	0.053*	0.523	0.062*	0.061*
	[0.166]	[0.318]	[0.093]	[0.283]	[0.092]	[0.095]
FMxUN	0.078	0.071	0.078	0.078	0.047	0.064
	[0.200]	[0.278]	[0.265]	[0.261]	[0.469]	[0.317]
LM	0.054	0.057*	0.067	0.067*	0.082*	0.077**
	[0.250]	[0.099]	[0.198]	[0.193]	[0.093]	[0.033]
LMxUN	0.030	0.041	0.029	0.045	0.021	0.054
	[0.654]	[0.444]	[0.678]	[0.417]	[0.751]	[0.319]
# Obs	3357	3357	2919	2919	2919	2919
# FM	104	156	94	141	94	141
# FMxU	23	35	23	35	23	35
# LM	104	156	96	142	96	142
# LMxU	26	37	26	37	26	37

P-value between [ ], calculated with robust standard errors.

Of course, since we consider subsamples of countries, the number of transitions drops substantially, which implies less precise estimates. It is reassuring, though, that transition effects remain positive with economically relevant magnitudes. Furthermore, once we control for fiscal policy and uncertainty measures, which might correlate with unexpected transitions, transition effects become significant in most cases. This suggests a limited influence of unexpected transitions on the results.

B Heterogeneities

In this section, we explore the heterogeneities summarized in Section 4 to argue that their direction, in most cases, is consistent with the proposed explanations of signalling dynamics and career concerns.

B.1 Independence, transparency and regulatory quality

Countries with strong institutions, or similarly, less institutional uncertainty, tend to select better governors, trusted by the public. In addition, changes of governors are less likely to trigger fears of bad policy. Hence, monetary policy distortions due to signalling incentives and career concerns should arguably play a minor role during transitions in those countries.

We consider three indices that should reflect whether institutions are relatively weaker or stronger. Namely, *Central Bank Transparency* from Crowe and Meade (2007), *Central Bank Independence* from Dincer and Eichengreen (2014) and *Regulatory Quality* from the World Bank Governance Indicators. Notice that the first and second indices refer specifically to Central Banks, whereas the third refers to the whole country. Although every index has flaws, they should roughly capture some dimension of institutional strength. As all indices were constructed by different authors, there is less risk of one methodology being the sole driver of results. Also, since the indices were not constructed to study leadership transitions, we do not worry about hindsight biasing our results.

We normalize these indices and, then, interact them with the variables of interest. Results are reported in Table 18.

Table 18: CB Independence[a], CB Transparency[b] and Country Regulatory Quality[c]

# Meet	2		2		2
FM	0.073***	FM	0.070***	FM	0.061***
	[0.003]		[0.003]		[0.005]
FM × Ind	−0.038*	FM × Trp	−0.061***	FM × RQ	−0.068***
	[0.064]		[0.003]		[0.002]
LM	0.080**	LM	0.078**	LM	0.073**
	[0.022]		[0.023]		[0.019]
LM × Ind	−0.051**	LM × Trp	−0.041	LM × RQ	-0.043
	[0.014]		[0.148]		[0.179]
# Obs	3750	# Obs	3789	# Obs	3866
# FM	128	# FM	128	# FM	132
# LM	126	# LM	126	# LM	130
# Meet	3		3		3
FM	0.062*	FM	0.063*	FM	0.056*
	[0.054]		[0.055]		[0.055]
FM × Ind	−0.021	FM × Trp	−0.019	FM × RQ	−0.058**
	[0.507]		[0.447]		[0.025]
LM	0.089***	LM	0.088***	LM	0.083***
	[0.001]		[0.001]		[0.001]
LM × Ind	−0.035**	LM × Trp	−0.042*	LM × RQ	−0.045*
	[0.040]		[0.074]		[0.080]
# Obs	3750	# Obs	3789	# Obs	3866
# FM	191	# FM	191	# FM	197
# LM	186	# LM	186	# LM	192

P-value between [ ], calculated with robust standard errors. Indices are normalized.

[a] Central Bank Independence (Crowe and Meade 2007)

[b] Central Bank Transparency (Dincer and Eichengreen 2013)

[c] Regulatory Quality (World Bank Governance Indicators).

The heterogeneity goes in the direction we expect: the more independent, transparent or the better the regulatory quality, the smaller the tightening of monetary policy during first and last meetings is. The interaction coefficients are always negative and most are statistically significant. Even in the cases where the coefficients are less precisely estimated, point estimates are similar in magnitude to their significant counterparts. Finally, note that transition effects are positive, economically relevant and statistically significant for countries with average institutional qualities.

B.2 Monetary policy committee

Nowadays most monetary policy decisions are made by committees. We can use the committee structure to exploit heterogeneities and assess if they are consistent with the interpretations we offer for our results. Namely, signalling dynamics and career concerns.

B.2.1 Governor's strength

This paper focuses only on leadership transitions, i.e. changes of the governor. Hence, wherever the governor is stronger, transition effects are expected to be larger. One can evaluate the strength of the governor according to the characteristics of the committee. Blinder (2007) proposes the following typology, in increasing order of governor's strength.

1. Individualistic Committee.
2. Genuinely Collegial Committee.
3. Autocratically Collegial Committee.
4. Individual Governor.

According to Blinder (2007), one is characterized by all members being exhorted to vote their own mind, with the governor often on the losing side of the vote (e.g. Bank of England); two is the case in which there is an atmosphere that strives for consensus and thus the governor plays a role in forging this consensus (e.g. European Central Bank or Bernanke's Fed); in three the governor plays the dominant role and can shift the board to his preferred policy (e.g. Volcker's or Greenspan's Fed);[20] four is obviously the case with the strongest governor as he is the sole determiner of policy (e.g. Reserve Bank of New Zealand). We create a variable that classifies central banks according to this typology and, then, normalize it. Call the normalized one *Blin*.

The caveat with this typology is that it is inevitably subjective. For instance, both the Bank of England (BoE) and the Fed have similar committee structures on the surface – one vote per

[20]Blinder tells an anecdote in which Greenspan started on the losing vote, but managed to persuade the committee to vote unanimously in favor of his choice.

member, which is released to the public – but Blinder argues that tradition gives the Fed governor a much greater sway over the board than the BoE one. Despite this caveat, we use Blinder's opinion for the countries he did categorize; search in central bank's staff papers of each country how they categorize their own central bank; and, as a last resort, take our best guess based on the committee structure and minutes. Appendix C.4 discusses in details how this index is constructed.

Table 19: Monetary Policy Committee

# Meet	2	3		2	3
FM	0.075***	0.064**	FM	0.098***	0.043
	[0.002]	[0.040]		[0.001]	[0.150]
FM × Blin	0.025	0.020	FM × Prev	−0.066	0.052
	[0.130]	[0.234]		[0.118]	[0.477]
LM	0.078**	0.087***	LM	0.063	0.068*
	[0.022]	[0.001]		[0.185]	[0.068]
LM × Blin	0.059***	0.058***	LM × Prev	0.034	0.055
	[0.002]	[0.000]		[0.586]	[0.263]
# Obs	3916	3916	# Obs	3916	3916
# FM	138	206	# FM	138	206
# LM	134	198	# LM	134	198
			# FMxPrev	47	70
			# LMxPrev	52	78

P-value between [ ], calculated with robust standard errors.

The first two columns in Table 19 show that the coefficients associated with $LM \times Blin$ are positive and significant, in line with the interpretations based on signalling incentives and career concerns. The stronger the governor (higher $Blin$), the stronger the monetary contraction at the last meetings. In addition, we also find positive coefficients associated with $FM \times Blin$, in line with signalling incentives, but they are not precisely estimated. Finally, governors with average strength still contract monetary policy during transitions in a meaningful way.

B.2.2 Governor was previously part of the committee

The public should have a better idea whether a new governor is Dove or Hawk if he was already part of the monetary policy committee, before taking office. Hence, we create a dummy variable $Prev$ indicating whether the incoming governor was part of the previous board. If this is the case, there is less need of signalling by both departing and incoming governors. Hence we hypothesize a smaller policy tightening at the first meetings (smaller incentives to prove he is a Hawk) and at the last meetings (smaller incentives to help the signalling process).

Overall, the last two columns of Table 19 show that this exercise is inconclusive. In three cases, the estimated coefficients associated with $FM \times Prev$ and $LM \times Prev$ are positive, in contrast with the aforementioned hypothesis, but statistically insignificant. However, there is some very weak evidence that policy tightening at the first meetings is smaller when the new governor was part of the board. Again, these results should be read with caution given the substantive decrease in the number of transitions when the governor was previously part of the committee.

B.3 Governor's CV

In this section, we explore the educational and occupational background of governors to shed light on the mechanisms behind our results.[21] After an extensive research, we create dummy variables, Pub and PhD, for whether governors were previously employed in the public sector and whether they hold a PhD degree, respectively. As we could not find the employment history and the education degree for all departing and incoming governors, these variables are measured with noise. We opt to use information on employment before, rather than after, being a governor for two reasons. First, previous employment proved to be easier to find as the press usually emphasizes the employment history of the incoming governor at times of transitions. Second, due to temporary barrier clauses in some countries, the immediate job of departing governors may not reflect their career preferences.

Our working hypotheses are the following. First, to the extent that the public sector is less meritocratic and more prone to patronage, acting as a Hawk should reveal information that are more valuable for career progression in the private sector. If governors previously employed in the public sector are less willing to take actions to enhance their career prospects in the private sector, we should find less tightening in the last meetings. Second, governors holding a PhD degree should better understand signalling incentives. Also, governors holding a PhD degree might also be more career oriented. Indeed, they are less likely to have been nominated due to political patronage and thus be more concerned about their career after the end of their mandate. Hence, we should find more tightening at both first and last meetings. Table 20 considers a specification in which Pub

[21] Gohlmann and Vaubel (2007) also explore the educational and occupational background of governors. They find that former members of the central bank staff deliver lower inflation rates than other occupational groups.

and PhD are interacted with FM and LM. Transition effects are consistent with these hypotheses, although not always statistically significant.

Table 20: Governor's CV

# Meet	2	3		2	3
FM	0.040	0.042	FM	−0.002	0.042
	[0.298]	[0.227]		[0.918]	[0.467]
FM × Pub	0.055	0.030	FM × PhD	0.125***	0.031
	[0.239]	[0.570]		[0.002]	[0.621]
LM	0.172**	0.183***	LM	0.041	0.069**
	[0.030]	[0.002]		[0.236]	[0.020]
LM × Pub	−0.154*	−0.152***	LM × PhD	0.070	0.034
	[0.052]	[0.011]		[0.289]	[0.490]
# Obs	3916	3916	# Obs	3916	3916
# FM	138	206	# FM	138	206
# FMxPub	89	133	# FMxPhD	84	124
# LM	134	198	# LM	134	198
# LMxPub	82	124	# LMxPhD	64	97

P-value between [ ], calculated with robust standard errors.

C Data appendix

C.1 Countries

Tables 21 and 22 report the list of countries in the sample, the first and last year each country appears in the sample, the total number of meetings per country, the number of different governors per country, and the number of transitions (i.e. the number of first and last meetings) per country. We report these statistics for the full sample as well as the restricted sample used in the baseline estimation in Section 3.1.

Table 21: Meetings and governors per country

Country	First Year	Last Year	# Meets FS*	# Meets RS**	# Govs FS*	# Govs RS**
Albania	2001	2014	103	79	2	2
Australia	1990	2014	270	248	3	3
Brazil	1999	2014	156	140	3	3
Chile	2000	2013	167	143	4	4
Colombia	1995	2014	242	216	2	2
Czech Republic	1998	2014	172	156	4	4
European Union	1999	2014	214	189	3	3
Georgia	2008	2014	61	39	2	1
Ghana	2002	2014	60	50	3	3
Guatemala	2005	2014	82	62	3	3
Hungary	2002	2014	141	117	3	3
India	2005	2014	60	45	3	3
Indonesia	2005	2014	110	86	6	4
Israel	1995	2014	231	207	6	6
Japan***	1998	2013	162	132	3	3
Kenya	2006	2014	48	37	2	2
Mexico	2005	2014	94	72	2	2
New Zealand	1999	2014	121	105	4	4
Nigeria	2003	2014	60	49	4	4
Norway	1999	2013	128	110	2	2
Pakistan	2005	2014	40	31	7	7
Peru	2001	2014	162	138	5	5
Philippines	2002	2014	124	104	2	2
Poland	1999	2014	182	158	5	5
Serbia	2007	2014	124	81	3	3
South Africa	2001	2014	78	63	2	2
South Korea	1999	2014	183	159	5	5
Sweden	1994	2014	174	161	3	3
Switzerland	2000	2014	62	51	4	4
Thailand	2001	2014	112	96	4	4
Tunisia	2000	2014	175	151	5	5
Turkey	2005	2014	115	91	3	3
United Kingdom	1997	2014	202	178	3	3
United States	1984	2014	300	272	3	3
Uruguay	2007	2013	25	17	2	2
Sum			4740	4033	120	117
Mean			135.4	115.2	3.4	3.3
Median			124	105	3	3

* # of meetings and governors in the full sample.

** # of meetings and governors in the restricted sample (used in the baseline estimation).

*** Between March 2001 and February 2006, Japan's monetary target was money growth. We drop these meetings from the sample.

Table 22: Transitions per country

Country	# First Meets FS*	# First Meets RS**	# Last Meets FS*	# Last Meets RS**
Albania	1	1	1	1
Australia	2	2	2	2
Brazil	3	3	2	2
Chile	3	3	3	3
Colombia	1	1	1	1
Czech Republic	3	3	3	3
European Union	2	2	2	2
Georgia	1	0	1	0
Ghana	2	1	2	1
Guatemala	2	2	2	2
Hungary	2	2	2	2
India	2	1	2	1
Indonesia	4	2	4	1
Israel	3	3	4	4
Japan	2	1	2	1
Kenya	1	1	1	1
Mexico	1	1	1	0
New Zealand	2	2	3	3
Nigeria	3	2	3	2
Norway	2	2	1	1
Pakistan	5	4	6	5
Peru	4	4	4	4
Philippines	1	1	1	1
Poland	3	3	4	4
Serbia	2	2	2	2
South Africa	1	0	1	0
South Korea	4	4	4	4
Sweden	2	2	2	2
Switzerland	3	3	3	2
Thailand	3	3	3	3
Tunisia	4	4	4	4
Turkey	2	2	2	2
United Kingdom	2	2	2	2
United States	2	2	2	2
Uruguay	1	0	1	0
Sum	81	71	83	70
Mean	2.3	2.0	2.4	2.0
Median	2	2	2	2

* # of first and last meetings in the full sample.

** # of first and last meetings in the restricted sample (used in the baseline estimation).

C.2 Transition coding

In this section we detail different possibilities to code the transitions in the data, and explain our choice based on the theoretical arguments we put forth to explain our results. The following example illustrates some of the challenges in our coding decisions. Assume that one governor's term finishes, but the body of government responsible for nominating the new governor has not yet announced its decision. In such case an acting governor must be conducting the meetings. This acting governor may be later appointed to office, and thus, become the official governor. When should the first meeting be labeled? As soon as she becomes the acting governor? Or after she is officially appointed? Similarly, when should the last meeting be labeled? These are the kinds of choices one must make. In this section we explain our options.

We consider the first meeting of a governor as the one right after she takes office for the first time. Hence, meetings in which the new central banker was an acting governor before being officially appointed are not coded as transitions. Our view is that an acting governor might not have power to change policy much so to print his own mark. In other words, there is a stand-by until the leadership appointment is settled. Also, we do not consider transitions when the governor is reappointed to office after his current mandate expires. Both explanations based on signalling dynamics and career concerns imply that, if known in advance, we should not observe policy tightening after a governor is reappointed.

We consider the last meeting of a governor as the one right before she definitely leaves office. Here, we do not make a distinction whether the departing governor is an acting or official one. As the aforementioned example illustrates, the final meeting of a governor might not be the one exactly before the first meeting of her successor. Hence, our definition of transition implies that a departing governor may not know the identity of his successor. Notice that this argument does not invalidate our signalling explanation. In fact, the theoretical argument holds whether the departing governor knows his successor identity or not.

Finally, notice that, in principle, a governor may be appointed to office twice for two non-consecutive mandates. In this case, the explanations based on both career concerns and signalling dynamics suggest that we should code as transitions the last meetings associated with both mandates. In contrast, one may argue that signaling dynamics imply that only the first meeting associated with the first mandate, when her type is private information, should be coded as transitions. This situation does not arise in our dataset. In other words, all governors in our dataset were appointed for either a single mandate or consecutive mandates.

C.3 Unexpected transitions

We determine if a country had an unexpected transition in two steps. First, we look for governors that did not finish their mandates. For countries where central banks have fixed mandates, we consider governors that left the central bank before the officially scheduled end of tenure. For countries without fixed mandates, such as Brazil, we consider governors that were replaced within the mandate of the corresponding government. In other words, we did not consider replacements that occurred in these countries due to changes in the government, as transitions in central bank leadership are arguably expected in these cases.

Second, we check the reason (e.g., resignation, dismissal or death) why governors left the central bank before completing their mandates. If resignations are known in advance such as, for example, the case of the former Norges Bank Governor Kjell Storvik (among others), we did not consider them as unexpected. If the mandate was fulfilled or the resignation was announced in advance, it is unlikely that transitions are due to tighter monetary policy. We consider the resignation to be expected when the public is informed about it at least two months before. Any choice of months is inevitably arbitrary.

After extensive research, we document the following unexpected transitions within our restricted sample (i.e. excluding 2008 and 2009).

1. Brazil, 1999, Governor Armínio Fraga took office after a speculative attack against the fixed exchange rate regime;
2. Chile, 2003, Governor Carlos Massad resigned due to a financial scandal;
3. Czech Republic, 2000, Governor Josef Tosovsky resigned;
4. Ghana, 2012, Governor Kwesi Bekoee Amissah-Arthur resigned to become the Vice President of Ghana;
5. Indonesia, 2013, Governor Darmin Nasution resigned;
6. Israel, 2000, Governor Jacob Frenkel resigned;
7. Japan, 1998, Governor Yasuo Matsushita resigned;
8. New Zealand, 2002, Governor Donald Brash resigned to stand as a candidate for Parliament;
9. Nigeria, 2014, Governor Lamido Sanusi was dismissed by the President due to a financial scandal;
10. Pakistan, 2010, Governor Syed Salim Raza resigned;
11. Pakistan, 2011, Governor Shahid Hafiz Kardar resigned;
12. Pakistan, 2014, Governor Yaseen Anwar resigned;
13. Peru, 2003, Governor Richard Webb resigned;

14. Peru, 2004, Governor Javier Silva Ruete resigned;
15. Poland, 2010, Governor Slawomir Stanislaw Skrzypek died in office;
16. Serbia, 2012, Governor Dejan Soskic resigned;
17. Thailand, 2001, Governor Chatumongol Sonakul was dismissed by the Prime Minister due to disagreement over rates;
18. Thailand, 2006, Governor Pridiyathorn Devakula resigned to serve as Minister of Finance after Thai coup d'état;
19. Tunisia, 2004, Governor Mohamed Daouas was dismissed;
20. Tunisia, 2011, Taoufik Baccar resigned;
21. Tunisia, 2012, Governor Mustapha Kamel Nabli was dismissed.

We consider these unexpected transitions in Section 3.4.2 to address the concern that transitions in central bank leadership could be endogenous.

C.4 Governor's strength

The goal of this section is to explain how we extended the typology proposed by Blinder (2007), used to generate an index of governor's strength that covers our dataset. In particular, this index is used in Appendix B.2.1 to explore heterogeneous transition effects. Almost goes without saying that this tentative extension is highly subjective, and potentially controversial, as Blinder himself recognized in the following quote.

> "I have ranked the same nine banks on their degree of "democracy" in making monetary policy decisions – ranging from the individual governor in New Zealand to the Bank of England's highly-democratic Monetary Policy Committee. This ranking is admittedly subjective, but I checked it with several colleagues and made some modifications of my original views – an ersatz Delphi method."

Blinder (2007) proposes the following typology, in increasing order of governor's strength.

1. Individualistic Committee.
2. Genuinely Collegial Committee.
3. Autocratically Collegial Committee.
4. Individual Governor.

We applied the following procedure. First, we checked whether a country was classified in Blinder (2007). Second, for other countries, we searched for documents (usually from central bank staff) in which the authors applied this typology for their own country. Third, lacking the previous options, we made our best guess after assessing the committee structure and its minutes, varying from the availability of individual votes, meaning less governor's strength, to policy decisions being exclusive of the governor.

As there is no clear cut classification in some countries, we allow the index to vary in 0.5 increments to reflect such uncertainty. In addition, we allow different governors within a country to be classified differently, though only for a couple of countries we find strong reasons to do so: Israel, South Korea and United States.

In Table 23 we report the classification for each country following the procedure outlined above. In case the classification was derived from a particular document, we report its link. Otherwise, our best guess was based on the committee structure discussed in a central bank webpage (e.g. decomposition of nominal votes seems to indicate less governor's strength).

Table 23: Countries

Country	Blinder Index	Source
Albania	2.5	best guess
Australia	3	Blinder (2007)
Brazil	2.5	best guess
Chile	2	best guess
Colombia	2	best guess
Czech Republic	1.5	best guess
European Union	2	Blinder (2007)
Georgia	3.5	https://www.nbg.gov.ge/index.php?m=553&lng=eng
Ghana	3	best guess
Guatemala	2.5	best guess
Hungary	1	best guess
India	3	http://rbi.org.in/scripts/BS_SpeechesView.aspx?Id=395
Indonesia	2	http://www.bis.org/publ/work262.pdf
Israel*	3.5 / 2	best guess
Japan	2.5	Blinder (2007)
Kenya	2	best guess
Mexico	2.5	best guess
New Zealand	4	Blinder (2007)
Nigeria	2.5	http://www.bis.org/events/fmda07.pdf
Norway	3	http://www.bis.org/publ/work274.pdf
Pakistan	2.5	best guess
Peru	2.5	best guess
Philippines	2	http://www.bsp.gov.ph/downloads/EcoNews/EN12-05.pdf
Poland	1.5	http://www.suerf.org/download/collmay11/ppt_/1sirchenko.pdf
Serbia	2.5	best guess
South Africa	3	http://www.scielo.br/pdf/rep/v31n4/06.pdf
South Korea**	3 / 1	http://www.kmfa.or.kr/paper/econo/2008/12.pdf
Sweden	1	Blinder (2007)
Switzerland	2	Blinder (2007)
Thailand	2	http://www.bis.org/publ/work262.pdf
Tunisia	3	best guess
Turkey	2	best guess
United Kingdom	1	Blinder (2007)
United States***	3 / 2	Blinder (2007)
Uruguay	2	best guess

* Changed from 3.5 to 2 in 2013 following a big change in how the committee was organized.

** Changed from 3 to 1 in 2013 as explained in the paper cited in the third column.

*** 3 for the Volcker and Greenspan periods and 2 for the Bernanke period.

D A simple model of signalling dynamics

In this section we sketch a simple model of signalling dynamics that rationalizes monetary policy tightening during transitions. Proofs are omitted but available upon request. Similarly, some results only informally discussed here are also available upon request.

We consider a model based on the seminal contributions of Kydland and Prescott (1977) and Barro and Gordon (1983b). Both papers study the time inconsistency of policy. The objective is to study monetary policy during transitions in central bank leadership. Since contractions in monetary policy in the first meetings are consistent with standard results in the literature on signalling and monetary policy, e.g. Barro (1986) or Vickers (1986), we use the model to justify why a more contractionary policy stance takes place in the last meetings. In particular, we argue that, by tightening monetary policy, the departing central bank facilitates separation between Dove and Hawk incoming central banks. Before adapting Barro and Gordon (1983b) for that purpose, we briefly summarize their main contribution through a basic setup which serves as a benchmark for the rest of the analysis.

D.1 Basic setup

Time is discrete and the horizon is finite, i.e. $t = 1, ..., T$. The relation between output y_t and inflation π_t is given by the following Phillips curve:

$$y_t = y_t^n + a(\pi_t - E[\pi_t]), \tag{2}$$

where y_t^n is the natural level of output, $E[\pi_t]$ is expected inflation, and $a > 0$ measures the output response to inflation surprises.

For each period t, taking $E[\pi_t]$ as given, the central bank (CB) chooses π_t in order to minimize the current loss function,

$$\frac{\pi_t^2}{2} - \lambda(y_t - y_t^n), \tag{3}$$

subject to the Phillips curve (2).

In equilibrium, rational expectations require that $\pi_t = E[\pi_t]$. The classic result of inconsistency arises. In particular, the desire to stimulate output leads to positive inflation, $\pi_t = E[\pi_t] = a\lambda > 0$, without output gains, i.e. $y_t = y_t^n$. In contrast, if at $t = 1$, the CB could credibly commit to $\pi_t = 0$ for $t = 1, ..., T$, then society would be better off as $\pi_t = E[\pi_t] = 0$ and $y_t = y_t^n$ arise in equilibrium. We define $\kappa \equiv a\lambda$, which is the inflationary bias that arises in this basic setup.

D.2 Novel elements

In order to study monetary policy decisions during transitions, we add two ingredients to the basic setup. First, inflation π_t comprises the sum of two components,

$$\pi_t = \gamma\pi_{t-1} + (1-\gamma)\pi_t^c, \quad \text{for} \quad t = 1, ..., T, \tag{4}$$

where $\gamma \in (0,1)$ measures the degree of inertia in the economy and π_t^c is the inflation component under control of the CB. Hence, π_{t-1} is the state variable and π_t^c is the control variable. This extension is necessary to connect the decisions of different central bankers through time. Indeed, π_{t-1}^c chosen by the previous CB would affect current inflation π_t and, thus, the current CB's choice of π_t^c.

Second, the CB not only cares about current inflation π_t but also about inflation under its control π_t^c. In particular, the current loss function reads

$$\frac{\theta(\pi_t^c)^2}{2} + \frac{\pi_t^2}{2} - \lambda(y_t - y_t^n), \tag{5}$$

where $\theta > 0$ measures the weight attributed to the controllable part of inflation. If θ is low (high), we say that the CB is Dove (Hawk). This extension is necessary to generate non-trivial dynamics. Otherwise, if there is no cost to change inflation π_t^c (i.e. $\theta = 0$), then the CB could simply adjust π_t^c to set total inflation π_t at its preferred level. As a result, previous inflation π_{t-1} becomes irrelevant.

These two ingredients, inertial inflation and losses from changing π_t^c, allow us to transform the basic setup into a dynamic model. Inertial inflation is an intuitive assumption, easily motivated by some kind of indexation. In contrast, the assumption that, apart from total inflation π_t, controllable inflation π_t^c also enters the loss function merits some digression.

We offer two interpretations for $\theta > 0$. The first is that it is costly to change inflation. In practice, the CB does not control inflation directly. Instead, it controls policy instruments, such as the interest rate, that affect inflation. One finds, for instance, many reasons in the literature to avoid abrupt changes in the interest rate: to avoid financial stress (Cukierman, 1991); better control over long-term interest rates (Woodford, 2003); politico-economic costs associated with committee decision making (Riboni and Ruge-Murcia, 2010), among others. Due to any of these reasons, it could be costly to engineer abrupt changes in current inflation.

The second interpretation is that θ can capture career concerns. The public may consider the inherited state of the economy when evaluating the competence of a CB. Hence, central bankers that deliver the same inflation rate, but inherit different ones, should be perceived differently. If the CB cares about how competent it is perceived to bring inflation close to target (here set to zero without loss of generality), there is an extra cost associated with the controllable inflation component, π_t^c.

In order to show that signalling dynamics are consistent with the empirical results above, we assume that θ is private information. In particular, $\theta \in \{\theta^H, \theta^D\}$, with $\theta^H > \theta^D$, where H and D stand for Hawk and Dove, respectively. Thus the Hawk CB finds controllable inflation π_t^c more costly. As the public tries to infer CB's type from its actions, the model becomes a signaling game: there may be separating, pooling or mixed equilibria depending on the parameters.

D.3 Central bankers' problems

We assume that at $t = 1$, a new central bank (NCB) takes office inheriting inflation π_0 from the old central bank (OCB). Although π_0 is treated as a parameter in the model, we interpret it as a choice variable of the OCB. Indeed, by doing comparative statics in π_0, one may inspect the properties of the equilibrium that the OCB can induce. In particular, π_0 affects the existence conditions of separating and pooling actions and, as a result, how the belief updating process unfolds. We show that a reduction in π_0 is warranted if the OCB wishes to foster type revelation, thereby substantiating the tight monetary stance in last meetings found in the data.[22]

We stress that we do not model the OCB's decision process explicitly for simplicity and ease of exposition. The argument above implicitly assumes that, for some reason, facilitating type revelation yields utility to the OCB. Importantly, it is possible to model an OCB with similar preferences to the NCB so that the OCB finds optimal to foster type separation. The main assumption one needs to add in this case is that the OCB knows that the NCB is a Hawk and cares about inflation in periods that go beyond its tenure.

After taking office at $t = 1$, the NCB stays in office for T periods and discounts the future with $\beta \geq 0$. Its loss function at $t = j$ reads:

$$L_j = \sum_{t=j}^{T} \beta^{t-j} \left[\frac{\theta(\pi_t^c)^2}{2} + \frac{\pi_t^2}{2} - \lambda(y_t - y_t^n) \right]. \tag{6}$$

Notice that the NCB knows its decision at t influences its later decision at $t + 1$ through the state variable π_t. This kind of mechanism is found elsewhere in the literature as in Alesina and Tabellini (1990) and in Debortoli and Nunes (2013).

In order to be consistent with the basic setup in Section D.1, we assume that expected inflation $E[\pi_t]$ is set before the NCB chooses its control variable π_t^c, but $E[\pi_{t+1}]$ is set after the NCB's choice at t. Hence, the NCB takes current inflation expectations as given but recognizes that, in equilibrium, $E[\pi_{t+1}] = \pi_{t+1}$ and, thus, $y_{t+1} = y_{t+1}^n$. In other words, the NCB knows it cannot stimulate output in the following period.

[22]Other papers have also studied how an inherited state variable affects the existence conditions of separating and pooling equilibria in related contexts. Benigno and Missale (2004) and Gonçalves (2005), for instance, consider the role of public debt.

Finally, for the rest of this section, which solves and analyzes this model, we assume that $T = 2$. It is the smallest number of periods that allows the model to capture an important incentive faced by the NCB. In particular, the Dove NCB may want to mimic the Hawk NCB in order to face more favorable inflation expectations in the next period.

D.4 Analysis

One shortcoming of signalling models is that different beliefs often sustain multiple equilibria for a given set of parameter values. Multiple equilibria hinder the analysis of the mechanisms at play. In order to circumvent this problem, we consider a specific set of beliefs in line with Cukierman and Liviatan (1991) and Walsh (2000). In particular, agents always expect a Hawk NCB to choose its preferred action as if it did not fear being mistaken for a Dove NCB. Thus, whether actions are pooled or separated depends on the Dove NCB's choice. If it prefers to mimic the Hawk NCB's choice of inflation, actions are pooled. If, instead, it prefers to reveal its type by choosing its preferred level of inflation, then actions are separated. This "refinement criterion" guarantees uniqueness of equilibrium.

Let π_{1S}^{cH} and π_{1S}^{cD} be the Hawk and Dove, respectively, NCBs' preferred choice of π_1^c when actions are separated at $t = 1$. Similarly, let π_{1P}^c be chosen by the Hawk NBC when it expects that the Dove NCB pools its action at $t = 1$. The Dove NCB may want to pool its action at $t = 1$ in order to face better inflation expectations at $t = 2$. Let $\mu \in (0, 1)$ be the prior probability that the NCB's type is θ^H. Hence, the public has the following expectations in a separating equilibrium: $E[\pi_{1S}^c] = \mu\pi_{1S}^{cH} + (1 - \mu)\pi_{1S}^{cD}$. Of course, in a pooling equilibrium, the expected controlled inflation is the chosen one, $E[\pi_{1P}^c] = \pi_{1P}^c$.

D.4.1 Equilibrium candidates with pure strategies

There are two possible equilibrium paths with pure strategies. The first entails NCBs separating their actions at $t = 1$ and $t = 2$, whereas the second considers NCBs pooling their actions at $t = 1$ but separating them at $t = 2$. Although actions cannot be pooled at $t = 2$ as both Dove and Hawk NCBs prefer to separate, we call the first equilibrium separating, whereas the second pooling, due to what occurs in the first period. We also consider below the case with mixed strategies.

For each period $t = 1, 2$, possible equilibrium $j = S, P$, and NCB's type $i = D, H$, let π_{tj}^{ci} be the optimal level of controllable inflation, and define $\varphi^i \equiv \frac{\theta^i\gamma^2}{\theta^i+(1-\gamma)^2}$. Notice, for instance, that $\pi_{1P}^{cD} = \pi_{1P}^{cH} = \pi_{1P}^c$. After solving each NCB problem for each possible equilibrium path with pure strategies, one obtains:

$$\pi_{1S}^{ci} = \frac{(1-\gamma)\{\kappa - \gamma\pi_0(1+\beta\varphi^i)\}}{\theta^i + (1-\gamma)^2(1+\beta\varphi^i)}, \quad i = D, H;$$
$$\pi_{1P}^{c} = \frac{(1-\gamma)\{\kappa\left(1+\frac{\beta(1-\mu)\gamma(1-\gamma)^2(\theta^H-\theta^D)}{(\theta^H+(1-\gamma)^2)(\theta^D+(1-\gamma)^2)}\right) - \gamma\pi_0\left(1+\beta\varphi^H\right)\}}{\theta^H + (1-\gamma)^2\left(1+\beta\varphi^H\right)};$$
$$\pi_{2j}^{ci} = \frac{(1-\gamma)\{\kappa - \gamma[\gamma\pi_0 + (1-\gamma)\pi_{1j}^{ci}]\}}{\theta^i + (1-\gamma)^2}, \quad j = S, P, \quad i = D, H.$$

D.4.2 Equilibrium existence

In this section, we discuss conditions that determine the existence of a particular equilibrium. The definition of equilibrium has three requirements. First, each type of the NCB minimizes its loss function taking current expectations and beliefs as given, but accounting for the effect of its choice on future expectations and beliefs. Second, expectations are rational; that is, inflation expectations must reflect the weighted average, with beliefs determining the weights, of the Hawk and Dove NBCs' equilibrium strategies. Third, beliefs are updated following a Bayes' rule along the equilibrium path. Recall that we name an equilibrium after what happens in the first period.

A - Separating equilibrium. Let μ_{2S} be the belief in a separating equilibrium that the NCB is a Hawk at $t = 2$. Bayes' rule and the refinement criterion imply that beliefs are updated according to:

$$\mu_{2S} = \begin{cases} 1, & \text{if } \pi_1^c = \pi_{1S}^{cH} \\ 0, & \text{if } \pi_1^c = \pi_{1S}^{cD} \\ 0, & \text{if } \pi_1^c \neq \pi_{1S}^{cH} \text{ or } \pi_1 \neq \pi_{1S}^{cD} \end{cases}.$$

In words, if observed controllable inflation is different from the equilibrium one chosen by a Hawk NCB, agents believe the NCB is Dove, updating their beliefs to zero. Notice that we rely on the refinement criterion to make explicit how beliefs are updated off the equilibrium path.[23] If they observe the equilibrium inflation chosen by a Hawk NCB, then beliefs are updated to one.

In order to confirm that the separating equilibrium exists, one must check whether the Dove or Hawk NCB has incentives to deviate from its equilibrium strategy, i.e. its choice for controllable inflation, given expectations and beliefs. Consider the Hawk NCB. If it chooses an inflation rate different from π_{1S}^{cH}, agents will think it is a Dove NCB in the second period and, thus, expected inflation will be higher. This outcome not only worsens welfare in the second period, but also

[23]Recall that the refinement criterion requires the Hawk NCB to always choose its preferred actions π_{tS}^{cH} at $t = 1, 2$, which are its choices when it does not fear being mistaken by a Dove NCB.

in the first period. In fact, π_{1S}^{cH} was found by minimizing the Hawk NCB's loss function, taking expectations as given. Hence, if the Hawk NCB deviates, it harms itself in every period.

Alternately, the Dove NCB could potentially improve its welfare by pretending to be a Hawk, i.e. by choosing π_{1S}^{cH}, in order to generate lower expected inflation in the second period. Hence, the Dove NCB faces a tradeoff: it can choose its preferred level of inflation at $t = 1$ and reveal its type; or it can pretend to be the Hawk NCB at $t = 1$ and improve its welfare at $t = 2$.

Let L_S^D be the welfare loss of the Dove NCB associated with a separating equilibrium. Define L_{SD}^D as the loss associated with deviating from the prescribed equilibrium strategy and trying to pass itself for a Hawk, i.e. to choose π_{1S}^{cH}. For the separating equilibrium to exist, it cannot be profitable for a Dove NCB to pretend to be the Hawk NCB, given beliefs and expectations. Hence, it is required that $L_S^D \leq L_{SD}^D$. After some algebra, one can show that this is the case if γ is small enough and β is smaller than a given threshold β^S.[24]

Proposition 1. *For γ small enough, there exists $\beta^S \geq 0$ such that $L_S^D \leq L_{SD}^D$ for all $\beta \in [0, \beta^S]$, and that $L_S^D > L_{SD}^D$ for all $\beta \in (\beta^S, \infty)$.*

The intuition of this proposition is straightforward. For β small, the Dove NCB cares less about the second period, choosing its preferred inflation level and, thus, engendering a separating equilibrium. Alternatively, for large β, the Dove NCB cares more about the second period and, thus, the benefits accrued from lower expected inflation at $t = 2$ surpass the costs of pretending to be Hawk at $t = 1$.

B - Pooling equilibrium. Let μ_{2P} be the belief in a pooling equilibrium that the NCB is a Hawk at $t = 2$. Recall that π_{1P}^c is the inflation rate chosen by the Hawk NCB in a pooling equilibrium. Bayes' rule and our refinement criterion imply that beliefs are updated according to:

$$\mu_{2P} = \begin{cases} \mu, & \text{if } \pi_1^c = \pi_{1P}^c \\ 0, & \text{if } \pi_1^c \neq \pi_{1P}^c \end{cases}.$$

If agents observe anything other than the equilibrium inflation of the Hawk NCB expecting to be imitated, they are certain the NCB is Dove and revise their beliefs to zero. Otherwise, beliefs are not updated. Notice that the Hawk NCB has no incentives to deviate as it would be worse off in both periods. Indeed, it would incur a cost at $t = 1$ and face higher expectations at $t = 2$. In contrast, the Dove NCB may wish to deviate from the pooling equilibrium as π_{1P}^c is not the Dove NCB's preferred inflation at $t = 1$.

Let L_P^D be the welfare loss of the Dove NCB associated with a pooling equilibrium. Define L_{PD}^D as the loss associated with deviating from the prescribed strategy in a pooling equilibrium. For the

[24]Proofs are omitted but available upon request.

pooling equilibrium to exist, it cannot be profitable for a Dove NCB to deviate and reveal its type, given beliefs and expectations. Hence, it is required that $L_P^D \leq L_{PD}^D$. After some simple algebra, one can show that this is the case if γ is small enough and β is greater than a given threshold β^P.

Proposition 2. *For γ small enough, there exists $\beta_P \geq 0$ such that $L_P^D \leq L_{PD}^D$ for all $\beta \in (\beta^P, \infty)$, and that $L_P^D > L_{PD}^D$ for all $\beta \in [0, \beta^P]$.*

The intuition behind this proposition is quite straightforward. A Dove NCB mimics a Hawk NCB's strategy at $t = 1$ in order to face lower expectations at $t = 2$. Consequently, if the Dove NCB does not care much about the future, i.e. β is small, it never plays the pooling strategy. Alternatively, if β is large, a pooling equilibrium arises as any extra loss borne at $t = 1$ is acceptable because it is more than compensated by the welfare gain at $t = 2$.

In summary, whether a separating or pooling equilibrium prevails depends mainly on the discounting factor β: for small β, it is not worth to mask oneself as Hawk in order to improve future expectations – separating equilibrium prevails; for large β, it is worth to sacrifice one's favorite choice at $t = 1$ for more favorable expectations at $t = 2$ – pooling equilibrium prevails. For values of β that cannot sustain either a separating or a pooling equilibrium, a mixed strategy equilibrium arises, in which the Dove NCB randomizes between pooling and separating actions (we discuss this case below). Provided that the conditions of Propositions 1 and 2 are satisfied, the dependence on β can be depicted by Figure 5. Notice also that $\beta^S \leq \beta^P$ as both pooling and separating equilibria cannot coexist due to our refinement criterion.

Figure 5: Types of Equilibrium Depending on β

D.4.3 Comparative Statics in π_0

In the previous section, we show how the kind of prevailing equilibrium depends on the discount factor β. However, it also hinges on inherited inflation π_0, which the NCB treats as exogenous. If we interpret a decrease in π_0 as a monetary contraction in the last meetings of the OCB, one may convey, through the lens of this model, theoretical reasons that corroborate our empirical finding.

In the context of pure strategies equilibria, this section shows that a reduction in π_0 increases the scope for separating actions and, thus, helps the Hawk NCB build reputation.[25] In other words, a reduction in π_0 makes it easier (harder) to sustain a separating (pooling) equilibrium and,

[25]Reputation means the public's perceived likelihood that the central bank will fight inflation. It does not refer to the concept used in the repeated games literature, in which a deviation from a low-inflation solution may trigger a punishment from the public, such as in Barro and Gordon (1983a).

thus, the OCB helps the public discover whether or not its successor is a Hawk. This is captured by Proposition 3, which is the relevant theoretical result once only pure strategies equilibria are considered.

Define $\Delta_S^D(\pi_0) \equiv L_{DS}^D - L_S^D$ and $\Delta_P^D(\pi_0) \equiv L_{DP}^D - L_P^D$, which are the gains a Dove NCB gets by deviating from a separating equilibrium and pooling equilibrium, respectively. Let $\bar{\pi}_0$, which depends on the parameters of the model, be an upper bound on π_0 that guarantees that both π_{1P}^c and π_{1P}^{cH} are positive.

Proposition 3. *For $\pi_0 < \bar{\pi}_0$, $\Delta_S^D(\pi_0)$ decreases in π_0 and $\Delta_P^D(\pi_0)$ increases in π_0.*

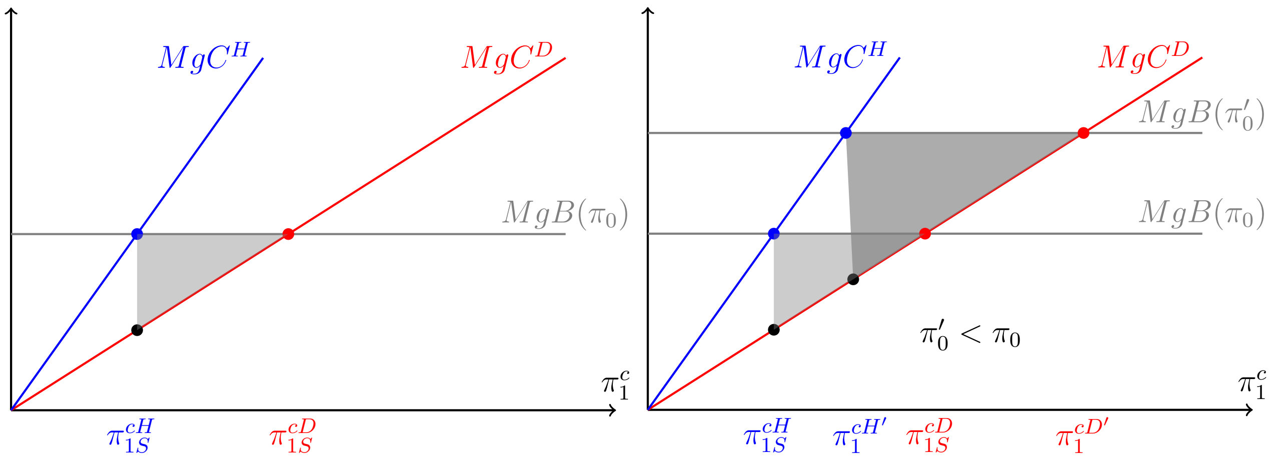
Proposition 3 states that a reduction in π_0 leads to an increase (decrease) in the loss difference from deviating from a separating (pooling) equilibrium, thereby making this deviation less (more) attractive for the Dove NCB. In other words, a contraction in monetary policy makes separating more attractive and pooling less attractive.

The intuition behind Proposition 3 is illustrated in Figure 6, which assumes that $\beta = 0$. The main message from this example also follows for $\beta > 0$. If $\beta = 0$, it is easy to verify that:

$$\underbrace{[(1-\gamma)^2 + \theta^i] \times \pi_{1S}^{ci}}_{\equiv\text{"Marginal Cost"}} = \underbrace{(1-\gamma)(\kappa - \gamma\pi_0)}_{\equiv\text{"Marginal Benefit"}}.$$

Equilibrium is obviously separating. The preferred actions for Hawk (blue circle) and Dove (red circle) NCBs are located at the points that the marginal cost (MgC^i, $i = D, H$) of choosing controllable inflation at $t = 1$ equalizes its marginal benefit (MgB) – left plot. The linearity of the marginal costs is a consequence of the quadratic loss specification. Moreover, $\theta^H > \theta^D$ implies that MgC^H is steeper than MgC^D and, as a consequence, $\pi_{1S}^{cH} < \pi_{1S}^{cD}$. The area of the shaded gray triangle represents the cost a Dove NCB incurs for mimicking the Hawk's preferred action – it is the area where the marginal benefit is above the marginal cost for the Dove NCB.

Figure 6: Intuition for Proposition 3



The fall in π_0 causes an increase in the marginal benefit for both types. As it can be seen in the right plot, this increases the cost of a Dove passing himself as Hawk, which is represented by the larger dark gray triangle. This is the main mechanism by which, in general, a tighter monetary stance set by the OCB helps to sustain a separating equilibrium.

Proposition 3 therefore helps to substantiate our empirical findings regarding central bank leadership transitions. If the OCB wishes to reveal whether the NCB is a Hawk or a Dove, it prescribes a tighter policy stance in the last meetings. After all, this tight policy stance will make it harder for a Dove to pretend to be a Hawk. Mapping directly with interest rate choice, only a true Hawk would raise interest rates on top of the recent increase conducted in the last meetings. In the next section, we discuss an analogous result to Proposition 3 for mixed strategies equilibrium.

Finally, π_0 affects β_S and β_P, the threshold values of discounting that trigger the existence of a particular equilibrium (see Propositions 1 and 2). In fact, the tighter the monetary policy is, the more patient the NCBs can be and still sustain a separating equilibrium. Conversely, they must have an even higher discount factor if a pooling equilibrium is to be sustained. Figure 7 illustrates this result. Naturally, π_0 also alters the values of other parameters of the model, e.g. γ, that help sustain each equilibrium. We focus, however, on β because it has the most intuitive effect on the type equilibria: patience fosters the pooling equilibrium and undermines the separating one.

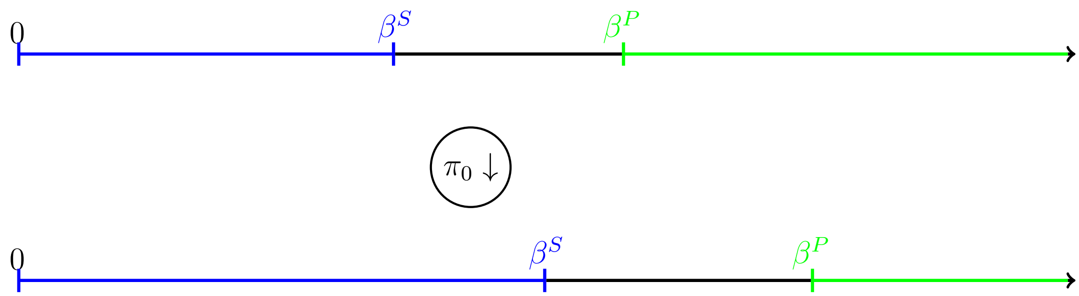


Figure 7: Parameter Space

D.4.4 Mixed Strategies Equilibrium

As mentioned before, for certain intermediate values of β, it is possible that neither a separating nor a pooling equilibrium in pure strategies exists. That is, the Dove NCB is not patient enough too pool its action, but also not impatient enough to separate it. In other words, if both NCBs play pure strategies, the Dove NCB will always decrease its losses by deviating if the Hawk NCB expects the equilibrium to be either pooling or separating.

Recall that our refinement criterion implies that the Hawk NCB plays its preferred action without fear of being mistaken for a Dove. Hence, in a mixed strategy equilibrium, only the Dove NCB mixes its strategies. In particular, it separates its action with probability α and pools it with the Hawk's choice with probability $1-\alpha$. If actions are separated at $t=1$, beliefs that the NCB is a Hawk are updated to zero. In this case the Dove and Hawk NCBs' actions are still π_{1S}^{cD} and π_{1S}^{cH}, respectively. If actions are pooled instead, Bayes' rule implies that beliefs at $t=2$ are given by $\mu_{post} = \frac{\mu}{\mu+(1-\mu)(1-\alpha)}$. In this case, by properly accounting for the evolution of beliefs and solving the both NCBs' problems, one obtains,

$$\pi_{1M}^{c} = \frac{(1-\gamma)\kappa\left(1+\frac{\beta(1-\alpha)(1-\mu_{post})\gamma(1-\gamma)^2(\theta^H-\theta^D)}{(\theta^H+(1-\gamma)^2)(\theta^D+(1-\gamma)^2)}\right)-\gamma(1-\gamma)\pi_0\left(1+\beta\varphi^H\right)}{\theta^H+(1-\gamma)^2\left(1+\beta\varphi^H\right)},$$

$$\pi_{2j}^{ci} = \frac{(1-\gamma)\{\kappa-\gamma[\gamma\pi_0+(1-\gamma)\pi_{1j}^{ci}]\}}{\theta^i+(1-\gamma)^2}, \quad j=S,M, \quad i=D,H,$$

where $j=M$ represents the pooling equilibrium when the Dove NCB plays mixed strategies.

The Dove NCB mixes with probabilities α and $1-\alpha$ its separating and pooling actions, π_{1M}^{c} and π_{1S}^{cD}, respectively. The value of α is pinned down by equalizing the loss functions associated with the Dove NCB's pooling and separating strategies. In other words, the Dove NCB must be indifferent between separating from and pooling with the Hawk NCB's inflation choice.

The following proposition reinforces Proposition 3 by stating that a contraction in monetary policy, i.e. a reduction in π_0, increases the probability α that actions are separated. Again, if the

OCB wishes to reveal the NCB's type by separating actions, Proposition 4 prescribes a contraction in monetary policy in the last meetings, a result that is in line with the empirical finding above. Let $\bar{\bar{\pi}}_0$ and $\underline{\mu}$, which depend in a non-trivial way on the parameters of the model, be an upper bound on π_0 and a lower bound on $\underline{\mu}$, respectively.

Proposition 4. *For $\pi_0 < \bar{\bar{\pi}}_0$ and $\mu > \underline{\mu}$, α decreases in π_0.*

The intuition is the same behind Proposition 3. A lower π_0 increases the cost of deviating from a separating equilibrium. In a mixed strategy equilibrium, this translates into a higher probability α that the separating action is played. In addition, for the Dove NCB to be indifferent between both actions, the pooling equilibrium must be more attractive at $t = 2$ to compensate the costs of mimicking incurred at $t = 1$. The higher value of α ensures this by increasing μ_{post}, which implies a lower inflation expectations at $t = 2$.

As μ_{post} increases with α, a monetary policy contraction also raises μ_{post}. Intuitively, as the probability α of the Dove NCB choosing the separating action increases, if agents observe the pooling action, π^c_{1M}, then they attribute a higher probability μ_{post} that the NCB is a Hawk. Thus, the OCB affects the belief updating process, helping the Hawk NCB build reputation.

The mixed strategies case has the advantage of showing how the fall in π_0 affects an endogenous variable of the model α instead of altering the parameter space that sustains one equilibrium or the other. Indeed, the effect on α has the obvious interpretation of an increase in the likelihood of a separating equilibrium arising. This is precisely one of the explanations we offer for our empirical finding that, on average, monetary policy is tighter in the last meetings of departing governors.

D.5 Discussion

As discussed above, the model was designed to understand the empirical result of policy tightening in the last meetings, which cannot be explained by standard models in the literature on monetary policy and signalling. A shortcoming of the model is that equilibrium outcomes in the first meetings of a NCB have a less clear mapping with our empirical results. In fact, whenever a Dove NCB separates and reveals its type, it sets a higher level of controllable inflation – i.e., it loosens policy – contrasting with the empirical result of further tight policy in the first meetings. Other papers in the literature that might be invoked to explain this empirical fact would be subject to the same criticism. However, in our case, this criticism is more acute, since we argue that monetary policy becomes more contractionary in the last meeting precisely to induce a separating equilibrium.

Model and data would reconcile if most transitions in the data involve incoming Hawks rather than Doves (relative to the public's beliefs). This assumption seems realistic. Indeed, the bulk of transitions in our sample had happened by the beginning of the 2000s, when inflation targeting regimes and, thus, the explicit notion that keeping inflation on target is the main objective of monetary policy, had been adopted in many countries. In addition, we exclude the financial crisis from the sample, which could arguably create a favorable atmosphere for dovish central bankers. Finally, economies at the zero lower bound, which also create such atmosphere, do not drive our results.

Although this assumption on more incoming Hawks than Doves in our sample seems to be realistic, we cannot easily validate it. Therefore, we also conjecture a slight modification of the model that could circumvent the aforementioned shortcoming. What seems to be needed is a more gradual belief updating process, such that types are not revealed immediately. One way to do so is to add some noise to inflation, so that agents can never be sure whether the NCB is a Dove or a Hawk – even in a separating equilibrium. In particular,

$$\pi_1 = \gamma\pi_0 + \pi_1^c(1-\gamma) + u, \text{ where } u \text{ i.i.d } N(0,\sigma^2).$$

In this case, agents still update using Bayes' rule, but it is a gradual process that preserves uncertainty regarding the NCB's type. Hence, even if the Dove NCB does not profit from mimicking the Hawk NCB completely, it still has incentives to choose a lower inflation than it would otherwise. Indeed, there is an incentive to approach the Hawk NCB's choice slightly and, thus, to induce more favorable posterior beliefs on the part of the public. Without this noise u, small reductions in inflation produce no benefit for a Dove NCB. It had to choose between mimicking a Hawk or revealing itself as a Dove. Once the noise u is added to inflation, the Dove NCB may not desire a pooling equilibrium, but since it does not fully reveal its type, it may have incentives to tighten monetary policy a bit. Results regarding first meetings and the model would be thus reconciled. In addition, as we argue above, early tightening due to signalling concerns has already been explored by the literature on monetary policy and signalling.